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RESULTS OF THE FY09 ENHANCED DOE HIGH-LEVEL WASTE MELTER THROUGHPUT STUDIES AT SRNL

Fabienne C. Johnson
Thomas B. Edwards

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Savannah River National Laboratory
Savannah River Nuclear Solutions
Aiken, SC 29808

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REVIEWS AND APPROVALS

F.C. Johnson, Co-author, Process Technology Programs Date

T.B. Edwards, Co-author, Applied Computational Engineering and Statistics Date

D.K. Peeler, Peer Reviewer, Process Technology Programs Date

C. C. Herman, Manager, Process Technology Programs Date

S.L. Marra, Manager, Date
Environmental & Chemical Process Technology Research Programs

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AD	Analytical Development
ARM	Approved Reference Material
AR	As Received
ccc	Centerline Canister Cooling
DOE	Department of Energy
DWPF	Defense Waste Processing Facility
EA	Environmental Assessment
EM	Environmental Management
HLW	High-level Waste
ICP-AES	Inductively Coupled Plasma-Atomic Emission Spectroscopy
LM	Lithium Metaborate
MAR	Measurement Acceptability Region
PCCS	Product Composition Control System
PCT	Product Consistency Test
PF	Peroxide Fusion
PNNL	Pacific Northwest National Laboratory
PSAL	Process Science Analytical
SRNL	Savannah River National Laboratory
SRS	Savannah River Site
SWPF	Salt Waste Processing Facility
TCR	Task Change Request
T_L	Liquidus Temperature
WL	Waste Loading
WTP	Waste Treatment and Immobilization Plant
XRD	X-ray Diffraction

1.0 EXECUTIVE SUMMARY

High-level waste (HLW) throughput (i.e., the amount of waste processed per unit time) is a function of two critical parameters: waste loading (WL) and melt rate. For the Waste Treatment and Immobilization Plant (WTP) at the Hanford Site and the Defense Waste Processing Facility (DWPF) at the Savannah River Site (SRS), increasing HLW throughput would significantly reduce the overall mission life cycle costs for the Department of Energy (DOE).

The objective of this task is to develop data, assess property models, and refine or develop the necessary models to support increased WL of HLW at SRS. It is a continuation of the studies initiated in FY07, but is under the specific guidance of a Task Change Request (TCR)/Work Authorization received from DOE headquarters (Project Number RV071301). Using the data generated in FY07, FY08 and historical data, two test matrices (60 glasses total) were developed at the Savannah River National Laboratory (SRNL) in order to generate data in broader compositional regions. These glasses were fabricated and characterized using chemical composition analysis, X-ray Diffraction (XRD), viscosity, liquidus temperature (T_L) measurement and durability as defined by the Product Consistency Test (PCT).

The results of this study are summarized below:

- In general, the current durability model predicts the durabilities of higher waste loading glasses quite well. A few of the glasses exhibited poorer durability than predicted.
- Some of the glasses exhibited anomalous behavior with respect to durability (normalized leachate for boron (NL [B])). The quenched samples of FY09EM21-02, -07 and -21 contained no nepheline or other wasteform affecting crystals, but have unacceptable NL [B] values (> 10 g/L). The ccc sample of FY09EM21-07 has a NL [B] value that is more than one half the value of the quenched sample. These glasses also have lower concentrations of Al_2O_3 and SiO_2.
- Five of the ccc samples (EM-13, -14, -15, -29 and -30) completely crystallized with both magnetite and nepheline, and still had extremely low NL [B] values. These particular glasses have more CaO present than any of the other glasses in the matrix. It appears that while all of the glasses contain nepheline, the NL [B] values decrease as the CaO concentration increases from 2.3 wt% to 4.3 wt%. A different form of nepheline may be created at higher concentrations of CaO that does not significantly reduce glass durability.
- The T_L model appears to be under-predicting the measured values of higher waste loading glasses. Trends in T_L with composition are not evident in the data from these studies.
- A small number of glasses in the FY09 matrix have measured viscosities that are much lower than the viscosity range over which the current model was developed. The decrease in viscosity is due to a higher concentration of non-bridging oxygens (NBO). A high iron concentration is the cause of the increase in NBO.

Durability, viscosity and T_L data collected during FY07 and FY09 that specifically targeted higher waste loading glasses was compiled and assessed. It appears that additional data may be required to expand the coverage of the T_L and viscosity models for higher waste loading glasses.

In general, the compositional regions of the higher waste loading glasses are very different than those used to develop these models. On the other hand, the current durability model seems to be applicable to the new data. At this time, there is no evidence to modify this model; however additional experimental studies should be conducted to determine the cause of the anomalous durability data.

2.0 INTRODUCTION

High-level waste (HLW) throughput (i.e., the amount of waste processed per unit time) is a function of two critical parameters: waste loading (WL) and melting rate. The melting rate is in turn a function of WL, feed chemistry and heat transfer characteristics within the melter. For the Waste Treatment and Immobilization Plant (WTP) at Hanford and the Defense Waste Processing Facility (DWPF) at the Savannah River Site (SRS), increasing HLW throughput would significantly reduce the overall mission life cycle costs for the Department of Energy (DOE).

Alternative melter technologies and strategic glass formulation could lead to significant improvements in both waste loading and melt rate, thus increasing waste throughput. Assuming that an alternative melter technology would eliminate the dependence of melt rate on waste loading, access to higher waste loadings would then be limited by specific process or product performance constraints, such as liquidus temperature (T_L), viscosity, durability, or nepheline formation. Glass composition-property prediction models are currently employed by DWPF to demonstrate that these constraints are successfully and confidently being met for each process batch.[1] A similar model-based approach is planned for WTP. The DWPF models also play a key role in frit development efforts for each new sludge batch, as well as providing important feedback on batching, washing and blending scenarios to describe the resulting sludge composition. While the reliable performance of these models to date is immediately apparent in the successful operation of DWPF, a push toward processing glass systems having higher WLs may result in a shift to glass compositional regions that have not been previously evaluated. Several questions are associated with reliable performance of the models in these broader compositional regions:

- Do the models help avoid glass compositional regions that are prone to processing or product quality issues?
- Do they allow entry into glass compositional regions that attain the target higher WLs while maintaining processability and product quality?

In order to answer these questions, data are needed in these broader compositional regions to ensure that the current models are applicable or that adequate data are available to refine the models or develop alternative models. Preemptive assessments of the process control models in the projected compositional regions of interest must be performed in order to ensure access to higher WL regions which may be required to meet contractual agreements. This assessment is currently being performed through DOE's Environmental Management (EM) program as both Savannah River National Laboratory (SRNL) and Pacific Northwest National Laboratory (PNNL) are focusing on the development of glass composition-property data in the anticipated regions covering higher waste loadings for DWPF.

A preliminary assessment of the current DWPF process control models for specific sludge compositions targeting higher WLs was completed in FY08.[2] Glasses were fabricated and characterized in a joint SRNL-PNNL study to assess the applicability of the current process control models outside of the compositional region over which the current models were developed or validated. The results identified the inability of certain DWPF process control models to adequately predict physical properties related to processability, particular, the viscosity and liquidus temperature of select higher WL glasses that were outside of the compositional regions over which the models were developed or validated. In general, as the compositional overlap between the model validation ranges diverged from the target glass compositions, the difference between the measured and the predicted property values increased. This implies that there are individual oxides or oxide combinations that are outside of the model validation range, which include B_2O_3, SiO_2, MnO, and TiO_2 or their combinations. Additional data are needed in these broader compositional regions to assess and/or refine current model predictions or to develop alternative models. Data generation, model development or refinement and model validation will be required prior to the implementation of updated alternative models into the DWPF process control system. The timing of these efforts must be coordinated with the DWPF schedule for higher waste loadings to ensure that there is no disconnect between contractual expectations and a control system that can support higher waste loadings during melter feed acceptability decisions.

This task is a continuation of the studies initiated in FY07, but is under the specific guidance of a Task Change Request (TCR)/Work Authorization received from DOE headquarters.[3-6] Using the data generated in FY07, FY08 and historical data, two test matrices (Matrix 2 and Matrix 2A – 60 glasses total) were developed in order to generate data in broader compositional regions. These glasses were fabricated and characterized using chemical composition analysis, X-ray Diffraction (XRD), viscosity, T_L measurement and the Product Consistency Test (PCT).[7]

2.1 GLASS SELECTION STRATEGY

2.1.1 Matrix 2

The HLW System Plan (Revision 13)[8] was used as the compositional basis for future flowsheets to be processed at the DWPF. The minimum and maximum ranges for each sludge oxide were determined from the "with and without Al-dissolution cases" and are shown in Table 1. The bounding glass compositional region was developed by (i) applying a 30% WL to the *minimum* values of each sludge component, and (ii) applying a 50% WL to the *maximum* values of each sludge component. The resulting oxide intervals are shown in Table 2.[*] Minimum and maximum concentrations for the frit components (B_2O_3, Li_2O, Na_2O and SiO_2) were selected by considering the Product Composition Control System (PCCS) constraints. The maximum CaO content was raised to gauge the affect of Ca-containing frit. In order to account for the Salt Waste Processing Facility (SWPF) flowsheet, the TiO_2 content was raised from 0-2 wt% to 2-6 wt% and the upper Na_2O concentration was increased to 18 wt%. JMP™ was used to D-optimally[†] select 30 glasses based on the oxide ranges in Table 2; three of these glasses contained varying amounts of U_3O_8 (2, 4 and 6 wt%).[9] Target compositions and a summary of the Measurement Acceptability Region (MAR) assessment results are provided in Table 3. Glasses were chosen to focus on specific technical issues that have been identified for future sludge batches to be processed at DWPF, which include glass systems with WLs restricted by T_L predictions and TiO_2 retention and model applicability of glass systems for coupled operations[‡].

[*] "Others" in Table 2 includes BaO, Ce_2O_3, CuO, La_2O_3, PbO, SO_4, ZnO and ZrO_2.
[†] D-optimality is an experimental design method that minimizes the variance of the estimates of the coefficients of the proposed model. In this study, the proposed model was taken to be a linear function of the oxides in Table 2.
[‡] Addition of the Actinide Removal Process (ARP) stream to the sludge.

Table 1. Projection Ranges Based on the HLW System Plan Revision

Oxide	Mininum	Maximum
	wt%	
Al_2O_3	11.95	34.31
BaO	0.07	0.28
CaO	1.74	3.66
Ce_2O_3	0.08	0.96
Cr_2O_3	0.19	0.41
CuO	0.04	0.14
Fe_2O_3	18.71	41.22
K_2O	0.07	0.41
La_2O_3	0.03	0.31
MgO	0.27	2.65
MnO	1.21	10.66
Na_2O	19.12	27.85
NiO	0.17	4.51
PbO	0.04	0.39
SO_4	0.09	1.88
SiO_2	1.79	8.27
TiO_2	0.00	3.89
U_3O_8	0.54	18.80
ZnO	0.05	0.24
ZrO_2	0.10	0.67

Table 2. Oxide Interval Used to Develop the Glass Compositions

Oxide	Mininum	Maximum
	wt%	
Al_2O_3	3.25	18
B_2O_3	4.5	14
CaO	0	4
Cr_2O_3	0	0.2
Fe_2O_3	5	21
Li_2O	4	7
MgO	0	1.5
MnO	0.3	5.5
Na_2O	10	18
NiO	0	2.5
SiO_2	30	55
TiO_2	2	6
U_3O_8	0	9.5
Others	0	2

Table 3. Target Compositions

Glass ID	Al_2O_3	B_2O_3	BaO	CaO	CdO	Ce_2O_3	Cr_2O_3	CuO	Fe_2O_3	La_2O_3	Li_2O	MgO	MnO	Na_2O	NiO	PbO	SO_4	SiO_2	TiO_2	U_3O_8	ZnO	ZrO_2
FY09EM21-01	9.97	4.50	0.00	0.00	0.00	0.00	0.20	0.00	18.35	0.00	4.00	0.00	5.50	11.39	2.50	0.00	0.00	37.99	5.60	0.00	0.00	0.00
FY09EM21-02	4.01	5.07	0.08	0.00	0.30	0.36	0.00	0.13	20.63	0.10	4.00	1.50	0.30	17.98	2.50	0.22	0.48	40.02	2.00	0.00	0.13	0.21
FY09EM21-03	6.97	4.50	0.00	0.00	0.00	0.00	0.00	0.00	12.52	0.00	7.00	1.50	5.50	14.13	2.50	0.00	0.00	40.65	4.73	0.00	0.00	0.00
FY09EM21-04	7.03	14.00	0.00	4.00	0.00	0.00	0.00	0.00	16.49	0.00	7.00	1.50	0.30	10.74	2.50	0.00	0.00	32.45	4.00	0.00	0.00	0.00
FY09EM21-05	3.60	4.50	0.00	4.00	0.00	0.00	0.00	0.00	13.77	0.00	4.00	0.00	0.30	10.00	2.50	0.00	0.00	51.50	5.83	0.00	0.00	0.00
FY09EM21-06	4.39	11.49	0.08	0.00	0.30	0.36	0.20	0.13	5.30	0.10	4.00	0.00	5.50	14.78	2.50	0.22	0.48	43.84	6.00	0.00	0.13	0.21
FY09EM21-07	4.87	13.92	0.00	3.92	0.00	0.00	0.00	0.00	17.98	0.00	4.00	1.50	5.50	12.71	0.00	0.00	0.00	33.60	2.00	0.00	0.00	0.00
FY09EM21-08	3.25	4.97	0.00	0.50	0.00	0.00	0.20	0.00	20.48	0.00	7.00	1.50	1.39	10.00	0.00	0.00	0.00	44.71	6.00	0.00	0.00	0.00
FY09EM21-09	12.97	9.48	0.00	3.03	0.00	0.00	0.20	0.00	10.96	0.00	7.00	0.00	2.01	10.00	0.68	0.00	0.00	41.19	2.47	0.00	0.00	0.00
FY09EM21-10	6.40	4.72	0.08	4.00	0.30	0.36	0.00	0.13	17.73	0.10	4.00	0.00	5.46	10.39	2.50	0.22	0.48	40.40	2.40	0.00	0.13	0.21
FY09EM21-11	3.25	4.58	0.08	4.00	0.30	0.36	0.00	0.13	6.04	0.10	5.63	1.50	5.50	12.21	0.00	0.22	0.48	49.30	6.00	0.00	0.13	0.21
FY09EM21-12	4.55	5.29	0.00	0.00	0.00	0.00	0.00	0.00	16.86	0.00	6.79	0.00	4.67	10.00	1.91	0.00	0.00	47.92	2.00	0.00	0.00	0.00
FY09EM21-13	10.38	5.88	0.08	4.00	0.30	0.36	0.20	0.13	14.08	0.10	7.00	0.00	0.30	10.52	2.50	0.22	0.48	37.14	6.00	0.00	0.13	0.21
FY09EM21-14	3.25	13.65	0.08	0.00	0.30	0.36	0.20	0.13	20.54	0.10	4.00	0.00	0.30	10.00	0.00	0.22	0.48	40.35	5.71	0.00	0.13	0.21
FY09EM21-15	5.32	4.50	0.08	3.19	0.30	0.36	0.20	0.13	8.29	0.10	6.00	1.50	5.36	10.00	2.50	0.22	0.48	49.14	2.00	0.00	0.13	0.21
FY09EM21-16	3.68	6.43	0.08	3.82	0.30	0.36	0.20	0.13	9.05	0.10	4.00	1.50	0.30	15.82	2.50	0.22	0.48	48.71	2.00	0.00	0.13	0.21
FY09EM21-17	7.19	4.50	0.08	0.10	0.30	0.36	0.00	0.13	13.91	0.10	6.74	0.00	5.50	14.85	0.00	0.22	0.48	39.20	6.00	0.00	0.13	0.21
FY09EM21-18	10.92	4.84	0.08	0.44	0.30	0.36	0.00	0.13	6.79	0.10	5.49	0.00	0.83	17.02	0.00	0.22	0.48	49.66	2.00	0.00	0.13	0.21
FY09EM21-19	5.72	4.50	0.00	4.00	0.00	0.00	0.00	0.00	5.00	0.00	4.00	0.00	0.30	18.00	0.98	0.00	0.00	51.50	6.00	0.00	0.00	0.00
FY09EM21-20	6.02	5.31	0.00	0.00	0.00	0.00	0.20	0.00	11.83	0.00	4.00	1.27	0.30	18.00	2.50	0.00	0.00	48.57	2.00	0.00	0.00	0.00
FY09EM21-21	4.86	9.01	0.08	0.00	0.30	0.36	0.20	0.13	19.95	0.10	7.00	0.00	1.00	14.67	0.00	0.22	0.48	39.31	2.01	0.00	0.13	0.21
FY09EM21-22	14.04	13.20	0.08	0.00	0.30	0.36	0.00	0.13	9.18	0.10	4.00	0.00	0.30	10.00	2.50	0.22	0.48	42.74	2.04	0.00	0.13	0.21
FY09EM21-23	13.96	5.78	0.08	0.00	0.30	0.36	0.00	0.13	12.11	0.10	4.00	1.50	0.30	10.00	0.00	0.22	0.48	44.35	6.00	0.00	0.13	0.21
FY09EM21-24	10.51	4.50	0.08	4.00	0.30	0.36	0.20	0.13	20.56	0.10	4.00	1.50	0.92	10.00	0.00	0.22	0.48	37.88	3.94	0.00	0.13	0.21
FY09EM21-25	6.24	4.73	0.00	4.00	0.00	0.00	0.20	0.00	7.83	0.00	4.00	0.00	5.50	15.46	0.00	0.00	0.00	50.03	2.00	0.00	0.00	0.00
FY09EM21-26	13.66	7.58	0.00	0.00	0.00	0.00	0.20	0.00	5.00	0.00	4.00	1.50	5.05	11.96	0.00	0.00	0.00	45.70	5.36	0.00	0.00	0.00
FY09EM21-27	7.19	6.98	0.04	1.81	0.16	0.19	0.10	0.07	13.12	0.05	5.10	0.68	2.62	12.72	1.29	0.12	0.26	43.38	3.93	0.00	0.07	0.11
FY09EM21-28	7.05	6.84	0.04	1.77	0.16	0.19	0.10	0.07	12.86	0.05	5.00	0.67	2.57	12.46	1.27	0.11	0.25	42.51	3.85	2.00	0.07	0.11
FY09EM21-29	6.90	6.70	0.04	1.74	0.15	0.19	0.10	0.07	12.60	0.05	4.90	0.66	2.52	12.21	1.24	0.11	0.25	41.64	3.77	4.00	0.07	0.11
FY09EM21-30	6.76	6.56	0.04	1.70	0.15	0.18	0.09	0.06	12.34	0.05	4.80	0.64	2.47	11.95	1.21	0.11	0.24	40.78	3.69	6.00	0.07	0.10

[a] newlv/newhv = viscosity; Homg = homogeneity; R_2O = alkali constraint; lfrit = associated with homogeneity

Table 4. Matrix 2 MAR Assessment Results

Glass ID	Al_2O_3 (wt%)	R_2O (wt%)	Nepheline Value	MAR Status
FY09EM21-01	9.97	15.39	0.64	T_L newlv TiO_2
FY09EM21-02	4.01	21.98	0.65	T_L newlv TiO_2 lFrit
FY09EM21-03	6.97	21.13	0.66	newlv TiO_2
FY09EM21-04	7.03	17.74	0.65	T_L newlv TiO_2
FY09EM21-05	3.60	14.00	0.79	T_L TiO_2 lFrit
FY09EM21-06	4.39	18.78	0.70	newlv TiO_2 Homg
FY09EM21-07	4.87	16.71	0.66	newlv TiO_2
FY09EM21-08	3.25	17.00	0.77	newlv TiO_2 lFrit
FY09EM21-09	12.97	17.00	0.64	T_L newlv TiO_2
FY09EM21-10	6.40	14.39	0.71	T_L TiO_2
FY09EM21-11	3.25	17.83	0.76	TiO_2 Homg lFrit
FY09EM21-12	4.55	16.79	0.77	newlv TiO_2 lFrit
FY09EM21-13	10.38	17.52	0.64	T_L newlv TiO_2
FY09EM21-14	3.25	14.00	0.75	newlv TiO_2 lFrit
FY09EM21-15	5.32	16.00	0.76	T_L TiO_2 Homg
FY09EM21-16	3.68	19.82	0.71	TiO_2 R_2O
FY09EM21-17	7.19	21.59	0.64	newlv TiO_2
FY09EM21-18	10.92	22.51	0.64	TiO_2
FY09EM21-19	5.72	22.00	0.68	TiO_2 Homg
FY09EM21-20	6.02	22.00	0.67	T_L newlv TiO_2
FY09EM21-21	4.86	21.67	0.67	newlv TiO_2
FY09EM21-22	14.04	14.00	0.64	T_L TiO_2
FY09EM21-23	13.96	14.00	0.65	newhv TiO_2
FY09EM21-24	10.51	14.00	0.65	T_L TiO_2
FY09EM21-25	6.24	19.46	0.70	TiO_2
FY09EM21-26	13.66	15.96	0.64	newhv TiO_2
FY09EM21-27	7.19	17.82	0.69	newlv TiO_2
FY09EM21-28	7.05	17.46	0.69	newlv TiO_2
FY09EM21-29	6.90	17.11	0.69	newlv TiO_2
FY09EM21-30	6.76	16.75	0.69	newlv TiO_2

2.1.2 Matrix 2A

JMP™ was used to develop a non-radioactive centroid sludge composition based on the sludge oxide intervals provided in Table 1.[§] In order to assess the impact of several sludge components on glass properties, 14 sludge compositions were developed by systematically altering the centroid composition. These compositions are shown Table 5. A summary of the method is provided below. For each of the compositions, Na_2O and SiO_2 were adjusted in order to compensate for the changes listed below. It should be noted that the adjustments to the oxide components still fall within the sludge oxide bounds in Table 1.

- Sludge 1: centroid
- Sludge 2: Al_2O_3 was increased by 5 wt%.
- Sludge 3: Al_2O_3 was decreased by 5 wt%.
- Sludge 4: Al_2O_3 was decreased by 10 wt%.
- Sludge 5: Al_2O_3 was decreased by 10 wt%. Fe_2O_3 was increased by 5 wt%.
- Sludge 6: Al_2O_3 was decreased by 10 wt%. Fe_2O_3 was increased by 10 wt%.
- Sludge 7: CaO was increased by 4 wt%. Al_2O_3 decreased by 10 wt%. Fe_2O_3 was increased by 10 wt%.
- Sludge 8: CaO was increased by 6 wt%. Al_2O_3 decreased by 10 wt%. Fe_2O_3 was increased by 10 wt%.
- Sludge 9: Fe_2O_3 was increased by 5 wt%.
- Sludge 10: Fe_2O_3 was decreased by 5 wt%.
- Sludge 11: MnO was increased by 2 wt%.
- Sludge 12: MnO was decreased by 2 wt%.
- Sludge 13: CaO was increased by 2 wt%. Al_2O_3 was increased by 5 wt%. Fe_2O_3 was decreased by 5 wt%.
- Sludge 14: CaO was increased by 4 wt%. Al_2O_3 was increased by 5 wt%. Fe_2O_3 was decreased by 5 wt%.
- Sludge 15: CaO was increased by 6 wt%. Al_2O_3 was increased by 5 wt%. Fe_2O_3 was decreased by 5 wt%.

These sludges were each combined with Frit 418 and Frit 510 at a 50% WL in order to study the affects of B_2O_3 in the frit.[**] The target glass compositions are provided in Table 6 and MAR assessment results are shown in Table Table 4.

[§] The "Others" components (BaO, Ce_2O_3, Cr_2O_3, CuO, K_2O, La_2O_3, PbO, SO_4, ZnO and ZrO_2) were fixed at a total sum of 3 wt% of the sludge composition. The non-radioactive centroid was obtained by removing U_3O_8 from the sludge composition and renormalizing. In addition, the TiO_2 content in the centroid sludge composition was raised to 4 wt% so that the TiO_2 content of the glass would be 2 wt% at 50% WL. This renormalization caused the other oxide components to slightly decrease.

[**] Frit 418 = 8 wt% B_2O_3 – 8 wt% Li_2O – 8 wt% Na_2O – 70 wt% SiO_2 and Frit 510 = 14 wt% B_2O_3 – 8 wt% Li_2O – 8 wt% Na_2O – 70 wt% SiO_2.

Table 5. Sludge Compositions Used to Develop the Matrix 2A Glasses

Oxide	Sludge 1	Sludge 2	Sludge 3	Sludge 4	Sludge 5	Sludge 6	Sludge 7	Sludge 8	Sludge 9	Sludge 10	Sludge 11	Sludge 12	Sludge 13	Sludge 14	Sludge 15
	(wt%)														
Al_2O_3	23.18	28.18	18.18	13.18	13.18	13.18	13.18	13.18	23.18	23.18	23.18	23.18	28.18	28.18	28.18
CaO	2.64	2.64	2.64	2.64	2.64	2.64	6.64	8.64	2.64	2.64	2.64	2.64	4.64	6.64	8.64
Fe_2O_3	29.89	29.89	29.89	29.89	34.89	39.89	39.89	39.89	34.89	24.89	29.89	29.89	25.89	25.89	25.89
MgO	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42
MnO	5.85	5.85	5.85	5.85	5.85	5.85	5.85	5.85	5.85	5.85	7.85	3.85	5.85	5.85	5.85
Na_2O	22.96	19.20	27.01	27.85	24.54	19.54	19.20	19.20	19.20	27.01	19.20	27.01	21.11	20.11	19.11
NiO	2.27	2.27	2.27	2.27	2.27	2.27	2.27	2.27	2.27	2.27	2.27	2.27	2.27	2.27	2.27
SiO_2	4.85	3.61	5.80	9.96	8.27	8.27	4.61	2.61	3.61	5.80	6.61	2.80	3.70	2.70	1.70
TiO_2	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Others	2.94	2.94	2.94	2.94	2.94	2.94	2.94	2.94	2.94	2.94	2.94	2.94	2.94	2.94	2.94

Table 6. Target Glass Compositions of the Matrix 2A Glasses (wt%)

Glass ID	EM-01	EM-02	EM-03	EM-04	EM-05	EM-06	EM-07	EM-08	EM-09	EM-10	EM-11	EM-12	EM-13	EM-14	EM-15
Frit	418														
WL	50														
Sludge	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Al_2O_3	11.59	14.09	9.09	6.59	6.59	6.59	6.59	6.59	11.59	11.59	11.59	11.59	14.09	14.09	14.09
B_2O_3	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
BaO	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
CaO	1.32	1.32	1.32	1.32	1.32	1.32	3.32	4.32	1.32	1.32	1.32	1.32	2.32	3.32	4.32
Ce_2O_3	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
Cr_2O_3	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14
CuO	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Fe_2O_3	14.95	14.95	14.95	14.95	17.45	19.95	19.95	19.95	17.45	12.45	14.95	14.95	12.95	12.95	12.95
K_2O	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
La_2O_3	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
Li_2O	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
MgO	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71
MnO	2.92	2.92	2.92	2.92	2.92	2.92	2.92	2.92	2.92	2.92	3.92	1.92	2.92	2.92	2.92
Na_2O	15.48	13.60	17.51	17.93	16.27	13.77	13.60	13.60	13.60	17.51	13.60	17.51	14.56	14.06	13.56
NiO	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14
PbO	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
SiO_2	40.42	39.81	40.90	42.98	42.14	42.14	40.31	39.31	39.81	40.90	41.31	39.40	39.85	39.35	38.85
SO_4	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
TiO_2	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
ZnO	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
ZrO_2	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17

Table 6 cont. Target Glass Compositions of the Matrix 2A Glasses (wt%)

Glass ID	EM-16	EM-17	EM-18	EM-19	EM-20	EM-21	EM-22	EM-23	EM-24	EM-25	EM-26	EM-27	EM-28	EM-29	EM-30
Frit	510														
WL	50														
Sludge	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Al_2O_3	11.59	14.09	9.09	6.59	6.59	6.59	6.59	6.59	11.59	11.59	11.59	11.59	14.09	14.09	14.09
B_2O_3	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
BaO	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
CaO	1.32	1.32	1.32	1.32	1.32	1.32	3.32	4.32	1.32	1.32	1.32	1.32	2.32	3.32	4.32
Ce_2O_3	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
Cr_2O_3	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14
CuO	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Fe_2O_3	14.95	14.95	14.95	14.95	17.45	19.95	19.95	19.95	17.45	12.45	14.95	14.95	12.95	12.95	12.95
K_2O	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
La_2O_3	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
Li_2O	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
MgO	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71
MnO	2.92	2.92	2.92	2.92	2.92	2.92	2.92	2.92	2.92	2.92	3.92	1.92	2.92	2.92	2.92
Na_2O	15.48	13.60	17.51	17.93	16.27	13.77	13.60	13.60	13.60	17.51	13.60	17.51	14.56	14.06	13.56
NiO	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14
PbO	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
SiO_2	37.42	36.81	37.90	39.98	39.14	39.14	37.31	36.31	36.81	37.90	38.31	36.40	36.85	36.35	35.85
SO_4	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
TiO_2	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
ZnO	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
ZrO_2	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17

Table 7. Matrix 2A MAR Assessment Results

Glass ID	Al_2O_3 (wt%)	R_2O (wt%)	Nepheline Value	MAR Status
EM-01	11.59	19.59	0.60	T_L newlv TiO_2 Neph
EM-02	14.09	17.71	0.60	T_L TiO_2 Neph
EM-03	9.09	21.62	0.61	newlv TiO_2 Neph
EM-04	6.59	22.04	0.64	Del G_p newlv TiO_2
EM-05	6.59	20.38	0.65	T_L newlv TiO_2
EM-06	6.59	17.88	0.67	T_L newlv TiO_2
EM-07	6.59	17.71	0.67	T_L newlv TiO_2
EM-08	6.59	17.71	0.67	T_L newlv TiO_2
EM-09	11.59	17.71	0.61	T_L TiO_2 Neph
EM-10	11.59	21.62	0.58	newlv TiO_2 Neph
EM-11	11.59	17.71	0.62	T_L TiO_2 Neph
EM-12	11.59	21.62	0.58	T_L newlv TiO_2 Neph
EM-13	14.09	18.67	0.58	T_L TiO_2 Neph
EM-14	14.09	18.17	0.58	T_L TiO_2 Neph
EM-15	14.09	17.67	0.58	T_L TiO_2 Neph
EM-16	11.59	19.59	0.58	T_L newlv TiO_2 Neph
EM-17	14.09	17.71	0.57	T_L newlv TiO_2 Neph
EM-18	9.09	21.62	0.59	newlv TiO_2 Neph
EM-19	6.59	22.04	0.62	Del G_p newlv TiO_2 Neph
EM-20	6.59	20.38	0.63	T_L newlv TiO_2
EM-21	6.59	17.88	0.66	T_L newlv TiO_2
EM-22	6.59	17.71	0.65	T_L newlv TiO_2
EM-23	6.59	17.71	0.64	T_L newlv TiO_2
EM-24	11.59	17.71	0.59	T_L newlv TiO_2 Neph
EM-25	11.59	21.62	0.57	newlv TiO_2 Neph
EM-26	11.59	17.71	0.60	T_L newlv TiO_2 Neph
EM-27	11.59	21.62	0.56	T_L newlv TiO_2 Neph
EM-28	14.09	18.67	0.56	T_L newlv TiO_2 Neph
EM-29	14.09	18.17	0.56	T_L newlv TiO_2 Neph
EM-30	14.09	17.67	0.56	T_L newlv TiO_2 Neph

3.0 OBJECTIVES

The objective of this task is to develop data, assess property models, and determine if the current models need to be refined or re-developed to support increased WL of HLW at SRS.

4.0 EXPERIMENTAL PROCEDURES

4.1 GLASS FABRICATION

Each glass was prepared from the proper proportions of reagent-grade metal oxides, carbonates, H_3BO_3, and salts in (i) 250 g batches for FY09EM21-01 though 27, (ii) 200 g batches for EM-01 through 30, and (iii) 150 g for the radioactive glasses (FY09EM21-28 through 30).[10] The raw materials were thoroughly mixed and placed into a platinum alloy crucible. Batched materials were placed into a high-temperature furnace at 1150°C for 1 hour.[11] The molten glass was quenched by pouring the liquid onto a clean, stainless steel plate. It should be noted that a number of glasses[6] appeared to be crystallized and were re-melted at 1150°C for 30 minutes. The molten glass of these samples was poured directly into an ice bath. The glass pour patties were used as a sampling stock for the various property measurements (i.e., chemical composition, durability testing and XRD).

Approximately 25 g of each glass was heat-treated to simulate cooling along the centerline of a DWPF-type canister to gauge the effects of thermal history on product performance.[12] This cooling schedule is referred to as the canister centerline cooling (ccc) curve.

4.2 CHEMICAL COMPOSITION MEASUREMENTS

To confirm that the as-fabricated glasses met the target compositions, a representative sample from each non-radioactive glass was submitted to the SRNL Process Science Analytical Laboratory (PSAL) for chemical analysis under the auspices of two analytical plans: SRNL-L5200-2009-00007 for glasses FY09EM21-01 though 27 and SRNL-L5200-2009-00025 for EM-01 through 30.[13,14] Representative samples from each radioactive glass were submitted to Analytical Development (AD) under the auspices of a separate analytical plan: SRNL-L5100-2009-00003 for FY09EM21-28 through 30.[15] Two dissolution techniques were utilized by PSAL: sodium peroxide fusion (PF) and lithium metaborate fusion (LM). Each glass was prepared in duplicate for each cation dissolution technique (PF and LM). All of the prepared samples were analyzed (twice for each element of interest) by Inductively Coupled Plasma-Atomic Emission Spectroscopy (ICP-AES) with the instrumentation being re-calibrated between the duplicate analyses. Each analytical plan was developed in such a way as to provide the opportunity to evaluate potential sources of bias and error. Glass standards were also intermittently measured to assess the performance of the ICP-AES instrument over the course of these analyses.

The elemental concentrations were converted to oxide concentrations by multiplying the values for each element by the gravimetric factor for the corresponding oxide. During this process, an

[6] FY09EM21-01, -04, -13, -22, -23 and -24.

elemental concentration that was determined to be below the detection limit of the analytical procedures used by the PSAL/AD was reduced to half of that detection limit as the oxide concentration was determined.[16]

4.3 PCT

The PCT was performed in triplicate on each quenched and ccc glass to assess chemical durability using Method A of the PCT procedure.[17] Also included in the experimental test matrix was the Environmental Assessment (EA) glass, the Approved Reference Material (ARM) glass, and blanks from the sample cleaning batch.[18] Samples were ground, washed, and prepared according to the standard procedure.[19] The resulting non-radioactive solutions were sampled (filtered and acidified) and analyzed by PSAL under the auspices of two analytical plans: SRNL-L5200-2009-00008 and SRNL-L5200-2009-00024 for the non-radioactive samples.[20,21] The solutions containing uranium were analyzed by AD under the auspices of one analytical plan (SRNL-L5200-2009-00006).[22] Samples of a multi-element, standard solution were also included in the analytical plans (as a check on the accuracy of the ICP-AES instrument).

PCT leachate concentrations were normalized using the measured cation composition (expressed as a weight percent) in the glass to obtain a grams-per-liter (g/L) leachate concentration. For completeness, the target cation and the measured bias-corrected cation compositions were also used to conduct this normalization.

4.4 XRD

4.4.1 SRNL

Representative samples of the quenched and ccc glasses[7] were submitted to AD for XRD analysis. The glasses were ground in an agate mortar and pestle to reduce the particle size and to homogenize the samples. Ground powder was then placed on a glass slide. A few drops of a 10% Amyl Acetate Collidion solution were added to the ground powder to affix the powder to the glass slide. Data were collected between 5 and 70°2θ with a step size of 0.02°2θ and a 1 s dwell time. Note that the detection limit of the instrument is approximately 0.5 vol%.

4.4.2 PNNL

The amount and type of crystalline phases that formed during the ccc heat treatment on twenty two glass samples were analyzed by powdered XRD according to the PNNL procedures.[23,24] Samples were prepared by mixing 5 wt% CaF_2 (internal standard) with approximately 1.5 to 2.5 g of glass. The glass/CaF_2 mixture was milled to a fine powder for 2 minutes in a 10 cm^3 tungsten carbide disc mill. Samples were then loaded in round aluminum XRD sample holders and mounted in the automated 12 stage XRD sample platform. Each XRD scan was processed at a scan rate of 0.04°2θ between 10 and 70°2θ, with a 4 s dwell time. Data were analyzed with Jade 6.0 Software (MDI, Inc.) for phase identification.

[7] Only the quenched glasses of the FY09EM21-xx series were measured, while both the quenched and ccc glasses of the EM-xx series were measured.

4.5 T_L

The T_L and equilibrium crystal fraction as a function of temperature were measured in Pt-alloy crucibles with tight-fitting lids (to avoid volatility) according to PNNL procedure GDL-LQT.[25] The heat treatment times were roughly 24 h or longer to ensure equilibrium was achieved without excessive volatilization. Heat treated specimens were air quenched and analyzed to determine the type of crystalline phases according to PNNL procedure GDL-XRD.[24] The temperature was varied so that the temperature at which the specimens were crystal-free could be determined to within 10°C for the T_L. For the equilibrium crystal fraction as a function of temperature, heat treatments were performed for the temperature range from the T_L to ~ 5 mass% crystallization. Notes were taken on the location of crystals within the crucible to distinguish between surface and bulk crystallization.

A National Bureau of Standards (NBS) liquidus temperature standard glass (SRM-773) was used to validate the T_L measurement technique and profile the furnaces used in the experimentation. Based on the SRM-773 standard measurements (tested in all furnaces used to support the T_L measurements), the T_L values reported for the study glasses are estimated to be within ±5 to 10°C of the actual values. Calibrated thermocouples and temperature readouts were used for taking temperature measurements for all furnaces.

4.6 VISCOSITY

Viscosity was measured as a function of temperature using a Brookfield DV-II+ high temperature spindle viscometer for each as-fabricated glass. The measurements were obtained using standard procedures, which are compliant with ASTM C 965-81.[26]

In general, the glass was heated to ~1200°C or ~1250°C in a platinum alloy crucible and maintained until thermal equilibrium was achieved. An initial torque reading (at a constant spindle speed) was taken at this temperature with subsequent measurements at both higher and lower temperatures ranging from ~1050°C to 1300°C using a hysteresis approach (to the extent possible). The hysteresis approach provides the opportunity to detect any issues associated with either volatilization and/or devitrification over the temperature range of interest. For example, assume the initial measurement was at 1200°C followed by multiple higher temperature measurements. Prior to going to temperatures less than 1200°C, a second measurement was obtained at 1200°C to assess the potential impacts of volatility. If significant volatility occurred, then the second measurement at 1200°C would not be consistent with the initial measurement, leading to questionable data. A glass viscosity standard was used to determine the geometric constant of the spindle/cup based on torque and speed. This constant is corrected for temperature effects.

5.0 RESULTS AND DISCUSSION

5.1 TEST MATRIX 2

5.1.1 A Statistical Review of the Matrix 2 Chemical Composition Measurements of the Non-Radioactive Glasses

Table A1 (in two parts) in Appendix A provides the elemental concentration measurements from the study glasses that were prepared using LM, and Table A2 provides the measurements from the samples of these glasses prepared using PF. Measurements for samples of the standard Batch 1 glass that were included in the analytical plan along with the study glasses are also provided in these two tables.

5.1.1.1 Measurements in Analytical Sequence

Exhibit A1 in Appendix A provides plots in analytical sequence of the non-radioactive sample measurements generated by PSAL for each oxide over both preparation methods (i.e., LM and PF). These plots are in analytical sequence and include all of the measurement data from Tables A1 and A2. There do not appear to be any obvious patterns or trends due to the analytical sequence.

5.1.1.2 Composition Measurements by Glass Identifier

Exhibit A2 in Appendix A provide plots of the oxide concentration measurements by Glass ID/Lab ID for each analytical set (including Batch 1). These plots show the individual measurements across the duplicates of each preparation method and the two ICP-AES calibrations for each glass for each oxide. A review of the plots presented in these exhibits reveals the repeatability of the four individual values for each oxide of each glass. In general, there appears to be good repeatability among the measurements for each of the oxides for most of the glasses. However, there are some inconsistencies, which include: (i) in Set 1 the measurements for B_2O_3 and Li_2O for glass FY09EM21-14 indicate a dissolution effect, (ii) the measurements for glasses FY09EM21-01, -02, and -03 indicate little or no NiO while the target concentration for this oxide for these glasses was 2.5 wt%[8], (iii) in Set 2 the MnO measurements for FY09EM21-17 are well below the target value of 5.5 wt%[9], and (iv) in the Set 2 glasses there appears to be a calibration effect for the SiO_2 measurements.

5.1.1.3 Results of the Batch 1 Standard

Exhibit A3 in Appendix A provides statistical analyses of the Batch 1 results by analytical set and calibration block for each oxide of interest over both preparation methods. The results also include analysis of variance (ANOVA) investigations, which determine statistically significant differences among the means of these groups for each of the oxides for each of the standards.

[8] NiO was not present in FY09EM21-01, -02 and -03 due to batching error. See page 111 of WSRC-NB-2003-00050.

[9] There appears to be a batching error for the MnO in glass FY09EM21-17 based on the batching sheet or the measurement.

The following components of the Batch 1 standard indicate a significant ICP-AES calibration effect on the block averages at the 5% significance level:

- BaO, CaO, Cr_2O_3, CuO, Fe_2O_3, Li_2O, MgO, MnO, NiO, SiO_2, and ZrO_2

Results from these statistical analyses provide incentive for adjusting the measurements by the effects of the ICP-AES calibration. Thus, bias correction of these data was pursued in order to determine if the adjusted values impacted the conclusions of this study.[10] Batch 1 results were used to bias correct all of the oxides as long as the reference value for the oxide concentration in the Batch 1 glass was greater than or equal to 0.1 wt%. By applying this approach, the Batch 1 results were used to bias correct the Al_2O_3, B_2O_3, BaO, CaO, Cr_2O_3, CuO, Fe_2O_3, K_2O, Li_2O, MgO, MnO, Na_2O, NiO, SiO_2 and TiO_2 measurements. Bias correction was *not* conducted on CdO, Ce_2O_3, La_2O_3, PbO, SO_4, ThO_2, ZnO, or ZrO_2.

The bias correction was conducted as follows. For each oxide, let $\overline{a}_{ij}$ be the average measurement for the ith oxide at analytical block j for Batch 1, and let t_i be the reference value for the ith oxide for Batch 1. The averages and reference values are provided in Exhibit A3. Let $\overline{c}_{ijk}$ be the average measurement for the ith oxide at analytical block j for the kth glass. The bias adjustment was conducted as follows:

$$\overline{c}_{ijk} \bullet \left(1 - \frac{\overline{a}_{ij} - t_i}{\overline{a}_{ij}}\right) = \overline{c}_{ijk} \bullet \frac{t_i}{\overline{a}_{ij}}$$

Bias-corrected measurements are indicated by a "bc" suffix in the remainder of the document. Both measured and measured "bc" values are included in the following discussion. For completeness, the original values of CdO, Ce_2O_3, La_2O_3, PbO, SO_4, ThO_2, ZnO, and ZrO_2 were included in the bias-corrected results in order to calculate a "bc" sum of oxides.

5.1.1.4 Measured Versus Target Compositions

With only minor problems in the repeatability of the measurements being revealed during the review process, all of the measurements for each oxide for each glass (i.e., all of the measurements in Tables A1 through A2) were averaged to determine a representative chemical composition for each glass. These determinations were conducted both for the measured and for the bias-corrected data. A sum of oxides was also computed for each glass based upon both the measured and bias-corrected values. Exhibit A4 in Appendix A provides plots showing results for each glass for each oxide to help highlight the comparisons among the measured, bias-corrected, and target values. In general, there appear to have been few difficulties in hitting the target concentrations of the major oxides[11] for the study glasses. The average of the B_2O_3 measurements for FY09EM21-14 was higher than the target concentration. A preparation effect

[10] It should be emphasized that bias correction is considered in order to demonstrate that the results and conclusions from this study are not affected by the compositional view (target, measured, or measured-bc). Demonstrating that the compositional view does not alter or change the conclusions shows a degree of robustness for the objective of the study.

[11] Greater than 0.5 wt%.

for this glass was previously identified and would account for the higher than expected value. The average MnO measurement for FY09EM21-17 was very low compared to the target value of 5.5 wt%, which is probably due to a batching error since very little was detected. The average measurements for NiO for glasses FY09EM21-01, -02, -03 were much lower than their target values of 2.5 wt% due omission during batching (see Section 5.1.1.2).

Table A4 in Appendix A provides a summary of the average compositions as well as the target compositions and some associated differences and relative differences. Notice that the target sums of oxides for the standard glasses do not sum to 100% due to an incomplete coverage of the oxides in the Batch 1 glass. All of the sums of oxides (both measured and bias-corrected) for the Matrix 2 glasses fall within the interval of 95 to 105 wt%. Entries in Table A4 show the relative differences between the measured or bias-corrected values and the target values. These differences are shaded when they are greater than or equal to 5%. Overall, these comparisons between the measured and target compositions suggest only minor difficulties in meeting the target compositions for the study glasses.

5.1.2 Matrix 2 Measurement Acceptability Region (MAR) Assessment

MAR assessment results are provided in Table 8. The columns in the table give the percent waste loading (%WL), the frit, the glass identifier with compositional view, the Del Gp value for boron (B Del Gp Value), the normalized leachate for boron in grams/Liter (NL[B (g/L)]), the liquidus temperature prediction in degrees Celsius (T_L Pred (ºC)), the viscosity prediction in Poise (Visc Pred (P)), the sum of oxides (in wt%), the nepheline value, and the overall MAR assessment. In general, the MAR assessments of the measured compositions are consistent with those of the target compositions despite the compositional variation observed in Exhibit A4. All of the study glasses fail the TiO_2 constraint in order to study the effects of the addition of a secondary waste stream[12] on glass properties. Other properties such as T_L and viscosity were also challenged to determine the applicability of the current models.

[12] Future sludge batches to be processed at the DWPF may include as much as 6 wt% TiO_2 due to the waste stream coming from the Salt Waste Processing Facility (SWPF).

Table 8. Predicted Properties and MAR Assessment Results of the Non-Radioactive Matrix 2 Glasses

Glass ID	Compositional View	B Del G_p	NL [B (g/L)]	T_L (°C)	Viscosity (P)	Al_2O_3 (wt%)	TiO_2 (wt%)	R_2O (wt%)	Homogeneity (wt%)	Nepheline Value	MAR Status
FY09EM21-01	Measured	-6.69	0.21	1076	26	10.25	5.62	15.66	252.9	0.64	T_L TiO_2
	Measured bc	-6.54	0.19	1079	28	10.81	5.94	15.91	260.9	0.63	T_L TiO_2
	Target	-6.46	0.19	1232	25	9.97	5.60	15.39	252.8	0.64	T_L newlv TiO_2
FY09EM21-02	Measured	-12.50	2.31	899	5	4.11	2.06	21.08	246.9	0.66	newlv TiO_2 lFrit
	Measured bc	-12.61	2.42	905	5	4.34	2.18	21.47	253.9	0.66	newlv TiO_2 lFrit
	Target	-13.28	3.20	1019	4	4.01	2.00	21.98	249.3	0.65	T_L newlv TiO_2 lFrit
FY09EM21-03	Measured	-13.29	3.21	863	6	6.93	4.98	21.32	219.9	0.65	newlv TiO_2
	Measured bc	-13.04	2.90	876	6	7.17	5.33	21.26	222.8	0.65	newlv TiO_2
	Target	-13.12	2.99	994	7	6.97	4.73	21.13	216.4	0.66	newlv TiO_2
FY09EM21-04	Measured	-11.16	1.32	1105	1	7.01	3.95	17.63	252.7	0.64	T_L newlv TiO_2
	Measured bc	-11.01	1.24	1130	1	7.25	4.23	17.61	256.8	0.64	T_L newlv TiO_2
	Target	-11.14	1.31	1126	1	7.03	4.00	17.74	258.3	0.65	T_L newlv TiO_2
FY09EM21-05	Measured	-6.34	0.18	1015	69	3.69	5.83	13.90	228.5	0.79	T_L TiO_2 lFrit
	Measured bc	-6.31	0.17	1031	72	3.89	6.15	14.12	235.2	0.78	T_L TiO_2 lFrit
	Target	-6.29	0.17	1020	73	3.60	5.83	14.00	233.0	0.79	T_L TiO_2 lFrit
FY09EM21-06	Measured	-13.21	3.11	892	19	4.44	5.90	18.66	174.2	0.69	newlv TiO_2 Homg lFrit
	Measured bc	-12.95	2.78	921	20	4.59	6.30	18.56	175.6	0.69	newlv TiO_2 Homg lFrit
	Target	-13.22	3.12	900	20	4.39	6.00	18.78	176.1	0.70	newlv TiO_2 Homg
FY09EM21-07	Measured	-13.27	3.19	940	2	4.81	1.99	16.70	246.7	0.65	newlv TiO_2
	Measured bc	-13.08	2.95	955	2	4.98	2.13	16.60	250.2	0.65	newlv TiO_2
	Target	-13.18	3.07	954	2	4.87	2.00	16.71	254.2	0.66	newlv TiO_2
FY09EM21-08	Measured	-8.11	0.37	985	8	3.26	5.95	16.39	237.8	0.77	newlv TiO_2 lFrit
	Measured bc	-8.06	0.36	989	9	3.43	6.28	16.61	244.3	0.77	newlv TiO_2 lFrit
	Target	-8.47	0.43	987	9	3.25	6.00	17.00	243.8	0.77	newlv TiO_2 lFrit
FY09EM21-09	Measured	-7.98	0.35	998	23	12.97	2.49	16.87	256.9	0.64	newlv TiO_2
	Measured bc	-7.71	0.31	1007	24	13.41	2.67	16.81	261.3	0.63	newlv TiO_2
	Target	-7.97	0.35	1024	23	12.97	2.47	17.00	260.8	0.64	T_L newlv TiO_2
FY09EM21-10	Measured	-8.82	0.50	1129	27	6.39	2.44	14.56	249.8	0.70	T_L TiO_2
	Measured bc	-8.62	0.46	1159	28	6.61	2.60	14.48	254.0	0.70	T_L TiO_2
	Target	-8.52	0.44	1161	27	6.40	2.40	14.39	256.9	0.71	T_L TiO_2
FY09EM21-11	Measured	-12.36	2.18	719	37	3.23	6.76	17.78	189.0	0.75	TiO_2 Homg lFrit
	Measured bc	-12.20	2.04	733	38	3.34	7.23	17.73	191.5	0.76	TiO_2 Homg lFrit
	Target	-12.53	2.34	708	40	3.25	6.00	17.84	192.6	0.76	TiO_2 Homg lFrit
FY09EM21-12	Measured	-9.50	0.66	989	20	4.57	1.99	16.42	221.6	0.76	newlv TiO_2 lFrit
	Measured bc	-9.47	0.65	1010	21	4.82	2.11	16.65	227.8	0.76	newlv TiO_2
	Target	-9.57	0.68	1010	19	4.55	2.00	16.79	233.2	0.77	newlv TiO_2 lFrit
FY09EM21-13	Measured	-7.78	0.32	1099	10	10.31	5.97	17.37	255.0	0.64	T_L newlv TiO_2
	Measured bc	-7.69	0.31	1109	11	10.88	6.30	17.66	263.4	0.64	T_L newlv TiO_2
	Target	-7.77	0.32	1124	10	10.38	6.00	17.52	260.4	0.64	T_L newlv TiO_2

Table 8 continued.

Glass ID	Compositional View	B Del G_p	NL [B (g/L)]	T_L (°C)	Viscosity (P)	Al_2O_3 (wt%)	TiO_2 (wt%)	R_2O (wt%)	Homogeneity (wt%)	Nepheline Value	MAR Status
FY09EM21-14	Measured	-7.47	0.28	959	6	3.22	5.60	14.12	241.5	0.75	newlv TiO_2 lFrit
	Measured bc	-7.42	0.28	959	6	3.39	5.91	14.36	247.6	0.75	newlv TiO_2 lFrit
	Target	-6.99	0.23	975	8	3.25	5.71	14.00	246.0	0.75	newlv TiO_2 lFrit
FY09EM21-15	Measured	-10.27	0.91	1003	60	5.37	1.86	15.72	206.8	0.76	T_L Homg
	Measured bc	-10.35	0.94	1033	58	5.51	1.97	15.83	209.0	0.76	T_L TiO_2 Homg
	Target	-10.51	1.01	1046	53	5.32	2.00	16.00	209.2	0.76	T_L TiO_2 Homg
FY09EM21-16	Measured	-12.75	2.56	962	30	3.74	1.97	19.25	213.2	0.72	TiO_2 R_2O
	Measured bc	-12.69	2.50	992	29	3.81	2.10	19.21	215.0	0.71	T_L TiO_2 R_2O
	Target	-13.15	3.03	982	28	3.68	2.00	19.82	216.2	0.71	TiO_2 R_2O
FY09EM21-17	Measured	-11.37	1.44	857	6	7.67	6.13	22.03	233.9	0.65	newlv TiO_2
	Measured bc	-11.14	1.31	866	6	7.83	6.53	21.94	236.5	0.64	newlv TiO_2
	Target	-12.99	2.83	852	5	7.19	6.00	21.60	227.1	0.64	newlv TiO_2
FY09EM21-18	Measured	-10.77	1.12	759	49	11.07	1.96	21.44	226.8	0.65	TiO_2
	Measured bc	-10.76	1.12	763	49	11.36	2.08	21.56	228.8	0.64	TiO_2
	Target	-11.74	1.69	743	40	10.92	2.00	22.51	228.6	0.64	TiO_2
FY09EM21-19	Measured	-12.03	1.90	748	55	5.84	5.85	20.68	207.2	0.70	TiO_2 Homg
	Measured bc	-12.06	1.92	761	53	5.99	6.20	20.79	209.6	0.69	TiO_2 Homg
	Target	-13.13	3.01	732	45	5.72	6.00	22.00	208.2	0.69	TiO_2 Homg
FY09EM21-20	Measured	-11.89	1.79	994	26	6.16	1.98	20.97	218.3	0.67	T_L TiO_2
	Measured bc	-11.84	1.76	1020	25	6.32	2.09	20.97	218.6	0.67	T_L TiO_2
	Target	-12.73	2.54	1003	23	6.02	2.00	22.00	222.5	0.67	T_L newlv TiO_2
FY09EM21-21	Measured	-13.05	2.90	921	2	4.86	1.98	21.31	247.7	0.67	newlv TiO_2
	Measured bc	-13.01	2.86	928	2	4.96	2.11	21.40	251.9	0.67	newlv TiO_2
	Target	-13.23	3.14	930	2	4.86	2.01	21.67	254.9	0.67	newlv TiO_2
FY09EM21-22	Measured	-4.59	0.09	1031	83	14.26	2.00	14.11	245.6	0.64	T_L TiO_2
	Measured bc	-4.39	0.08	1051	85	14.56	2.13	14.07	247.8	0.64	T_L TiO_2
	Target	-4.56	0.08	1054	76	14.04	2.04	14.00	245.9	0.64	T_L TiO_2
FY09EM21-23	Measured	-2.46	0.04	952	136	13.98	5.71	13.73	247.6	0.65	newhv TiO_2
	Measured bc	-2.31	0.03	957	133	14.27	6.08	13.78	251.4	0.65	newhv TiO_2
	Target	-2.56	0.04	956	123	13.96	6.00	14.00	252.7	0.65	newhv TiO_2
FY09EM21-24	Measured	-4.97	0.10	1103	35	10.53	3.54	13.89	283.7	0.65	T_L TiO_2
	Measured bc	-4.97	0.10	1103	35	10.80	3.75	13.97	287.4	0.65	T_L TiO_2
	Target	-4.91	0.10	1122	29	10.51	3.94	14.00	291.0	0.65	T_L TiO_2
FY09EM21-25	Measured	-13.36	3.31	752	48	6.41	2.01	19.41	219.5	0.69	T_L TiO_2
	Measured bc	-13.30	3.23	761	47	6.54	2.14	19.36	221.5	0.69	T_L TiO_2
	Target	-13.24	3.14	764	51	6.24	2.00	19.46	221.1	0.70	T_L TiO_2
FY09EM21-26	Measured	-7.09	0.24	928	128	13.73	4.86	16.02	215.3	0.64	newhv TiO_2
	Measured bc	-6.91	0.22	938	130	14.02	5.18	15.97	216.7	0.63	newhv TiO_2
	Target	-6.89	0.22	953	130	13.66	5.36	15.96	216.4	0.64	newhv TiO_2
FY09EM21-27	Measured	-9.77	0.74	1003	22	7.29	3.89	17.58	232.5	0.68	newlv TiO_2
	Measured bc	-9.77	0.74	1016	21	7.48	4.12	17.69	234.7	0.68	newlv TiO_2
	Target	-9.93	0.79	1016	20	7.19	3.93	17.82	235.7	0.69	newlv TiO_2

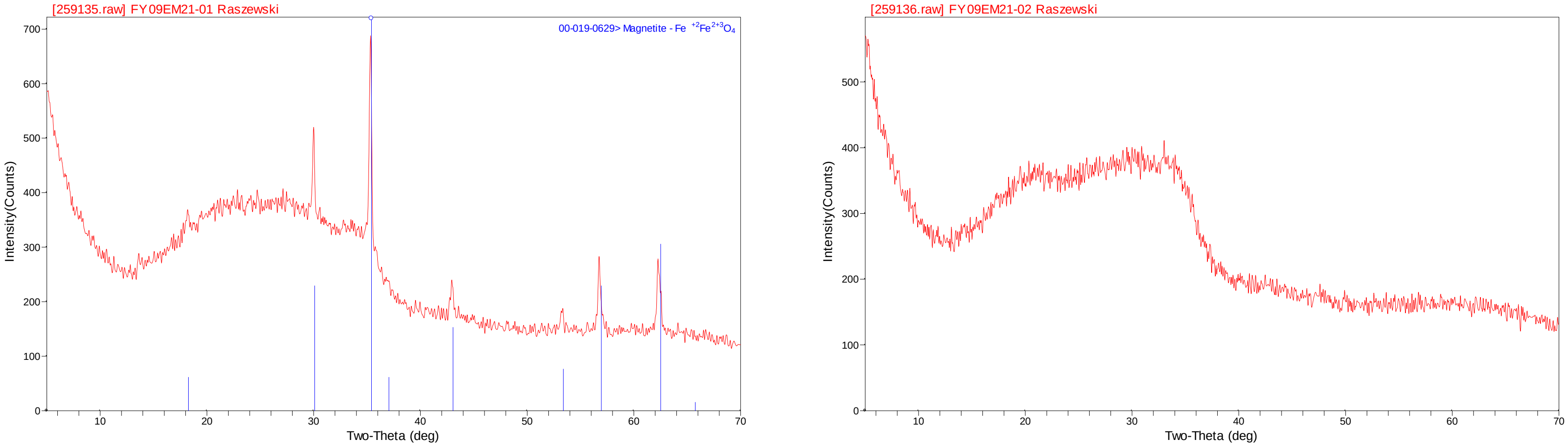
5.1.3 Matrix 2 XRD

A summary of the types of crystals present in the quenched glasses is provided in Table 9 and XRD patterns of the quenched non-radioactive glasses are shown in Figure 1 through Figure 14.[13] In general, most of the glasses were amorphous after quenching. Glasses that were not amorphous contained crystals that were either Fe-based spinels or Fe/Ni-based spinels. After the initial melting of the Matrix 2 glasses, FY09EM21-01, -04, -10, -13, -22, -23 and -24 all appeared to be crystallized throughout. These glasses were then re-melted at 1150°C for an additional 30 minutes and then poured directly into a cold water bath. The XRD results suggest that a faster quenching rate did not prevent crystallization in these glasses. It is also interesting to note the predicted T_L values of the glasses that crystallized (Table 9).[14] According to these values, all of the glasses except FY09EM21-10 should have been free of crystals when melted at 1150°C.

Table 9. XRD Results of the Matrix 2 Quenched Glasses

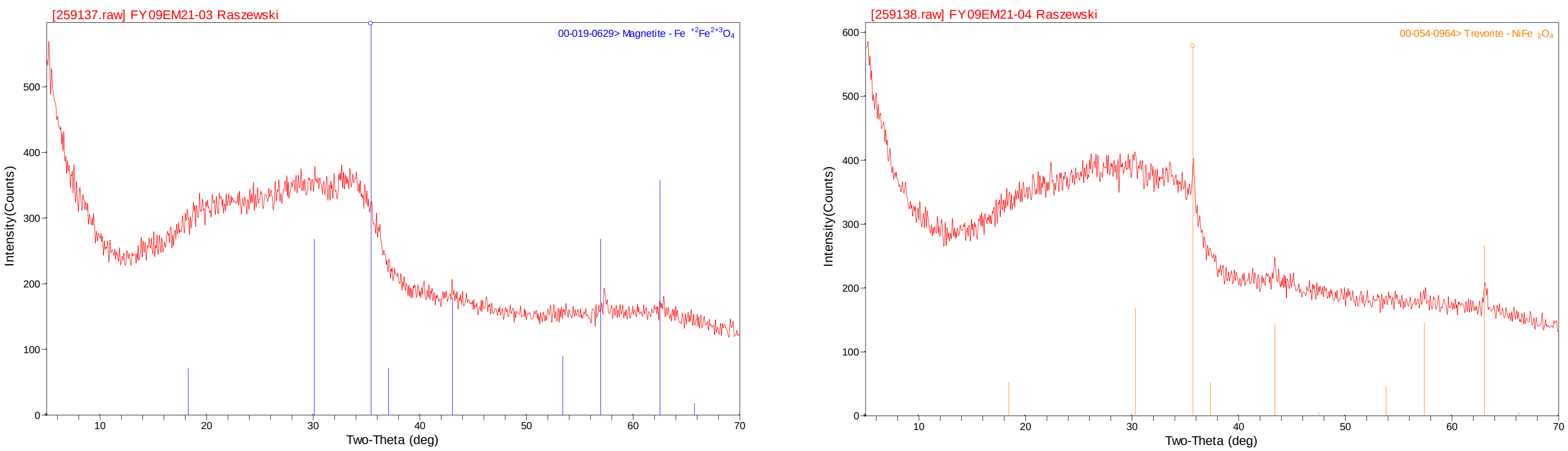
Glass ID	Predicted T_L (°C)	XRD Results	Water Quenched
		quenched	
FY09EM21-01	1079	Magnetite ($Fe^{+2}Fe^{2+3}O_4$)	x
FY09EM21-02	905	***Amorphous***	
FY09EM21-03	876	Magnetite ($Fe^{+2}Fe^{2+3}O_4$)	
FY09EM21-04	1130	Trevorite ($NiFe_2O_4$)	x
FY09EM21-05	1031	***Amorphous***	
FY09EM21-06	921	***Amorphous***	
FY09EM21-07	955	***Amorphous***	
FY09EM21-08	989	***Amorphous***	
FY09EM21-09	1007	***Amorphous***	
FY09EM21-10	1159	Magnetite ($Fe^{+2}Fe^{2+3}O_4$)	x
FY09EM21-11	733	***Amorphous***	
FY09EM21-12	1010	***Amorphous***	
FY09EM21-13	1109	Trevorite ($NiFe_2O_4$)	x
FY09EM21-14	959	***Amorphous***	
FY09EM21-15	1033	***Amorphous***	
FY09EM21-16	992	***Amorphous***	
FY09EM21-17	866	***Amorphous***	
FY09EM21-18	763	***Amorphous***	
FY09EM21-19	761	***Amorphous***	
FY09EM21-20	1020	***Amorphous***	
FY09EM21-21	928	***Amorphous***	
FY09EM21-22	1051	Trevorite ($NiFe_2O_4$)	x
FY09EM21-23	957	***Amorphous***	x
FY09EM21-24	1103	Trevorite ($NiFe_2O_4$), Hematite (Fe_2O_3)	x
FY09EM21-25	761	***Amorphous***	
FY09EM21-26	938	***Amorphous***	
FY09EM21-27	1016	***Amorphous***	

[13] Samples of the ccc glasses were sent to PNNL for semi-quantitative XRD analysis; however, no measurements were made due to instrumental issues.
[14] The predicted T_L is of the bias-corrected composition.



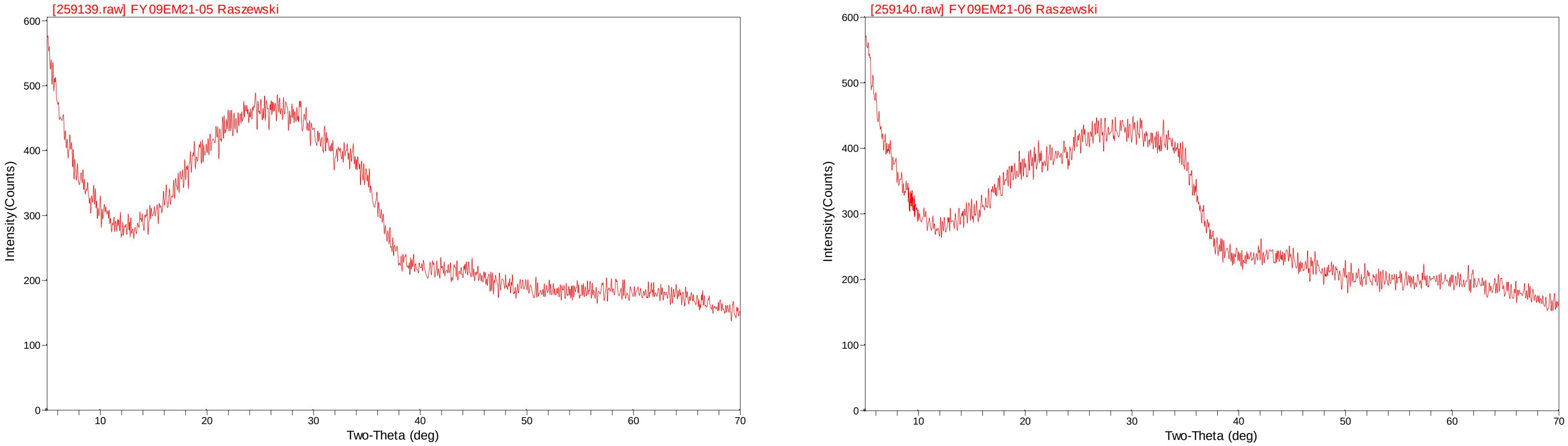
(a) (b)

Figure 1. XRD patterns of (a) FY09EM21-01 and (b) FY09EM21-02.



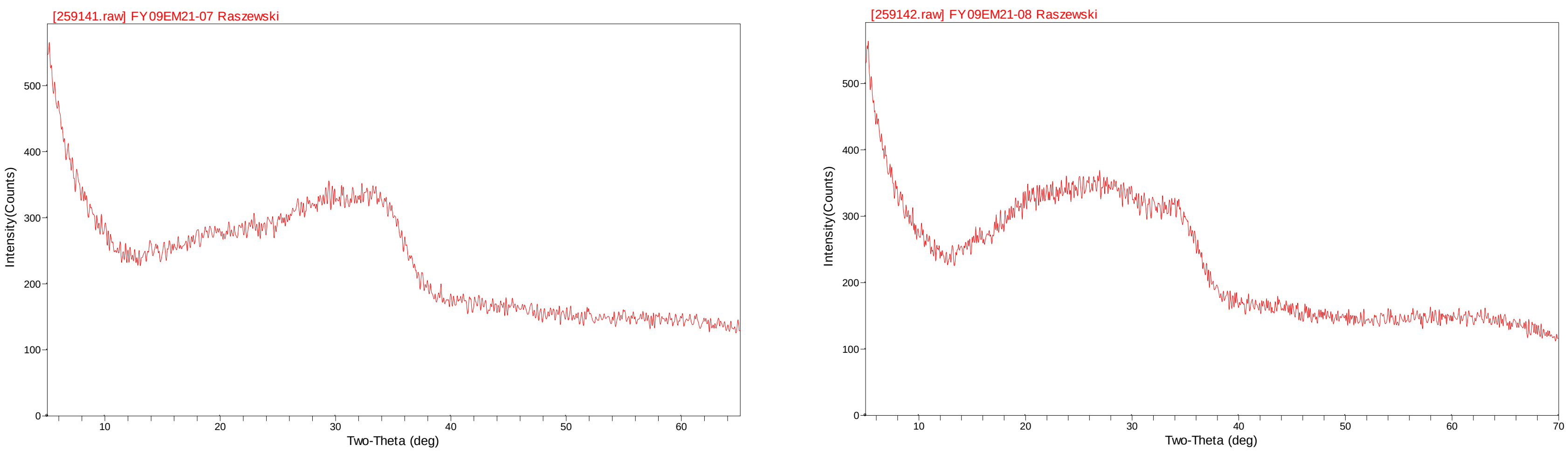
(a) (b)

Figure 2. XRD patterns of (a) FY09EM21-03 and (b) FY09EM21-04.



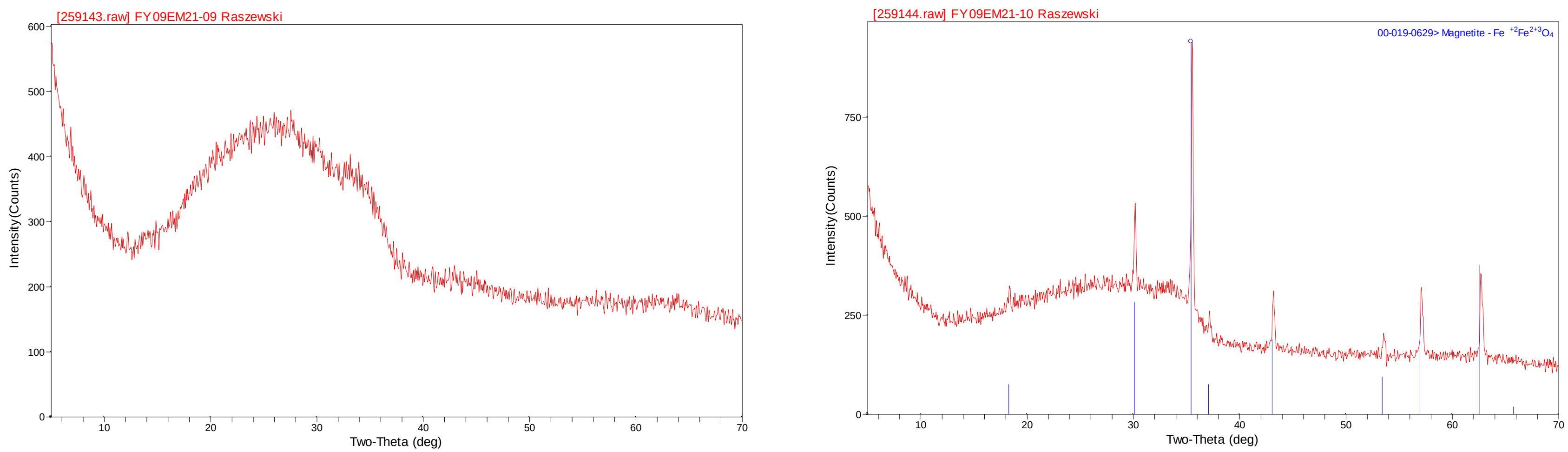
(a) (b)

Figure 3. XRD patterns of (a) FY09EM21-05 and (b) FY09EM21-06.



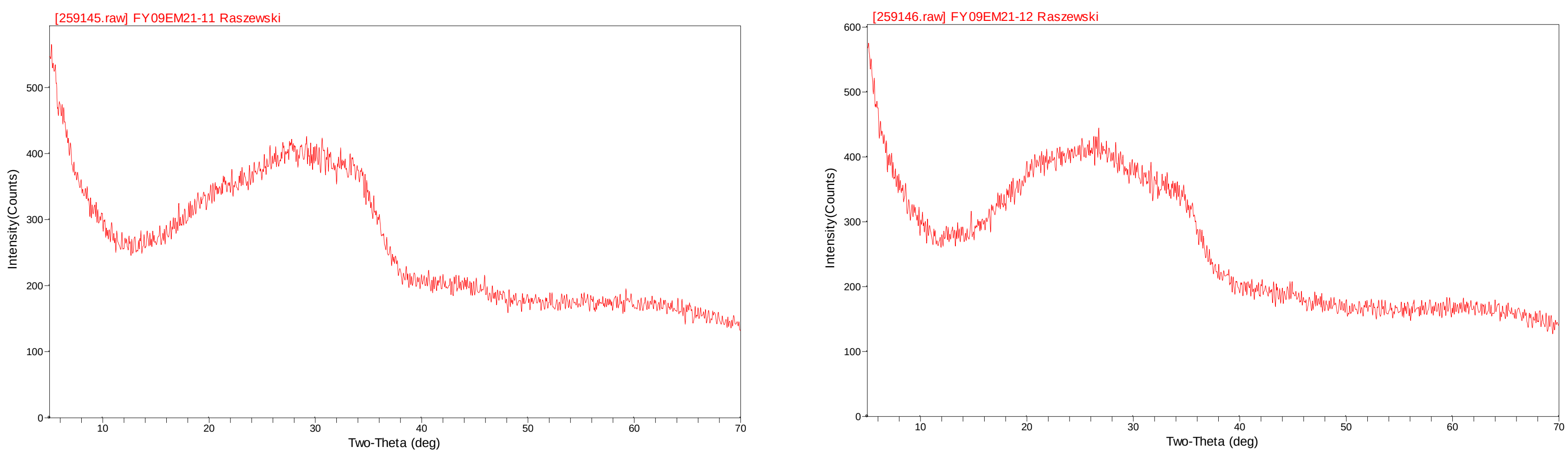
(a) (b)

Figure 4. XRD patterns of (a) FY09EM21-07 and (b) FY09EM21-08.



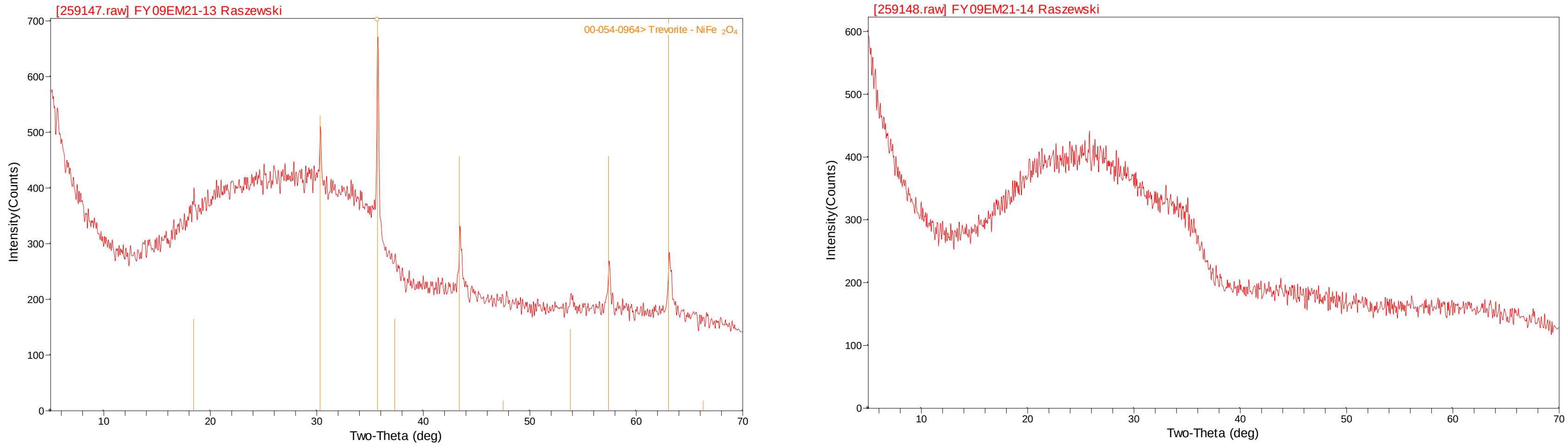
(a) (b)

Figure 5. XRD patterns of (a) FY09EM21-09 and (b) FY09EM21-10.



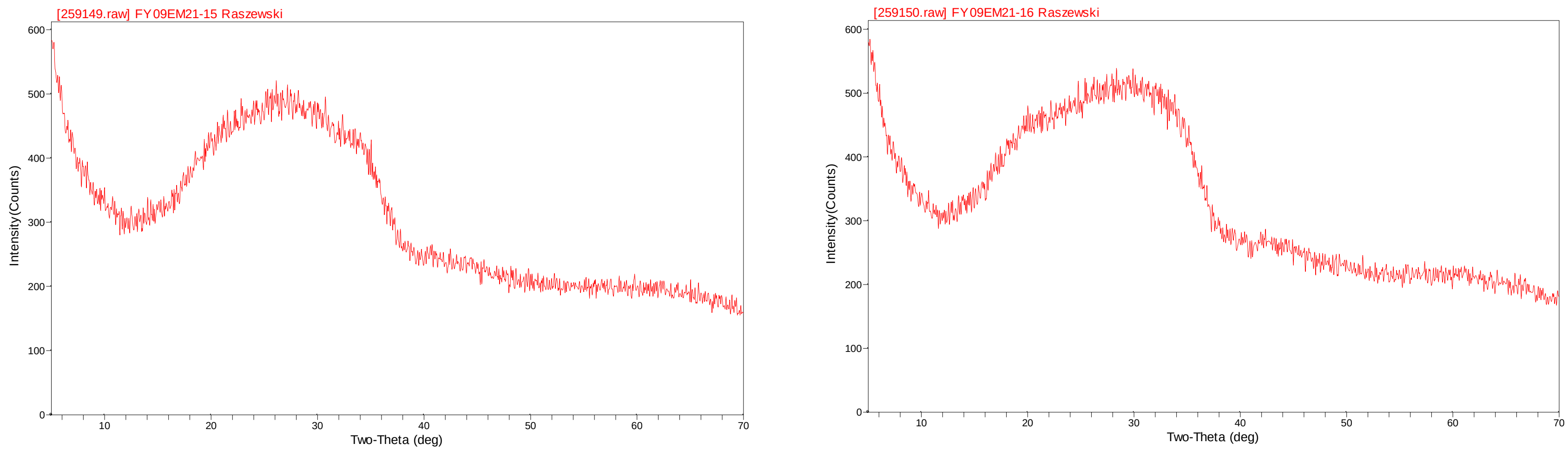
(a) (b)

Figure 6. XRD patterns of (a) FY09EM21-11 and (b) FY09EM21-12.



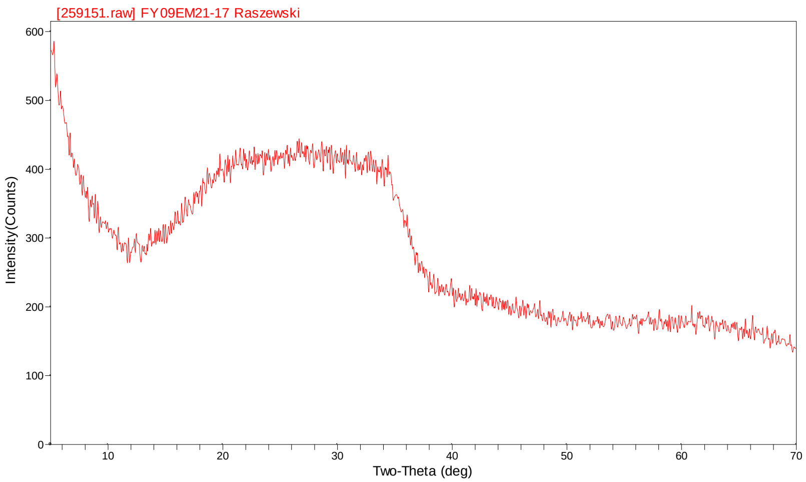
(a) (b)

Figure 7. XRD patterns of (a) FY09EM21-13 and (b) FY09EM21-14.

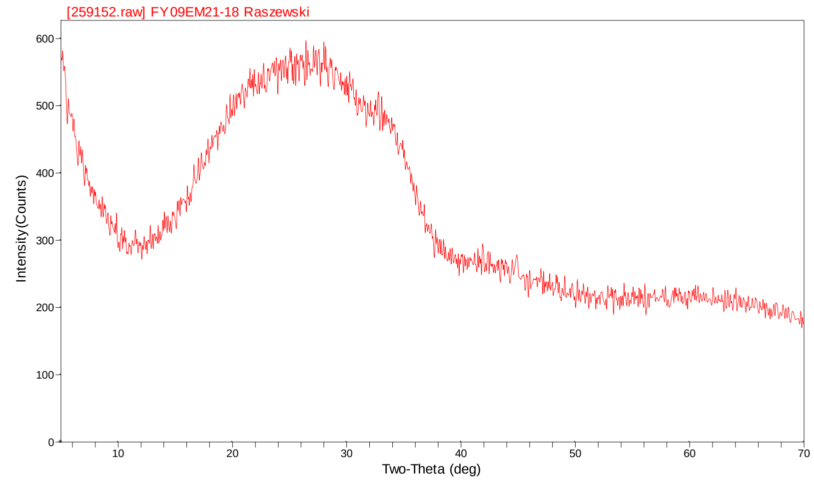


(a) (b)

Figure 8. XRD patterns of (a) FY09EM21-15 and (b) FY09EM21-16.

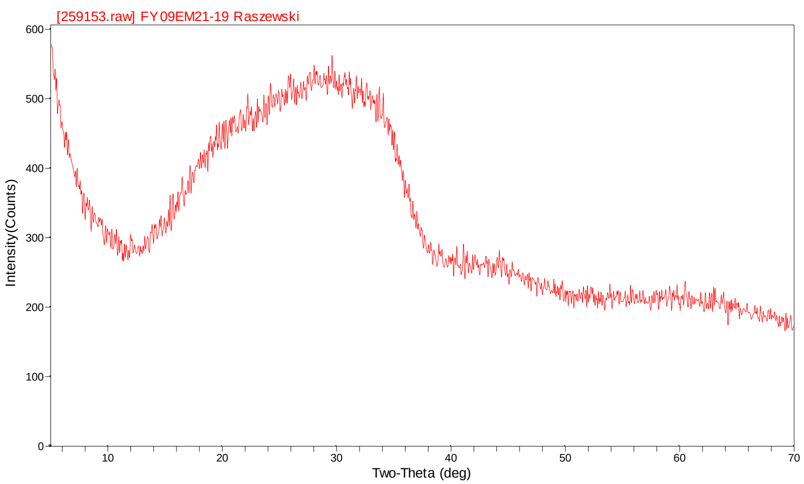


(a)

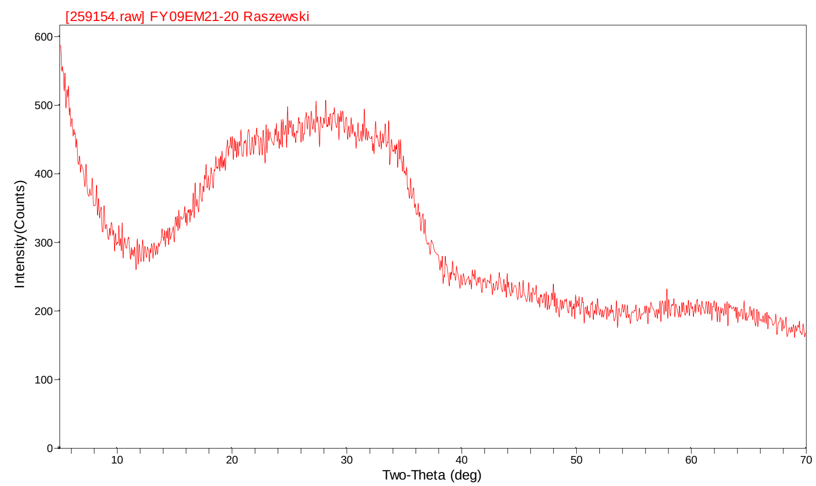


(b)

Figure 9. XRD patterns of (a) FY09EM21-17 and (b) FY09EM21-18.

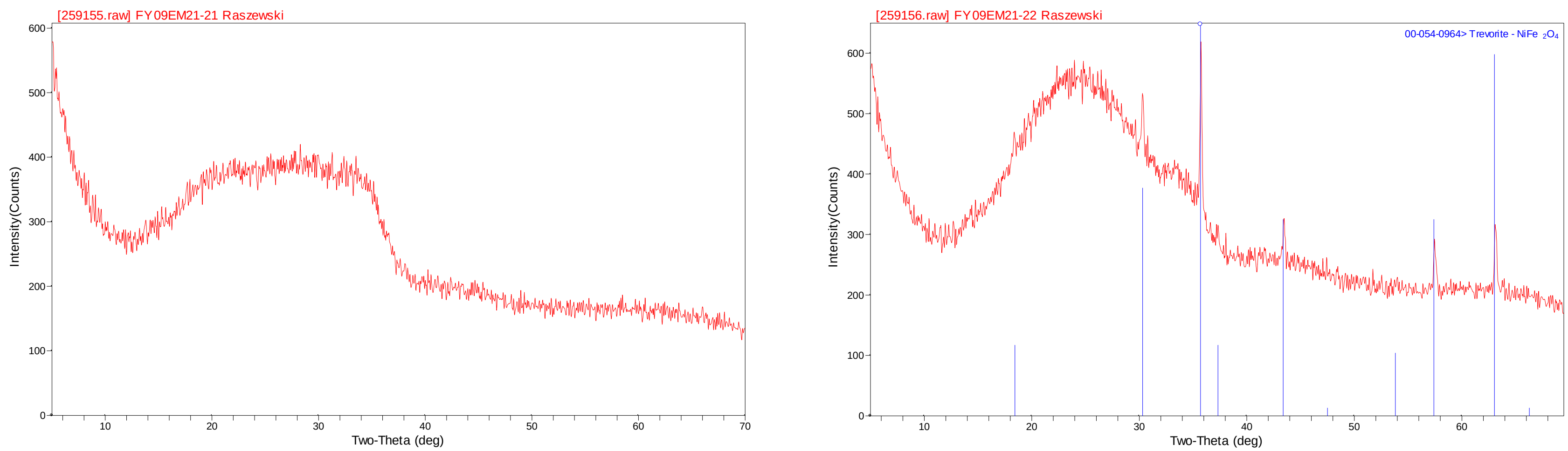


(a)



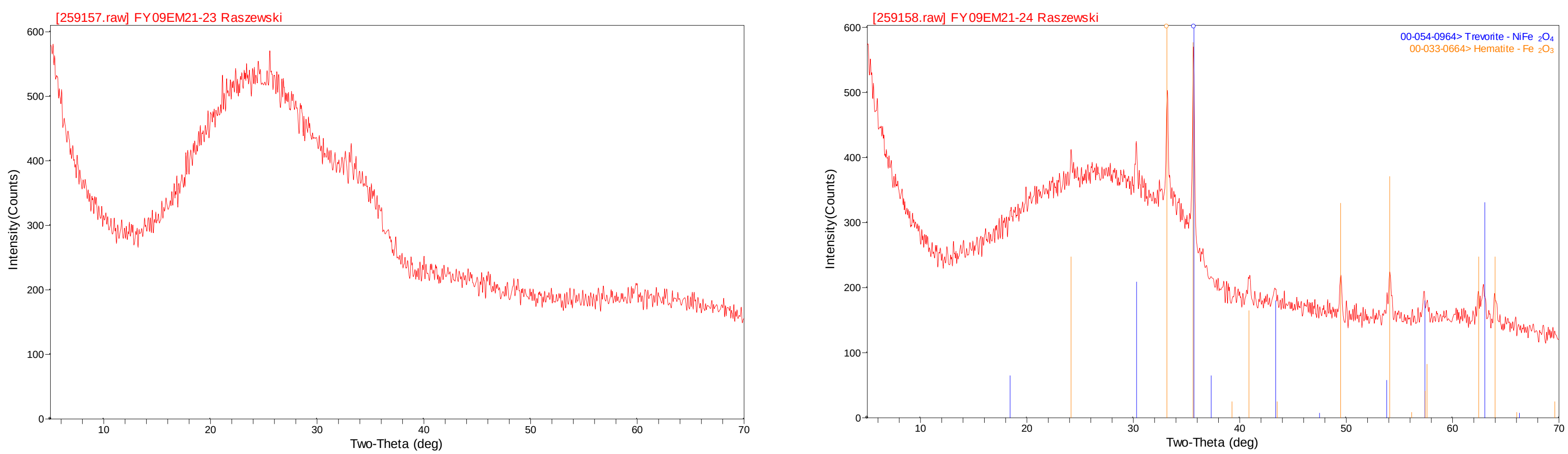
(b)

Figure 10. XRD patterns of (a) FY09EM21-19 and (b) FY09EM21-20.



(a) (b)

Figure 11. XRD patterns of (a) FY09EM21-21 and (b) FY09EM21-22.



(a) (b)

Figure 12. XRD patterns of (a) FY09EM21-23 and (b) FY09EM21-24.

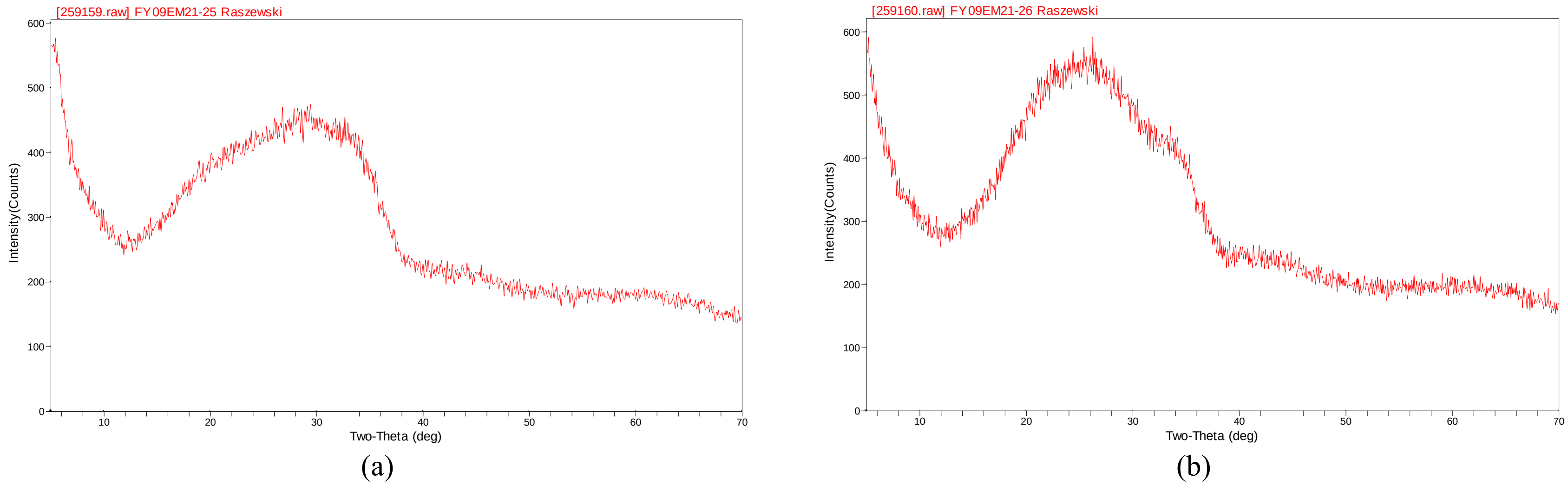


Figure 13. XRD patterns of (a) FY09EM21-25 and (b) FY09EM21-26.

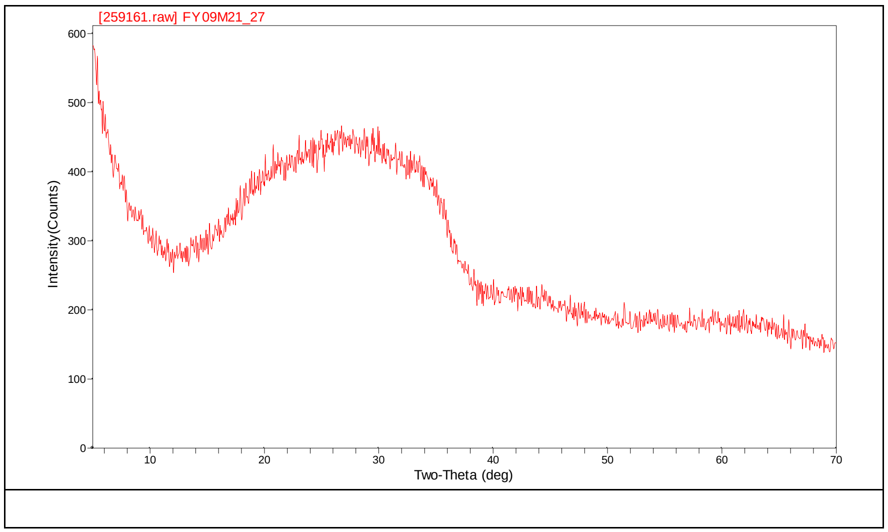


Figure 14. XRD pattern of FY09EM21-27.

5.1.4 A Statistical Review of the PCT Results of the Matrix 2 Non-Radioactive Glasses

Table B1 in Appendix B provides the as-received (AR) elemental leachate concentration measurements for the solution samples generated by the PCTs. Any measurement below the detection limit of the analytical procedure (indicated by a "<") was replaced by one half of the detection limit in subsequent analyses. In addition to adjustments for detection limits, the values were adjusted for the acid dilution factors: study glasses, blanks and the ARM glass were multiplied by 1.6667 to determine the values in parts per million (ppm) and the values for EA were multiplied by 16.6667. The last four columns of Table B1 in Appendix B provide the resulting ppm measurements.

One of the quality control checkpoints for the PCT procedure is solution-weight loss over the course of the 7-day test. None of the PCTs from these glasses indicated a solution-weight loss problem.

5.1.4.1 Measurements in Analytical Sequence

Exhibit B1 in Appendix B provides plots of the leachate concentrations in analytical sequence as generated by the PSAL for all of the data from all three sets of PCTs. Some scatter in the measurement of the EA glass is observed (blue X). No other issues are observed in these plots.

5.1.4.2 Results for the Samples of the Multi-Element Solution Standard

Exhibit B2 in Appendix B provides analyses of measurements of the multi-element solution standard by analytical set/ICP-AES calibration block, and an ANOVA investigation for each element of interest. A statistically significant difference (at a 5% level) among the averages of these measurements was indicated for Li and Si. No attempt was made to bias correct for these effects since averaging the ppm values for each set of triplicates helps to minimize the impact of any potential effects of the instrument.

Table 10 summarizes the average measurements and the reference values for the 4 elements of interest. The results indicate consistent and accurate measurements from the PSAL processes used to conduct these analyses.

5.1.4.3 Measurements by Glass Identifier

Exhibit B3 in Appendix B provides plots of the leachate concentrations for both the quenched and ccc version of each glass, as well as the reference samples (EA, ARM[O], multi-element solution standard and blanks).[27] Two units of measure are used in these plots: ppm and the common logarithms of the ppm values. The common logarithm plots allow for the assessment of the repeatability of the measurements.

For some of the glasses, scatter in the triplicate values of some analytes is observed. For example, there is some scatter in the Si values for the ccc version of FY07EM21-17.

[O] The concentrations of each element of interest for ARM are within the control limits in THERMO™.

Table 10. Multi-Element Solution Standard Results of the Non-Radioactive Matrix 2 Glasses

Set	Block	B (ppm)	Li (ppm)	Na (ppm)	Si (ppm)
1	1	21.5	10.0	82.7	52.7
1	1	20.5	10.0	81.9	51.5
1	1	19.9	10.0	84.0	52.1
1	2	20.4	9.9	84.4	52.5
1	2	19.2	10.0	85.1	52.6
1	2	18.2	9.6	79.9	51.3
1	3	22.0	10.2	83.4	51.9
1	3	19.9	9.9	77.7	50.6
1	3	20.4	10.1	80.6	51.5
Average		20.2	10.0	82.2	51.9
2	1	21.4	9.8	81.7	50.1
2	1	20.5	9.9	81.4	50.5
2	1	20.1	9.6	78.7	49.3
2	2	21.6	10.0	82.4	50.4
2	2	19.9	9.9	80.7	50.2
2	2	20.0	9.9	81.3	50.6
2	3	21.3	9.9	83.0	51.6
2	3	20.3	9.9	82.5	51.7
2	3	20.1	9.9	82.7	51.6
Average		20.6	9.9	81.6	50.7
3	1	21.2	10.1	83.1	51.1
3	1	20.2	9.9	82.7	49.5
3	1	20.7	10.2	86.4	50.1
3	2	21.0	10.2	81.9	51.3
3	2	20.2	10.1	80.8	50.8
3	2	20.4	10.2	81.6	51.6
3	3	20.3	10.0	82.8	50.4
3	3	20.2	10.1	83.8	50.6
3	3	22.9	10.1	82.1	50.8
Average		20.8	10.1	82.8	50.7
Grand Average		20.5	10.0	82.2	51.1
Reference Value		20	10	81	50
% difference		2.7%	-0.2%	1.5%	2.1%

5.1.4.4 Normalized PCT Results

PCT leachate concentrations were normalized using the target, measured and bias-corrected cation compositions (wt%) in the glass to obtain a grams-per-liter (g/L) leachate concentration.

As is the usual convention, the common logarithm of the normalized PCT (normalized leachate, NL) for each element of interest was determined and used for comparison. To accomplish this computation, one must:

1. Determine the common logarithm of the elemental leachate concentration (ppm) for each of the triplicates and each of the elements of interest (these values are provided in Table B1 of Appendix B).

2. Average the common logarithms over the triplicates for each element of interest.

Normalizing Using Measured Composition

3. Subtract a quantity equal to 1 plus the common logarithm of the average cation measured concentration (expressed as a weight percent of the glass) from the average computed in step 2.

Or Normalizing Using Target Composition

3. Subtract a quantity equal to 1 plus the common logarithm of the target cation concentration (expressed as a weight percent of the glass) from the average computed in step 2.

Or Normalizing Using Measured Bias-Corrected Composition

3. Subtract a quantity equal to 1 plus the common logarithm of the measured bias-corrected cation concentration (expressed as a weight percent of the glass) from the average computed in step 2.

Exhibit B4 in Appendix B provides scatter plots for these results and offers an opportunity to investigate the consistency in the leaching across the elements for the glasses of this study. All combinations of the normalizations of the PCTs (i.e., those generated using the target, measured, and bias-corrected compositional views) and both heat treatments are represented in the series of scatter plots. Consistency in the leaching across the elements is typically demonstrated by a high degree of linear correlation among the values for pairs of these elements. The smallest correlation in this plot is that for Na and Si, with a value of ~91.3%.

Table 11 summarizes the normalized PCTs for the glasses of this study.[P] The PCTs are listed by heat treatment and compositional view for each glass.

[P] The concentrations of each element of interest for ARM are within the control limits in THERMO™.

Table 11. Normalized PCT Results of the Non-Radioactive Matrix 2 Glasses

Set	Glass ID	Heat Treatment	Comp View	log NL [B (g/L)]	log NL [Li (g/L)]	log NL [Na (g/L)]	log NL [Si (g/L)]	NL B (g/L)	NL Li (g/L)	NL Na (g/L)	NL Si (g/L)
1	**ARM**	ref	ref	-0.27	-0.27	-0.32	-0.55	0.54	0.54	0.48	0.28
2	**ARM**	ref	ref	-0.34	-0.27	-0.35	-0.58	0.46	0.53	0.45	0.27
3	**ARM**	ref	ref	-0.24	-0.20	-0.26	-0.53	0.58	0.63	0.55	0.29
1	**EA**	ref	ref	1.27	0.98	1.14	0.62	18.70	9.54	13.85	4.15
2	**EA**	ref	ref	1.02	0.82	0.92	0.45	10.44	6.53	8.26	2.83
3	**EA**	ref	ref	1.25	0.97	1.13	0.60	17.87	9.35	13.37	3.98
1	**FY09EM21-01**	quenched	Measured	-0.09	-0.11	-0.14	-0.29	0.82	0.78	0.72	0.51
1			Measured bc	-0.08	-0.11	-0.15	-0.30	0.83	0.78	0.71	0.50
1			Target	-0.08	-0.11	-0.13	-0.28	0.84	0.78	0.74	0.52
1		ccc	Measured	0.05	-0.09	-0.22	-0.21	1.13	0.81	0.61	0.61
1			Measured bc	0.06	-0.09	-0.23	-0.22	1.14	0.81	0.60	0.60
1			Target	0.06	-0.09	-0.21	-0.21	1.15	0.81	0.62	0.62
1	**FY09EM21-02**	quenched	Measured	1.07	0.76	1.01	0.47	11.72	5.79	10.31	2.92
1			Measured bc	1.07	0.76	1.01	0.46	11.82	5.73	10.11	2.85
1			Target	1.08	0.77	0.99	0.47	11.99	5.83	9.78	2.94
1		ccc	Measured	1.08	0.78	1.01	0.47	11.93	5.97	10.16	2.97
1			Measured bc	1.08	0.77	1.00	0.46	12.03	5.90	9.96	2.90
1			Target	1.09	0.78	0.98	0.48	12.21	6.01	9.64	3.00
1	**FY09EM21-03**	quenched	Measured	0.42	0.36	0.34	0.10	2.65	2.29	2.16	1.26
1			Measured bc	0.43	0.35	0.34	0.10	2.68	2.26	2.19	1.25
1			Target	0.44	0.34	0.35	0.09	2.73	2.20	2.23	1.24
1		ccc	Measured	1.07	0.77	0.86	0.45	11.83	5.88	7.15	2.84
1			Measured bc	1.08	0.77	0.86	0.45	11.92	5.81	7.22	2.84
1			Target	1.09	0.75	0.87	0.45	12.16	5.67	7.38	2.81
1	**FY09EM21-04**	quenched	Measured	0.79	0.71	0.70	0.07	6.15	5.18	5.02	1.16
1			Measured bc	0.79	0.71	0.71	0.06	6.20	5.12	5.07	1.16
1			Target	0.79	0.71	0.70	0.06	6.15	5.14	5.00	1.15
1		ccc	Measured	0.31	0.29	0.28	-0.07	2.05	1.97	1.89	0.86
1			Measured bc	0.32	0.29	0.28	-0.07	2.06	1.95	1.91	0.85
1			Target	0.31	0.29	0.28	-0.07	2.05	1.95	1.88	0.85
1	**FY09EM21-05**	quenched	Measured	0.05	-0.02	-0.07	-0.28	1.12	0.95	0.86	0.52
1			Measured bc	0.06	-0.02	-0.08	-0.29	1.14	0.95	0.84	0.51
1			Target	0.03	-0.03	-0.07	-0.30	1.08	0.94	0.85	0.50
1		ccc	Measured	-0.10	-0.11	-0.20	-0.41	0.80	0.78	0.63	0.39
1			Measured bc	-0.09	-0.11	-0.21	-0.42	0.81	0.78	0.62	0.38
1			Target	-0.12	-0.11	-0.20	-0.42	0.77	0.77	0.63	0.38
1	**FY09EM21-06**	quenched	Measured	0.73	0.64	0.57	0.15	5.38	4.37	3.75	1.40
1			Measured bc	0.74	0.64	0.58	0.15	5.43	4.32	3.79	1.40
1			Target	0.73	0.63	0.58	0.14	5.38	4.21	3.76	1.37
1		ccc	Measured	0.81	0.73	0.66	0.24	6.50	5.34	4.57	1.72
1			Measured bc	0.82	0.72	0.66	0.24	6.55	5.28	4.61	1.72
1			Target	0.81	0.71	0.66	0.23	6.49	5.14	4.57	1.69
1	**FY09EM21-07**	quenched	Measured	1.14	1.03	1.00	0.05	13.87	10.69	10.00	1.11
1			Measured bc	1.15	1.03	1.00	0.04	14.06	10.63	10.09	1.11
1			Target	1.14	1.01	1.00	0.04	13.64	10.34	10.09	1.10
1		ccc	Measured	0.78	0.71	0.67	-0.01	6.02	5.14	4.70	0.98
1			Measured bc	0.79	0.71	0.68	-0.01	6.11	5.11	4.75	0.97
1			Target	0.77	0.70	0.68	-0.02	5.93	4.97	4.75	0.96
1	**FY09EM21-08**	quenched	Measured	0.72	0.56	0.56	0.25	5.28	3.61	3.59	1.76
1			Measured bc	0.73	0.56	0.55	0.24	5.36	3.59	3.52	1.72
1			Target	0.71	0.54	0.54	0.23	5.13	3.47	3.47	1.68
1		ccc	Measured	0.63	0.66	0.53	0.40	4.27	4.55	3.37	2.53
1			Measured bc	0.64	0.66	0.52	0.39	4.34	4.52	3.30	2.47
1			Target	0.62	0.64	0.51	0.38	4.15	4.37	3.25	2.42

Table 11 continued.

Set	Glass ID	Heat Treatment	Comp View	log NL [B (g/L)]	log NL [Li (g/L)]	log NL [Na (g/L)]	log NL [Si (g/L)]	NL B (g/L)	NL Li (g/L)	NL Na (g/L)	NL Si (g/L)
1	FY09EM21-09	quenched	Measured	-0.07	-0.05	-0.14	-0.34	0.85	0.89	0.72	0.46
1	FY09EM21-09	quenched	Measured bc	-0.06	-0.06	-0.14	-0.34	0.87	0.88	0.73	0.46
1	FY09EM21-09	quenched	Target	-0.07	-0.07	-0.14	-0.35	0.86	0.86	0.72	0.45
1	FY09EM21-09	ccc	Measured	-0.32	-0.23	-0.31	-0.45	0.48	0.59	0.49	0.36
1	FY09EM21-09	ccc	Measured bc	-0.31	-0.23	-0.31	-0.45	0.49	0.58	0.49	0.35
1	FY09EM21-09	ccc	Target	-0.31	-0.25	-0.31	-0.46	0.48	0.57	0.49	0.35
2	FY09EM21-10	quenched	Measured	0.10	0.10	0.09	-0.24	1.27	1.26	1.23	0.57
2	FY09EM21-10	quenched	Measured bc	0.11	0.10	0.09	-0.25	1.29	1.25	1.24	0.57
2	FY09EM21-10	quenched	Target	0.10	0.09	0.10	-0.25	1.26	1.22	1.26	0.56
2	FY09EM21-10	ccc	Measured	-0.14	0.03	-0.07	-0.32	0.73	1.08	0.86	0.48
2	FY09EM21-10	ccc	Measured bc	-0.13	0.03	-0.06	-0.32	0.74	1.07	0.87	0.48
2	FY09EM21-10	ccc	Target	-0.15	0.02	-0.05	-0.33	0.72	1.04	0.88	0.47
2	FY09EM21-11	quenched	Measured	0.40	0.33	0.35	0.08	2.53	2.15	2.21	1.20
2	FY09EM21-11	quenched	Measured bc	0.41	0.33	0.35	0.08	2.55	2.13	2.23	1.20
2	FY09EM21-11	quenched	Target	0.37	0.32	0.35	0.07	2.37	2.10	2.23	1.16
2	FY09EM21-11	ccc	Measured	0.38	0.32	0.30	0.07	2.39	2.10	1.99	1.17
2	FY09EM21-11	ccc	Measured bc	0.38	0.32	0.30	0.07	2.41	2.08	2.01	1.17
2	FY09EM21-11	ccc	Target	0.35	0.31	0.30	0.06	2.23	2.05	2.01	1.14
2	FY09EM21-12	quenched	Measured	0.15	0.12	0.08	-0.08	1.42	1.33	1.21	0.84
2	FY09EM21-12	quenched	Measured bc	0.16	0.12	0.08	-0.09	1.44	1.32	1.19	0.82
2	FY09EM21-12	quenched	Target	0.15	0.11	0.08	-0.09	1.40	1.30	1.19	0.81
2	FY09EM21-12	ccc	Measured	0.25	0.50	0.20	0.11	1.76	3.18	1.58	1.29
2	FY09EM21-12	ccc	Measured bc	0.25	0.50	0.19	0.10	1.78	3.17	1.54	1.26
2	FY09EM21-12	ccc	Target	0.24	0.49	0.19	0.09	1.74	3.10	1.54	1.24
2	FY09EM21-13	quenched	Measured	0.07	0.13	0.13	-0.20	1.19	1.35	1.33	0.64
2	FY09EM21-13	quenched	Measured bc	0.08	0.12	0.12	-0.21	1.19	1.33	1.31	0.62
2	FY09EM21-13	quenched	Target	0.07	0.12	0.12	-0.20	1.19	1.33	1.32	0.63
2	FY09EM21-13	ccc	Measured	-0.09	0.09	-0.04	-0.33	0.81	1.23	0.91	0.46
2	FY09EM21-13	ccc	Measured bc	-0.09	0.08	-0.05	-0.34	0.82	1.21	0.89	0.45
2	FY09EM21-13	ccc	Target	-0.09	0.08	-0.04	-0.34	0.81	1.21	0.90	0.46
2	FY09EM21-14	quenched	Measured	0.01	0.01	-0.12	-0.33	1.02	1.02	0.76	0.46
2	FY09EM21-14	quenched	Measured bc	0.01	0.00	-0.13	-0.34	1.02	1.00	0.74	0.45
2	FY09EM21-14	quenched	Target	0.05	0.04	-0.13	-0.34	1.12	1.10	0.74	0.45
2	FY09EM21-14	ccc	Measured	0.59	0.52	0.43	-0.01	3.87	3.33	2.70	0.99
2	FY09EM21-14	ccc	Measured bc	0.59	0.52	0.42	-0.02	3.90	3.29	2.65	0.96
2	FY09EM21-14	ccc	Target	0.63	0.56	0.42	-0.02	4.25	3.62	2.64	0.96
2	FY09EM21-15	quenched	Measured	0.05	0.05	0.04	-0.23	1.13	1.12	1.09	0.59
2	FY09EM21-15	quenched	Measured bc	0.05	0.04	0.04	-0.23	1.13	1.10	1.08	0.59
2	FY09EM21-15	quenched	Target	0.06	0.03	0.03	-0.23	1.15	1.08	1.08	0.59
2	FY09EM21-15	ccc	Measured	0.22	0.37	0.16	-0.05	1.65	2.35	1.46	0.89
2	FY09EM21-15	ccc	Measured bc	0.22	0.37	0.16	-0.05	1.65	2.32	1.45	0.90
2	FY09EM21-15	ccc	Target	0.23	0.36	0.16	-0.05	1.69	2.28	1.44	0.90
2	FY09EM21-16	quenched	Measured	0.45	0.37	0.46	0.10	2.82	2.33	2.88	1.27
2	FY09EM21-16	quenched	Measured bc	0.46	0.37	0.46	0.11	2.88	2.36	2.88	1.28
2	FY09EM21-16	quenched	Target	0.46	0.37	0.44	0.10	2.91	2.32	2.78	1.25
2	FY09EM21-16	ccc	Measured	0.23	0.19	0.28	-0.06	1.71	1.55	1.90	0.87
2	FY09EM21-16	ccc	Measured bc	0.24	0.20	0.28	-0.06	1.74	1.57	1.90	0.88
2	FY09EM21-16	ccc	Target	0.25	0.19	0.26	-0.07	1.76	1.54	1.84	0.86
2	FY09EM21-17	quenched	Measured	0.05	0.09	0.22	-0.04	1.11	1.24	1.64	0.92
2	FY09EM21-17	quenched	Measured bc	0.06	0.10	0.22	-0.03	1.14	1.25	1.64	0.93
2	FY09EM21-17	quenched	Target	0.08	0.11	0.22	-0.02	1.19	1.28	1.66	0.96
2	FY09EM21-17	ccc	Measured	0.44	0.55	0.36	0.33	2.76	3.54	2.29	2.13
2	FY09EM21-17	ccc	Measured bc	0.45	0.56	0.36	0.33	2.82	3.59	2.29	2.15
2	FY09EM21-17	ccc	Target	0.47	0.57	0.37	0.35	2.95	3.68	2.32	2.24

Table 11 continued.

Set	Glass ID	Heat Treatment	Comp View	log NL [B (g/L)]	log NL [Li (g/L)]	log NL [Na (g/L)]	log NL [Si (g/L)]	NL B (g/L)	NL Li (g/L)	NL Na (g/L)	NL Si (g/L)
2	FY09EM21-18	quenched	Measured	-0.21	-0.12	0.07	-0.24	0.62	0.76	1.18	0.57
2			Measured bc	-0.21	-0.13	0.07	-0.24	0.62	0.75	1.17	0.57
2			Target	-0.20	-0.13	0.05	-0.24	0.62	0.74	1.12	0.57
2		ccc	Measured	-0.20	-0.10	0.03	-0.24	0.63	0.79	1.06	0.57
2			Measured bc	-0.20	-0.11	0.03	-0.24	0.63	0.78	1.06	0.57
2			Target	-0.20	-0.11	0.00	-0.24	0.63	0.77	1.01	0.57
3	FY09EM21-19	quenched	Measured	-0.17	0.02	0.19	-0.25	0.68	1.05	1.54	0.56
3			Measured bc	-0.17	0.02	0.19	-0.25	0.68	1.04	1.53	0.56
3			Target	-0.16	0.02	0.16	-0.25	0.70	1.04	1.43	0.56
3		ccc	Measured	-0.13	0.05	0.19	-0.26	0.74	1.12	1.53	0.55
3			Measured bc	-0.13	0.04	0.18	-0.26	0.74	1.10	1.53	0.55
3			Target	-0.12	0.05	0.15	-0.26	0.75	1.11	1.42	0.55
3	FY09EM21-20	quenched	Measured	0.05	-0.01	0.20	-0.06	1.12	0.98	1.59	0.88
3			Measured bc	0.06	0.00	0.20	-0.05	1.14	0.99	1.59	0.89
3			Target	0.06	-0.01	0.18	-0.06	1.14	0.98	1.50	0.87
3		ccc	Measured	0.04	-0.01	0.18	-0.08	1.11	0.98	1.53	0.84
3			Measured bc	0.05	0.00	0.18	-0.07	1.13	0.99	1.52	0.85
3			Target	0.05	-0.01	0.16	-0.08	1.13	0.99	1.44	0.83
3	FY09EM21-21	quenched	Measured	1.48	1.16	1.34	0.58	30.16	14.33	21.91	3.79
3			Measured bc	1.48	1.15	1.34	0.58	30.15	14.14	21.90	3.80
3			Target	1.48	1.15	1.33	0.58	29.96	14.10	21.55	3.78
3		ccc	Measured	1.43	1.13	1.29	0.55	26.71	13.54	19.55	3.57
3			Measured bc	1.43	1.13	1.29	0.55	26.71	13.36	19.54	3.58
3			Target	1.42	1.12	1.28	0.55	26.54	13.32	19.22	3.56
3	FY09EM21-22	quenched	Measured	-0.22	-0.06	-0.55	-0.38	0.60	0.87	0.28	0.42
3			Measured bc	-0.21	-0.06	-0.55	-0.37	0.61	0.88	0.28	0.42
3			Target	-0.22	-0.05	-0.55	-0.37	0.60	0.88	0.29	0.43
3		ccc	Measured	-0.28	-0.15	-0.50	-0.40	0.52	0.71	0.31	0.40
3			Measured bc	-0.27	-0.14	-0.50	-0.39	0.53	0.72	0.31	0.41
3			Target	-0.28	-0.14	-0.50	-0.39	0.53	0.72	0.32	0.41
3	FY09EM21-23	quenched	Measured	-0.14	-0.04	-0.51	-0.40	0.72	0.92	0.31	0.40
3			Measured bc	-0.14	-0.04	-0.51	-0.40	0.72	0.91	0.31	0.40
3			Target	-0.14	-0.05	-0.52	-0.40	0.72	0.90	0.30	0.40
3		ccc	Measured	-0.20	-0.06	-0.37	-0.32	0.63	0.87	0.43	0.48
3			Measured bc	-0.20	-0.07	-0.37	-0.31	0.63	0.85	0.43	0.49
3			Target	-0.20	-0.08	-0.37	-0.32	0.63	0.84	0.42	0.48
3	FY09EM21-24	quenched	Measured	-0.03	0.00	-0.03	-0.40	0.94	1.01	0.95	0.40
3			Measured bc	-0.03	0.00	-0.03	-0.40	0.94	1.00	0.94	0.40
3			Target	-0.02	-0.01	-0.03	-0.39	0.96	0.99	0.94	0.40
3		ccc	Measured	-0.42	-0.24	-0.26	-0.56	0.38	0.57	0.55	0.27
3			Measured bc	-0.42	-0.25	-0.26	-0.56	0.38	0.57	0.55	0.27
3			Target	-0.41	-0.25	-0.26	-0.56	0.39	0.56	0.55	0.28
3	FY09EM21-25	quenched	Measured	-0.01	0.08	0.11	-0.21	0.99	1.21	1.30	0.62
3			Measured bc	0.00	0.09	0.11	-0.20	1.01	1.23	1.30	0.63
3			Target	0.02	0.08	0.11	-0.22	1.04	1.21	1.29	0.60
3		ccc	Measured	0.01	0.10	0.11	-0.21	1.03	1.26	1.28	0.62
3			Measured bc	0.02	0.11	0.11	-0.20	1.05	1.27	1.28	0.63
3			Target	0.04	0.10	0.11	-0.22	1.08	1.26	1.28	0.61
3	FY09EM21-26	quenched	Measured	-0.21	-0.15	-0.26	-0.36	0.62	0.71	0.55	0.44
3			Measured bc	-0.20	-0.15	-0.26	-0.36	0.63	0.72	0.55	0.44
3			Target	-0.21	-0.14	-0.26	-0.36	0.62	0.72	0.55	0.43
3		ccc	Measured	-0.17	-0.18	-0.28	-0.38	0.67	0.66	0.53	0.42
3			Measured bc	-0.16	-0.17	-0.28	-0.37	0.69	0.67	0.53	0.43
3			Target	-0.18	-0.17	-0.28	-0.38	0.67	0.68	0.53	0.42
3	FY09EM21-27	quenched	Measured	0.04	0.03	0.03	-0.23	1.10	1.07	1.07	0.59
3			Measured bc	0.04	0.03	0.03	-0.23	1.10	1.06	1.07	0.59
3			Target	0.03	0.02	0.03	-0.23	1.08	1.04	1.06	0.59
3		ccc	Measured	0.00	0.02	0.01	-0.22	1.01	1.04	1.02	0.60
3			Measured bc	0.00	0.01	0.01	-0.22	1.01	1.03	1.02	0.60
3			Target	0.00	0.01	0.01	-0.23	0.99	1.01	1.02	0.59

5.1.4.5 Effects of Heat Treatment

Exhibit B5 in Appendix B provides a series of plots and statistical comparisons that demonstrate the effects of heat treatment on the common logarithm ppm-responses of interest of the triplicate PCTs for each element for each non-radioactive study glass. The quenched version of a given glass yielded measurements indicating a significantly (at the 5% significance level) different mean log(ppm) response than the ccc version of the glass for a given element if the **Prob>|t|** value in the exhibit is 0.05 or smaller. Table 12 summaries the comparisons between the quenched and ccc versions of the study glasses for the four elements of the PCTs. The less durable heat treatment is noted.

Many of these glasses exhibit a statistically significant difference between the ccc versus the quenched versions for one or more of the PCT elements. Exhibit B6 in Appendix B provides plots of the normalized PCT responses between the two heat treatments grouped by compositional view. These plots provide a basis for judging the practical impact of differences in the PCT response due to the heat treatment of the glass.

The NL [B] values range from 0.61 g/L (FY09EM21-22) to 30.15 g/L (FY09EM21-21) for the quenched glasses and 0.38 g/L (FY09EM21-24) to 26.71 g/L (FY09EM21-21) for the ccc glasses. It is interesting to note that three of the quenched glasses are unacceptable[Q] (FY09EM21-02, -07 and -21) and nepheline was not detected in any of them.[28] The poor durability could be due to phase separation; however, further characterization would be required to verify this hypothesis. Three of the slow cooled glasses are also unacceptable (FY09EM21-02, -03 and -21), but it is unknown at this time if these glasses contain nepheline as XRD measurements could not be completed.

[Q] Historical glasses of interest to DWPF were found to be acceptable using a normalized boron release (NL [B]) of 10 g/L as a benchmark. This value was chosen so that the boron releases of the study glasses were well below that of the Environmental Assessment (EA) glass when accounting for measurement uncertainty. It should be emphasized that this limit was selected only as a guide to develop the Al_2O_3 and/or sum of alkali criteria used in PCCS.

Table 12. Samples Exhibiting a Statistically Significant Difference Between the Quenched and ccc Versions of the Non-Radioactive Matrix 2 Glasses

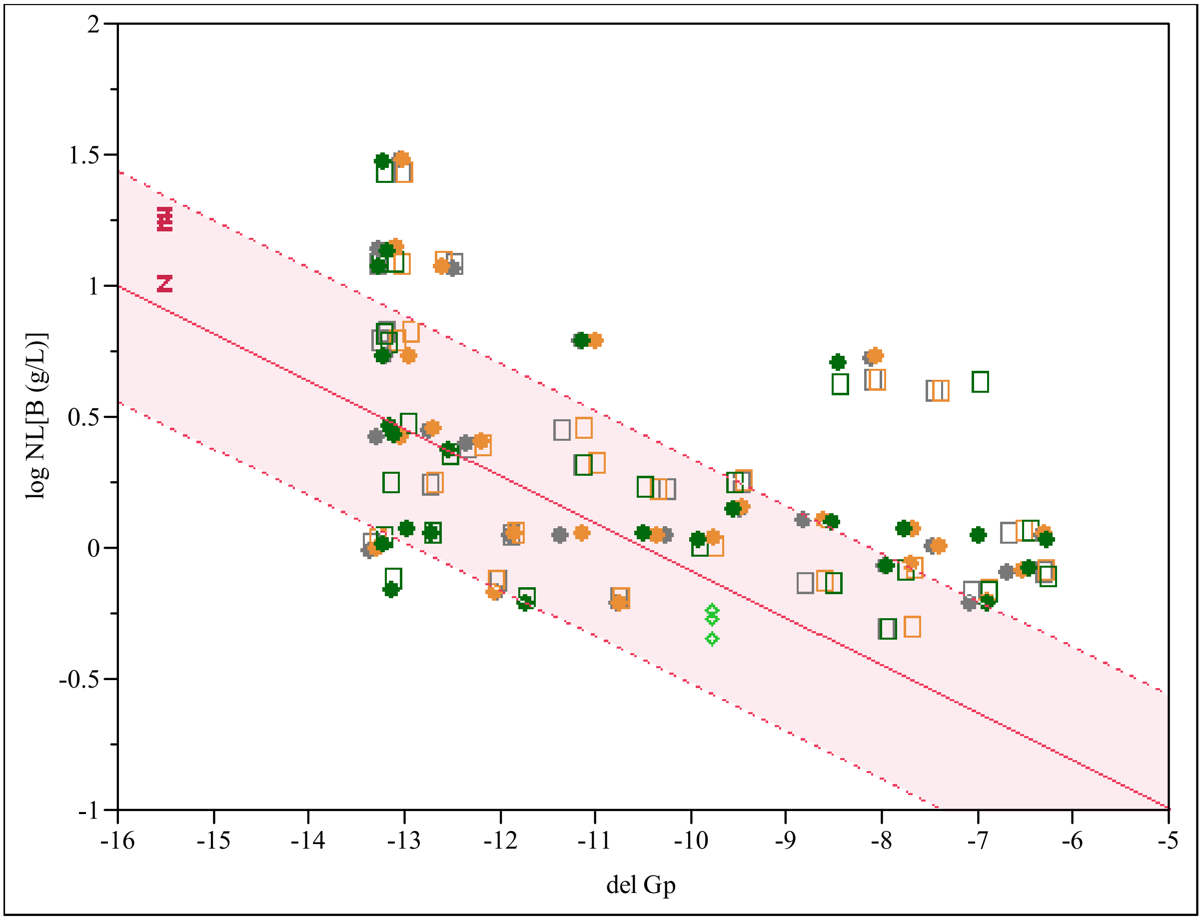
Glass ID	B	Li	Na	Si
FY09EM21-01	ccc			ccc
FY09EM21-02				
FY09EM21-03	ccc	ccc	ccc	ccc
FY09EM21-04	Q	Q	Q	Q
FY09EM21-05		Q	Q	Q
FY09EM21-06		ccc	ccc	ccc
FY09EM21-07	Q	Q	Q	Q
FY09EM21-08	Q	ccc		ccc
FY09EM21-09	Q	Q	Q	Q
FY09EM21-10	Q	Q	Q	Q
FY09EM21-11			Q	
FY09EM21-12	ccc	ccc	ccc	ccc
FY09EM21-13	Q	Q	Q	Q
FY09EM21-14	ccc	ccc	ccc	ccc
FY09EM21-15	ccc	ccc	ccc	ccc
FY09EM21-16	Q	Q	Q	Q
FY09EM21-17	ccc	ccc	ccc	ccc
FY09EM21-18		ccc	Q	
FY09EM21-19		ccc		
FY09EM21-20				
FY09EM21-21				
FY09EM21-22		Q	ccc	
FY09EM21-23		Q	ccc	ccc
FY09EM21-24	Q	Q	Q	Q
FY09EM21-25		ccc		
FY09EM21-26				
FY09EM21-27	Q		Q	

5.1.4.6 Predicted versus Measured PCTs

Exhibits B7 through B10 in Appendix B provides plots of the DWPF models[R] for B, Li, Na, and Si, respectively, that relate the logarithm of the normalized PCT (for each element of interest) to a linear function of a free energy of hydration term (ΔG_p, kcal/100g glass) derived for each of the compositional views and heat treatments for the Matrix 2 non-radioactive glasses.[27] Prediction limits (at a 95% confidence) for an individual PCT result are also plotted along with the linear fit. The EA and ARM results are also indicated on these plots.

There are a number of glasses that fall above the confidence limits for the non-radioactive study glasses. Exhibit B7 is repeated as Figure 15 below. As stated previously, three of the quenched glasses have unacceptable NL [B] values, one of which is greater than the EA glass. These glasses are of concern as no nepheline was detected by XRD. If these glasses are phase separated then the durability model would not be expected to predict their durability. It is highly recommended to use other characterization techniques in future studies to determine the cause of the poor durabilities of these glasses. These glasses do contain lower concentrations of SiO_2 and Al_2O_3 compared to some of the other glasses. A few of the glasses with log NL [B] values in the range of 0.6 to 0.8 are also unpredictable, but still acceptable with respect to the 10 g/L limit for boron release. Glasses at higher ΔG_p values (-8 to -6) are also unpredictable; however, none of these glasses have normalized boron releases greater than 1.5 g/L.

[R] It should be noted that the DWPF models for durability only apply to amorphous glasses. These models would not be expected to predict the durabilities of phase separated glasses or those glasses containing nepheline.



Symbol	Standard/ Comp View-Heat Treatment
z	EA
◊	ARM
□	Measured-ccc
□	Measured bc -ccc
□	Targeted-ccc
●	Measured-quenched
●	Measured bc - quenched
●	Targeted- quenched

Figure 15. log NL [B (g/L)] versus del Gp model with 95% Confidence Interval for Individual PCTs.

5.1.5 Matrix 2 T_L Data

A comparison of the predicted and measured T_L values is shown in Table 13. Oxides that are outside of the ranges used to develop the original model are also noted. In general, the current T_L model predicts values to be lower than those actually measured. The data do not suggest any trends with composition; however, compositions vary greatly from one composition to another and it is therefore difficult to make any conclusions. It is probable that this glass property is extremely sensitive to even small compositional changes. Unlike the series of glasses from the FY07 series[S], most of these compositions of this series have many components that are outside of the model development ranges. As this property is sensitive to compositional variation, with each component having a different magnitude in its influence, then the current liquidus model would not be expected to accurately predict glasses in higher waste loading regions.

Primary crystalline phases formed during the measurements are listed in Table 14. In general, spinel formed at temperatures near the T_L; however, there are some exceptions (FY09EM21-05, -06, -11, -12, -14, -18, -19 and -23). Iron titanate crystals formed in some of the glasses with TiO_2 concentrations of approximately 6 wt% (FY09EM-05, -14, and -23). Unidentifiable crystals were formed in FY09EM21-06, -11, -12, -18 and -19. The current T_L model is only applicable to glasses containing spinels, so it would not be expected to accurately predict glasses with unidentifiable crystals present. Optical micrographs and corresponding XRD patterns (if available) of all of the crystal types are shown in Figure 16 through Figure 19.

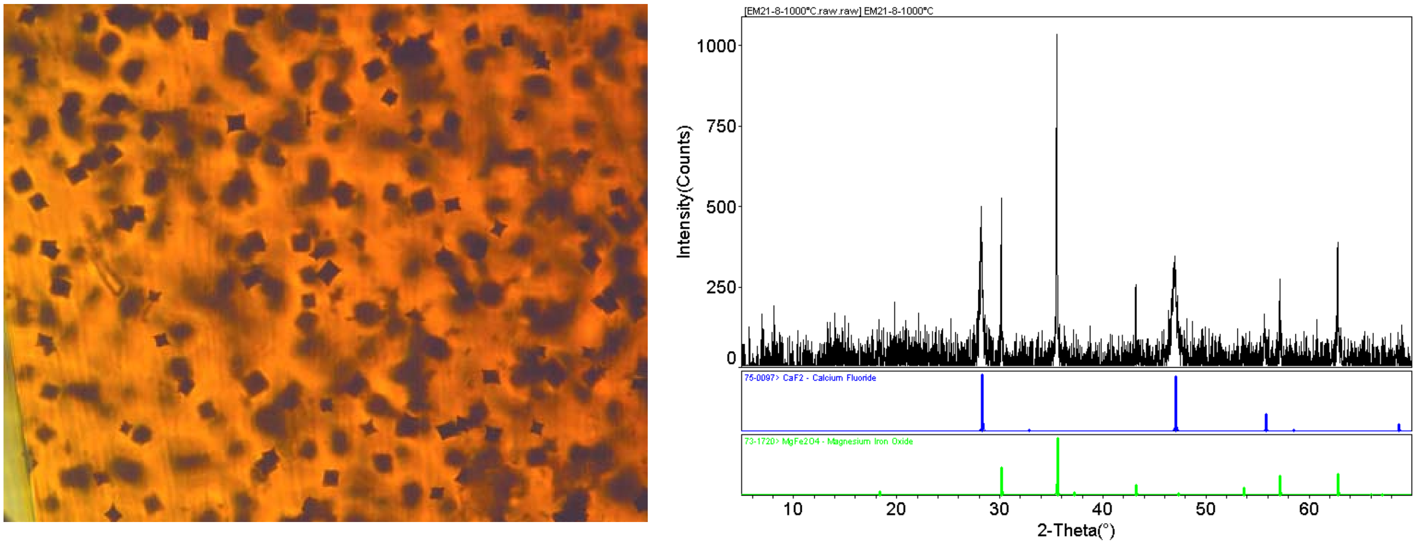
[S] In FY07, it was mostly limited to variation in MgO and TiO_2 (with some exceptions).

Table 13. Predicted and Measured T_L Values

Glass ID	T_L Predicted (°C)	T_L Measured	Measured - Predicted (°C)	Compositional Assessment Relative to Model Development Ranges
FY09EM21-02	905	980	75	Lower: CaO, MnO, NiO and SiO_2 Higher: Fe_2O_3, Na_2O and TiO_2
FY09EM21-05	1031	1115	84	Lower: B_2O_3, MgO and MnO Higher: CaO and TiO_2
FY09EM21-06	921	995	74	Lower: CaO and MgO Higher: MnO and TiO_2
FY09EM21-07	955	1055	100	Lower: SiO_2 Higher: B_2O_3, CaO, Fe_2O_3, MnO and TiO_2
FY09EM21-08	989	1096	107	Lower: B_2O_3 and NiO Higher: Fe_2O_3, Li_2O and TiO_2
FY09EM21-09	1007	1075	68	Lower: MgO and SiO_2 Higher: CaO, Li_2O and TiO_2
FY09EM21-11	733	858	125	Lower: B_2O_3 and NiO Higher: CaO, MnO and TiO_2
FY09EM21-12	1010	1096	86	Lower: CaO and MgO Higher: Li_2O, MnO and TiO_2
FY09EM21-14	959	1078	119	Lower: CaO, MgO, MnO, NiO and SiO_2 Higher: B_2O_3, Fe_2O_3 and TiO_2
FY09EM21-15	1033	1116	83	Lower: B_2O_3 Higher: CaO, MnO and TiO_2
FY09EM21-16	992	965	-27	Lower: MnO Higher: CaO, Na_2O and TiO_2
FY09EM21-17	866	898	32	Lower: B_2O_3, CaO, MgO, MnO, NiO and SiO_2 Higher: Li_2O, Na_2O and TiO_2
FY09EM21-18	763	829	66	Lower: B_2O_3, MgO and NiO Higher: Na_2O and TiO_2
FY09EM21-19	761	779	18	Lower: B_2O_3, MgO and MnO Higher: CaO, Na_2O and TiO_2
FY09EM21-20	1020	1045	25	Lower: CaO and MnO Higher: Na_2O and TiO_2
FY09EM21-21	928	933	5	Lower: CaO, MgO, NiO and SiO_2 Higher: Fe_2O_3, Li_2O and TiO_2
FY09EM21-23	957	1145	188	Lower: CaO, MnO and NiO Higher: Al_2O_3 and TiO_2
FY09EM21-25	761	858	97	Lower: B_2O_3, MgO and NiO Higher: CaO, MnO, Na_2O and TiO_2
FY09EM21-26	938	943	5	Lower: CaO and NiO Higher: MnO and TiO_2
FY09EM21-27	1016	1117	101	Higher: TiO_2

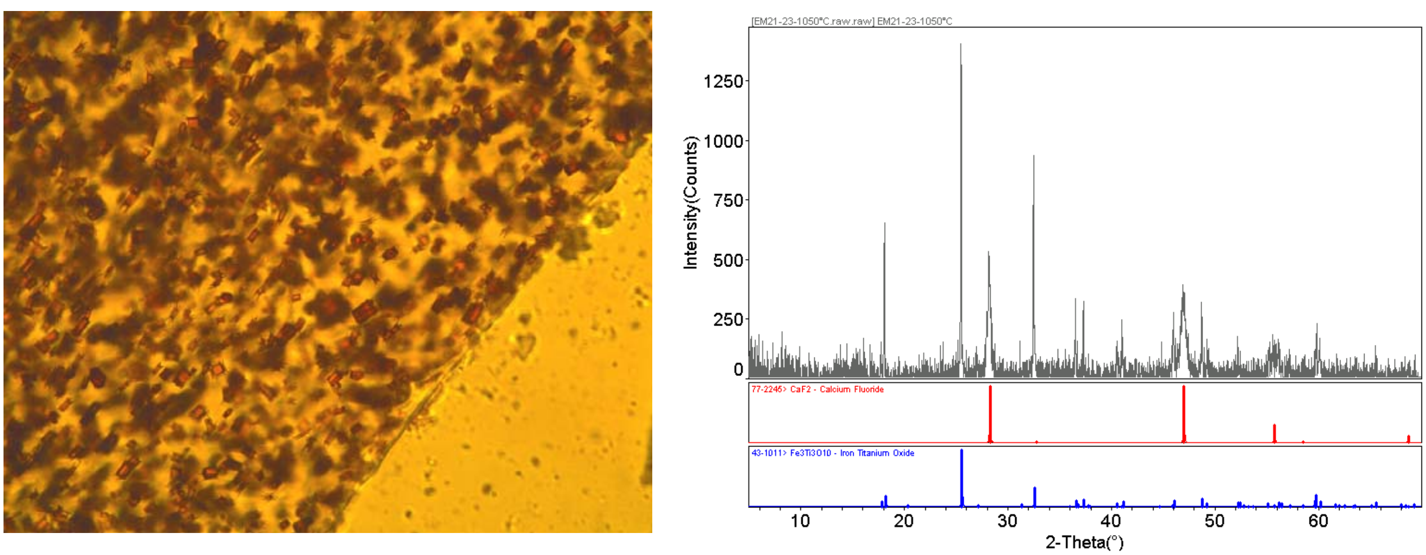
Table 14. Crystals Formed during T_L Measurements

Glass ID	Observations
FY09EM21-02	spinel
FY09EM21-05	iron titanate
FY09EM21-06	spinel and large rods
FY09EM21-07	spinel
FY09EM21-08	spinel
FY09EM21-09	spinel
FY09EM21-11	clear cuboctahedrons at 855°C spinel <855°C
FY09EM21-12	clear cuboctahedrons at 1075°C spinel at 1050°C
FY09EM21-14	iron titanate
FY09EM21-15	spinel
FY09EM21-16	spinel
FY09EM21-17	spinel
FY09EM21-18	clear cuboctahedrons
FY09EM21-19	very few clear rods and clear panes at 776°C
FY09EM21-20	spinel
FY09EM21-21	spinel
FY09EM21-23	iron titanate
FY09EM21-25	spinel
FY09EM21-26	spinel
FY09EM21-27	spinel



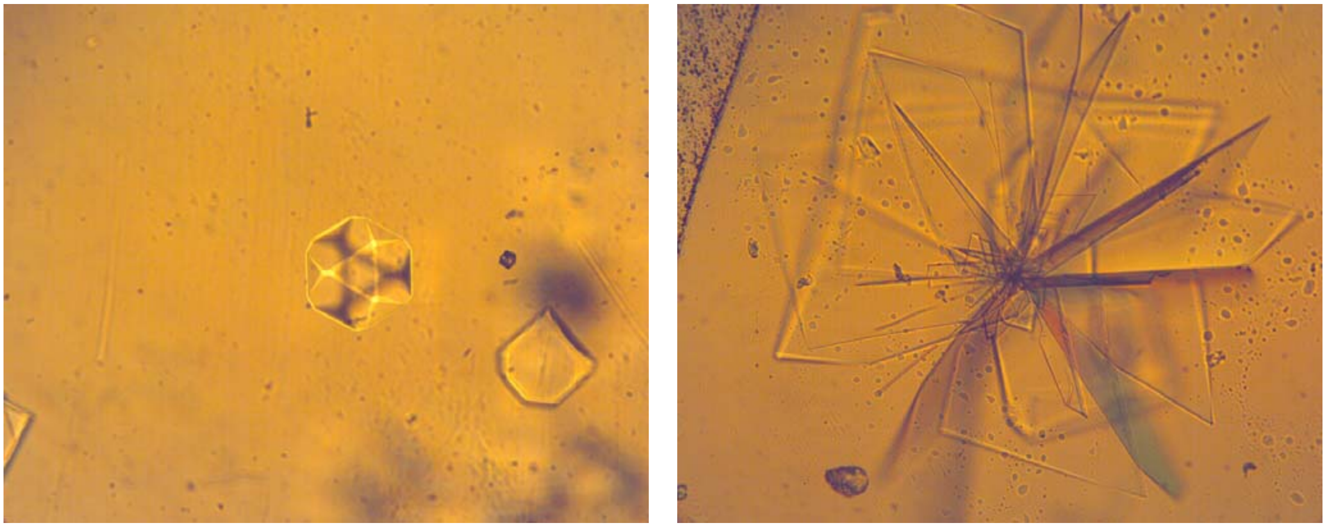
(a) (b)

Figure 16. (a) Optical micrograph of FY09EM21-08 treated at 1000°C showing spinel crystals and (b) XRD pattern of FY09EM21-08 treated at 1000°C showing that the spinel is magnesium iron oxide.



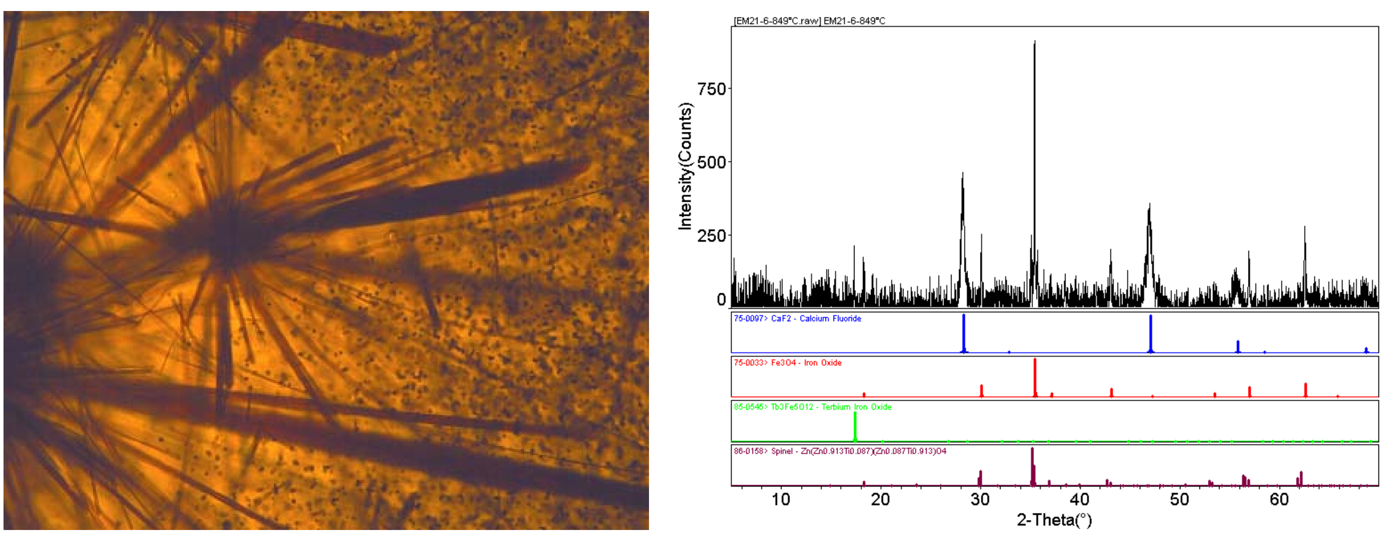
(a) (b)

Figure 17. (a) Optical micrograph of FY09EM21-23 treated at 1050°C showing iron titanate crystals and (b) XRD pattern of FY09EM21-23 treated at 1050°C showing that the crystals are iron titanium oxide.



(a) (b)

Figure 18. (a) Optical micrograph of FY09EM21-18 treated at 816°C. These clear geometric crystals take on a shape of cuboctahedrons (6 square and 8 triangular faces). (b) Optical micrograph of FY09EM21-19 treated at 740°C. Structure and chemical identification of both of these crystals is unknown at this time as their concentrations were below the detection limit of the XRD.



(a) (b)

Figure 19. (a) Optical micrograph of FY09EM21-06 treated at 849°C showing spinel and large rods and (b) XRD pattern showing evidence of iron oxide. Note that the terbium iron oxide would not be a crystalline phase present in this glass.

5.1.6 Matrix 2 Viscosity Data

Measured viscosity data were fit using the Vogel-Fulcher-Tammann (VFT) equation, given by:

$$ln\,\eta = A + \frac{B}{T - T_0}$$

where A, B and T_0 are constants.

A summary of the measured viscosity data and the predicted viscosities at 1150°C are shown in Table 15. Note that there are not values for all of the samples, as some of the quenched glasses contained crystals and could not be measured. Plots of the fitted data are shown in Exhibits C1 through C18 in Appendix C. The fit of HWL-18 above 1200°C deviates slightly from linearity.

Table 15. Predicted and Measured Viscosity Data at 1150°C

Glass ID	MAR Assessment Viscosity Prediction (P)	Measured Viscosity (P)
FY09EM21-02	5	12
FY09EM21-05	72	44
FY09EM21-06	20	11
FY09EM21-07	2	5
FY09EM21-08	9	10
FY09EM21-09	24	16
FY09EM21-11	38	18
FY09EM21-12	21	17
FY09EM21-14	6	15
FY09EM21-15	58	23
FY09EM21-16	29	22
FY09EM21-17	6	10
FY09EM21-18	49	53
FY09EM21-19	53	28
FY09EM21-20	25	28
FY09EM21-21	2	6
FY09EM21-25	47	28
FY09EM21-27	21	17

Some of the measured viscosities are quite low, which include FY09EM21-02, -07, -08, -14, -17 and -21, and would be below DWPF's current lower viscosity limit. All of these glasses, except FY09EM21-08, are outside of the compositional region over which the model was developed. A calculation of the non-bridging oxygen (NBO) ratio indicates that these glasses have considerably more NBOs than the glasses used to develop the current viscosity model. This ratio is given by,

$$NBO = \frac{2\left(Fe_2O_3\,(molar) - Al_2O_3\,(molar) + M_2O\,(molar)\right) + B_2O_3(molar)}{SiO_2(molar)}$$

where M = alkali cations (Li, Na, K and Cs). A higher concentration of NBOs would account for the low viscosity as the presence of NBOs break up the linkages between network polyhedra. Higher concentrations of Fe_2O_3 are the cause of the increased number of NBOs in these glasses.

5.1.7 A Statistical Review of the Chemical Composition Measurements for the Radioactive Glasses

Table A5 in Appendix A provides a listing of the measurements, the measurements bias-corrected using the standards included as part of the analytical plan, and the target concentrations for the samples of the Matrix 2 rad glasses. Exhibit A5 provides a plot of the measured values for these samples for each oxide. As seen in these plots, there is an indication of a difference in the measurements for the LM oxides between the two preparations for the FY09EM21-28 glass. However, all of the measurements were utilized in determining the chemical compositions for these radioactive glasses. These determinations were conducted both for the measured and for the bias-corrected data. A sum of oxides was also computed for each glass based upon both the measured and bias-corrected values. Exhibit A6 in Appendix A provides plots showing the results for each glass for each oxide to help highlight the comparisons among the measured, bias-corrected, and target values.

Table A6 in Appendix A provides a summary of the average compositions as well as the target compositions and some associated differences and relative differences for these radioactive glasses. All of the sums of oxides (both measured and bias-corrected) fall within the interval of 95 to 105 wt%. Entries in Table A6 show the relative differences between the measured or bias-corrected values and the target values. These differences are shaded when they are greater than or equal to 5%. Overall, the measured compositions are consistent with the target compositions and will serve the objectives of this study.

In Table 16, the MAR assessments of these radioactive glasses are presented in the same format as was used in Section 5.1.2 for the non-radioactive glasses. As in the non-radioactive glasses, these glasses also fail the TiO_2 constraint in order to determine its influence on glass properties.

Table 16. MAR Assessment Results of the Radioactive Matrix 2 Glasses

Glass ID	Compositional View	B Del G_p	NL [B (g/L)]	T_L (°C)	Viscosity (P)	Al_2O_3 (wt%)	TiO_2 (wt%)	R_2O (wt%)	Homogeneity (wt%)	Nepheline Value	MAR Status
FY09EM21-28	Measured	-9.45	0.65	1015	19	7.17	3.40	16.92	224.5	0.68	newlv TiO_2
	Measured bc	-9.54	0.67	1016	18	7.42	3.60	17.17	229.9	0.68	newlv TiO_2
	Target	-9.79	0.75	1016	20	7.05	3.85	17.46	231.0	0.69	newlv TiO_2
FY09EM21-29	Measured	-9.68	0.71	1005	20	7.24	3.57	17.27	226.6	0.68	newlv TiO_2
	Measured bc	-9.75	0.73	1001	20	7.26	3.77	17.35	228.2	0.68	newlv TiO_2
	Target	-9.64	0.70	1016	20	6.91	3.77	17.11	226.2	0.69	newlv TiO_2
FY09EM21-30	Measured	-9.15	0.57	1017	18	6.93	3.61	16.34	219.2	0.68	newlv TiO_2
	Measured bc	-9.26	0.60	1018	18	7.18	3.72	16.63	225.3	0.68	newlv TiO_2
	Target	-9.50	0.66	1016	20	6.76	3.69	16.75	221.5	0.69	newlv TiO_2

5.1.8 A Statistical Review of the PCT Results of the Matrix 2 Radioactive Glasses

Table B2 in Appendix B provides the measurements in ppm resulting from the PCTs. Exhibit B11 in Appendix B provides a series of plots and statistical comparisons that demonstrate the effects of heat treatment on the common logarithm ppm-responses of interest of the triplicate PCTs for each element for each radioactive glass. The quenched version of a given glass yielded measurements indicating a significantly different mean log(ppm) response (at the 5% significance level) than the ccc version of the glass for a given element if the **Prob>|t|** value in the exhibit is 0.05 or smaller. Table 17 summarizes the comparisons between the quenched and ccc versions of the radioactive glasses for the four elements of the PCTs. The less durable heat treatment is noted.

Table 17. Samples Exhibiting a Statistically Significant Difference Between the Quenched and ccc Versions of the Radioactive Matrix 2 Glasses

Glass ID	B	Li	Na	Si
FY09EM21-28	Q	Q	Q	Q
FY09EM21-29	Q	Q	Q	Q
FY09EM21-30	Q	Q	Q	Q

The PCT responses for the radioactive glasses are provided in Table 18. The PCT results were normalized following the approach outlined in Section 5.1.4.4. The resulting values are provided in Table 18. Differences in PCT responses due to heat treatment of the glass are shown in Exhibit B12 in Appendix B. The NL [B] values range from 1.03 g/L (FY09EM21-28) to 1.17 g/L (FY09EM21-29) for the quenched glasses and 0.75 g/L (FY09EM21-28) to 0.83 g/L (FY09EM21-29, -30) for the ccc glasses. While the NL [B] values of the quenched glasses are slightly higher than the ccc values, all of the release rates are well below the EA glass.

The predictability of the durabilities of the radioactive glasses is addressed in plots presented in Exhibit B13 of Appendix B. All of these glasses are acceptable and predictable with respect to the DWPF models for durability.

Table 18. Normalized PCT Results of the Radioactive Matrix 2 Glasses

Glass ID	Heat Treatment	Comp View	log NL [B (g/L)]	log NL [Li (g/L)]	log NL [Na (g/L)]	log NL [Si (g/L)]	NL B (g/L)	NL Li (g/L)	NL Na (g/L)	NL Si (g/L)
FY09EM21-28	quenched	Measured	0.04	0.05	0.03	-0.20	1.09	1.12	1.08	0.63
		Measured bc	0.01	0.03	0.03	-0.21	1.03	1.06	1.08	0.62
		Target	0.03	0.03	0.02	-0.23	1.07	1.07	1.05	0.60
	ccc	Measured	-0.10	-0.02	-0.04	-0.23	0.80	0.96	0.91	0.59
		Measured bc	-0.13	-0.05	-0.04	-0.23	0.75	0.90	0.91	0.59
		Target	-0.11	-0.04	-0.05	-0.25	0.78	0.91	0.88	0.56
FY09EM21-29	quenched	Measured	0.07	0.06	0.04	-0.19	1.17	1.15	1.09	0.65
		Measured bc	0.04	0.05	0.04	-0.20	1.10	1.12	1.09	0.64
		Target	0.06	0.06	0.04	-0.19	1.14	1.14	1.10	0.64
	ccc	Measured	-0.08	-0.04	-0.05	-0.23	0.83	0.91	0.89	0.59
		Measured bc	-0.11	-0.05	-0.05	-0.24	0.78	0.89	0.89	0.58
		Target	-0.09	-0.04	-0.05	-0.24	0.81	0.91	0.90	0.58
FY09EM21-30	quenched	Measured	0.05	0.06	0.03	-0.19	1.12	1.15	1.08	0.64
		Measured bc	0.02	0.04	0.03	-0.20	1.06	1.09	1.08	0.63
		Target	0.05	0.05	0.02	-0.21	1.11	1.11	1.05	0.61
	ccc	Measured	-0.08	0.00	-0.04	-0.20	0.83	1.00	0.91	0.62
		Measured bc	-0.11	-0.03	-0.04	-0.22	0.78	0.94	0.91	0.61
		Target	-0.08	-0.02	-0.05	-0.22	0.83	0.96	0.88	0.60

5.2 TEST MATRIX 2A

5.2.1 A Statistical Review of the Matrix 2A Chemical Composition Measurements

Table D1 (in two parts) in Appendix D provides the elemental concentration measurements from the study glasses that were prepared using LM, and Table D2 provides the measurements from the samples of these glasses prepared using PF. Measurements for samples of the standard Batch 1 glass that were included in the analytical plan along with the study glasses are also provided in these two tables.

5.2.1.1 Measurements in Analytical Sequence

Exhibit D1 in Appendix D provides plots in analytical sequence of the sample measurements generated by PSAL for each oxide over both preparation methods (i.e., LM and PF). These plots include all of the measurement data from Tables D1 and D2. Some scatter is observed in the Batch 1 values for Li and Si and there is also quite a bit of scatter in the Cr measurements; however, its concentration is quite low. There do not appear to be any obvious patterns or trends due to the analytical sequence.

5.2.1.2 Composition Measurements by Glass Identifier

Exhibit D2 in Appendix D provides plots of the oxide concentration measurements by Glass ID (including the Batch 1 standard) by Lab ID. These plots demonstrate the individual measurements across the duplicates of each preparation method and the two ICP calibrations for each glass for each oxide. A review of the plots presented in these exhibits reveals the repeatability of the four individual values for each oxide for each glass. In general, there appears to be good repeatability among the measurements for each of the oxides for most of the glasses;

however, there are some inconsistencies, which include: (i) in Set #1 there appears to be preparation effects for EM-14 affecting the CaO measurements, and for EM-12 affecting the Fe_2O_3 and NiO measurements, and there appear to be calibration effects for several glasses affecting the Li_2O and SiO_2 measurements, (ii) in Set #2 there appears to be a great deal of scatter in the B_2O_3 measurements[T] and there appears to be preparation effects for EM-19 affecting the Li_2O and B_2O_3 measurements, and for EM-22 and EM-28 affecting the NiO measurements for these glasses. None of the observations discussed here suggest a significant issue in the batching of the study glasses or in the analytical process used to provide representative measurements of their compositions.

5.2.1.3 Results for the Batch 1 Standard

Exhibit D3 in Appendix D provides statistical analyses of the Batch 1 results by analytical set and calibration block for each oxide of interest over both preparation methods. The results also include ANOVA investigations. The following components of the Batch 1 standard indicate a significant ICP-AES calibration effect on the block averages at the 5% significance level:

- Al_2O_3, BaO, CaO, CuO, Fe_2O_3, Li_2O, MgO, MnO, SiO_2, TiO_2, and ZrO_2

As a result, bias correction of the measured data was pursued to evaluate if the compositional view provided by the bias-corrected measurements has an impact of the conclusions of this study. The method for bias correction is discussed in Section 5.1.1.3.

5.2.1.4 Measured versus Target Compositions

With only minor problems in the repeatability of the measurements being revealed during the review process, all of the measurements for each oxide for each glass (i.e., all of the measurements in Tables D1 through D2) were averaged to determine a representative chemical composition for each glass. These determinations were conducted both for the measured and for the bias-corrected data. A sum of oxides was also computed for each glass based upon both the measured and bias-corrected values. Exhibit D4 in Appendix D provides plots showing results for each glass for each oxide to help highlight the comparisons among the measured, bias-corrected, and target values. Some observations from the plots of Exhibit D4 for the major oxides (those oxides at concentrations greater than 0.5 wt%) are offered: In general, there appear to have been few difficulties in hitting the target concentrations for the study glasses. The average of the B_2O_3 measurements for EM-19 was higher than the target concentration. A preparation issue was noted earlier for this glass. For all of the study glasses, the measured values for Fe_2O_3, Cr_2O_3 and for NiO were below the target concentrations.

Table D3 in Appendix D provides a summary of the average compositions as well as the target compositions and some associated differences and relative differences. Notice that the target sums of oxides for the standard glasses do not sum to 100% due to an incomplete coverage of the oxides in the Batch 1 glass. In fact, the only glass whose average measured value for sum of oxides fell below 95% was the Batch 1 glass for both Set #1 and for Set #2. All of the sums of

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[T] Note the small scale.

oxides (both measured and bias-corrected) for the Matrix 2A glasses fall within the interval of 95 to 105 wt%. Entries in Table D3 show the relative differences between the measured or bias-corrected values and the target values. These differences are shaded when they are greater than or equal to 5%. Overall, these comparisons between the measured and target compositions suggest only minor difficulties in hitting the target compositions for the study glasses with the exceptions/potential issues already noted.

5.2.2 Matrix 2A MAR Assessment Results

MAR assessment results are provided in Table 19. In general, the results of the measured compositions are consistent with those of the target compositions. As in Matrix 2, the TiO_2 constraint was intentionally failed for all of the glasses to determine model applicability.

Table 19. MAR Assessment Results of the Matrix 2A Glasses

Glass ID	Compositional View	B Del G_p	NL [B (g/L)]	T_L (°C)	Viscosity (P)	Al_2O_3 (wt%)	TiO_2 (wt%)	R_2O (wt%)	Homogeneity (wt%)	Nepheline Value	MAR Status
EM-01	Measured	-9.80	0.75	1025	27	11.49	2.07	19.45	257.8	0.60	T_L TiO_2 Neph
	Measured bc	-9.21	0.58	1042	38	11.81	2.16	19.12	264.1	0.62	T_L TiO_2 Neph
	Target	-9.75	0.74	1057	24	11.59	2.00	19.48	261.6	0.60	T_L newlv TiO_2 Neph
EM-02	Measured	-7.28	0.26	1074	48	14.14	2.06	17.55	267.6	0.59	T_L TiO_2 Neph
	Measured bc	-6.68	0.20	1089	65	14.54	2.15	17.26	274.3	0.60	T_L TiO_2 Neph
	Target	-7.26	0.26	1101	43	14.09	2.00	17.60	271.7	0.59	T_L TiO_2 Neph
EM-03	Measured	-12.24	2.07	976	14	9.09	2.00	21.17	246.0	0.61	newlv TiO_2 Neph
	Measured bc	-11.71	1.66	997	20	9.37	2.06	20.90	252.2	0.62	newlv TiO_2 Neph
	Target	-12.39	2.20	1000	13	9.09	2.00	21.51	251.5	0.61	newlv TiO_2 Neph
EM-04	Measured	-13.23	3.14	939	13	6.58	1.98	21.40	235.0	0.64	newlv TiO_2
	Measured bc	-12.77	2.59	959	18	6.78	2.04	21.21	242.1	0.65	newlv TiO_2
	Target	-13.53	3.55	956	12	6.59	2.00	21.93	241.4	0.64	Del Gp newlv TiO_2
EM-05	Measured	-11.80	1.72	991	14	6.59	1.99	19.91	243.8	0.65	newlv TiO_2
	Measured bc	-11.35	1.43	1012	19	6.79	2.05	19.73	251.1	0.66	newlv TiO_2
	Target	-11.94	1.83	1018	12	6.59	2.00	20.27	251.5	0.65	T_L newlv TiO_2
EM-06	Measured	-9.87	0.77	1053	17	6.71	2.03	17.93	251.9	0.67	T_L newlv TiO_2
	Measured bc	-9.38	0.63	1071	24	6.90	2.11	17.70	259.2	0.68	T_L newlv TiO_2
	Target	-9.57	0.68	1094	16	6.59	2.00	17.77	261.6	0.67	T_L newlv TiO_2
EM-07	Measured	-10.23	0.90	1049	16	6.67	1.91	17.56	258.9	0.67	T_L newlv
	Measured bc	-9.81	0.75	1068	22	6.87	1.97	17.41	266.5	0.68	T_L newlv TiO_2
	Target	-10.04	0.83	1100	13	6.59	2.00	17.60	269.7	0.67	T_L newlv TiO_2
EM-08	Measured	-10.64	1.07	1049	12	6.64	2.25	17.77	265.0	0.66	T_L newlv TiO_2
	Measured bc	-10.18	0.88	1066	18	6.83	2.35	17.54	272.3	0.67	T_L newlv TiO_2
	Target	-10.35	0.94	1102	12	6.59	2.00	17.60	273.8	0.66	T_L newlv TiO_2
EM-09	Measured	-8.22	0.39	1076	28	11.67	2.08	17.74	263.4	0.61	T_L TiO_2 Neph
	Measured bc	-7.69	0.31	1090	39	12.00	2.17	17.52	271.0	0.62	T_L TiO_2 Neph
	Target	-7.96	0.35	1119	27	11.59	2.00	17.60	271.7	0.61	T_L TiO_2 Neph
EM-10	Measured	-11.55	1.55	967	20	11.51	2.07	21.16	245.5	0.58	newlv TiO_2 Neph
	Measured bc	-10.99	1.23	983	29	11.83	2.16	20.89	252.5	0.59	TiO_2 Neph
	Target	-11.69	1.65	991	21	11.59	2.00	21.51	251.5	0.58	newlv TiO_2 Neph

Table 19 continued.

Glass ID	Compositional View	B Del G_p	NL [B (g/L)]	T_L (°C)	Viscosity (P)	Al_2O_3 (wt%)	TiO_2 (wt%)	R_2O (wt%)	Homogeneity (wt%)	Nepheline Value	MAR Status
EM-11	Measured	-8.39	0.42	1047	45	11.49	1.97	17.39	252.4	0.63	T_L TiO_2 Neph
	Measured bc	-7.86	0.33	1066	60	11.84	2.03	17.16	259.2	0.64	T_L TiO_2
	Target	-8.43	0.42	1091	37	11.59	2.00	17.60	260.0	0.62	T_L TiO_2 Neph
EM-12	Measured	-11.34	1.42	984	15	11.49	2.02	21.49	257.0	0.58	newlv TiO_2 Neph
	Measured bc	-10.72	1.10	1000	22	11.81	2.10	21.13	263.1	0.59	newlv TiO_2 Neph
	Target	-11.22	1.35	1019	15	11.59	2.00	21.51	263.2	0.58	T_L newlv TiO_2 Neph
EM-13	Measured	-8.75	0.48	1014	46	14.30	1.93	18.73	262.6	0.58	T_L TiO_2 Neph
	Measured bc	-8.19	0.38	1031	62	14.73	1.99	18.48	269.5	0.59	T_L TiO_2 Neph
	Target	-8.51	0.44	1061	42	14.09	2.00	18.56	267.7	0.58	T_L TiO_2 Neph
EM-14	Measured	-8.53	0.44	1026	47	14.25	2.01	18.06	268.5	0.58	T_L TiO_2 Neph
	Measured bc	-7.99	0.35	1043	64	14.69	2.08	17.83	275.3	0.59	T_L TiO_2 Neph
	Target	-8.36	0.41	1071	43	14.09	2.00	18.06	271.7	0.58	T_L TiO_2 Neph
EM-15	Measured	-8.45	0.43	1025	55	14.31	1.89	17.75	271.8	0.59	T_L Neph
	Measured bc	-7.91	0.34	1042	73	14.74	1.94	17.51	278.8	0.60	T_L TiO_2 Neph
	Target	-8.21	0.39	1080	45	14.09	2.00	17.56	275.8	0.58	T_L TiO_2 Neph
EM-16	Measured	-10.17	0.87	1024	15	11.39	2.02	19.00	252.1	0.59	T_L newlv TiO_2 Neph
	Measured bc	-9.71	0.72	1042	22	12.17	2.18	19.05	265.1	0.59	T_L newlv TiO_2 Neph
	Target	-10.41	0.96	1061	13	11.59	2.00	19.48	261.6	0.58	T_L newlv TiO_2 Neph
EM-17	Measured	-7.73	0.32	1073	27	13.58	1.84	17.00	257.9	0.58	T_L Neph
	Measured bc	-7.21	0.25	1088	39	14.51	1.99	17.04	271.5	0.59	T_L TiO_2 Neph
	Target	-7.91	0.34	1106	24	14.09	2.00	17.60	271.7	0.57	T_L newlv TiO_2 Neph
EM-18	Measured	-12.84	2.66	975	7	8.97	1.98	21.07	242.0	0.59	newlv TiO_2 Neph
	Measured bc	-12.05	1.92	1002	12	9.36	2.08	20.57	251.5	0.61	newlv TiO_2 Neph
	Target	-13.04	2.89	1004	7	9.09	2.00	21.51	251.5	0.59	newlv TiO_2 Neph
EM-19	Measured	-13.82	4.00	940	7	6.53	2.01	21.27	232.9	0.62	Del Gp newlv TiO_2 Neph
	Measured bc	-13.48	3.47	962	10	6.98	2.16	21.32	244.3	0.64	Del Gp newlv TiO_2
	Target	-14.18	4.66	959	6	6.59	2.00	21.93	241.4	0.62	Del Gp newlv TiO_2 Neph
EM-20	Measured	-12.39	2.20	991	7	6.59	1.98	19.82	240.1	0.63	newlv TiO_2 Neph
	Measured bc	-11.71	1.66	1016	11	6.87	2.08	19.45	250.4	0.65	newlv TiO_2
	Target	-12.59	2.40	1022	6	6.59	2.00	20.27	251.5	0.63	T_L newlv TiO_2

Table 19 continued.

Glass ID	Compositional View	B Del G_p	NL [B (g/L)]	T_L (°C)	Viscosity (P)	Al_2O_3 (wt%)	TiO_2 (wt%)	R_2O (wt%)	Homogeneity (wt%)	Nepheline Value	MAR Status
EM-21	Measured	-10.46	0.98	1068	9	6.96	1.90	17.95	256.0	0.65	T_L newlv
	Measured bc	-9.81	0.75	1092	14	7.26	2.00	17.64	267.3	0.67	T_L newlv TiO_2
	Target	-10.22	0.89	1099	9	6.59	2.00	17.77	261.6	0.66	T_L newlv TiO_2
EM-22	Measured	-11.01	1.24	1055	7	6.53	1.97	17.71	260.9	0.65	T_L newlv TiO_2
	Measured bc	-10.39	0.96	1078	11	6.81	2.07	17.41	272.0	0.66	T_L newlv TiO_2
	Target	-10.69	1.08	1105	7	6.59	2.00	17.60	269.7	0.65	T_L newlv TiO_2
EM-23	Measured	-10.76	1.12	1059	9	6.64	1.94	17.26	265.4	0.65	T_L newlv TiO_2
	Measured bc	-10.49	1.00	1076	13	7.10	2.09	17.40	279.4	0.67	T_L newlv TiO_2
	Target	-11.00	1.24	1106	6	6.59	2.00	17.60	273.8	0.64	T_L newlv TiO_2
EM-24	Measured	-8.71	0.48	1077	17	11.73	2.02	17.66	264.6	0.60	T_L newlv TiO_2 Neph
	Measured bc	-7.95	0.35	1099	26	12.23	2.12	17.25	275.4	0.61	T_L TiO_2 Neph
	Target	-8.61	0.46	1124	14	11.59	2.00	17.60	271.7	0.59	T_L newlv TiO_2 Neph
EM-25	Measured	-12.10	1.95	973	12	11.49	1.99	21.04	244.7	0.56	newlv TiO_2 Neph
	Measured bc	-11.34	1.42	996	19	11.99	2.10	20.64	255.0	0.58	newlv TiO_2 Neph
	Target	-12.34	2.16	995	11	11.59	2.00	21.51	251.5	0.57	newlv TiO_2 Neph
EM-26	Measured	-8.90	0.52	1044	24	11.25	1.95	17.07	246.8	0.61	T_L newlv TiO_2 Neph
	Measured bc	-8.51	0.44	1059	34	12.02	2.10	17.21	260.4	0.62	T_L TiO_2 Neph
	Target	-9.08	0.56	1096	21	11.59	2.00	17.60	260.0	0.60	T_L newlv TiO_2 Neph
EM-27	Measured	-11.54	1.55	995	8	11.13	2.02	20.86	252.6	0.56	newlv TiO_2 Neph
	Measured bc	-11.09	1.28	1012	13	11.90	2.18	20.91	265.4	0.57	T_L newlv TiO_2 Neph
	Target	-11.87	1.78	1023	7	11.59	2.00	21.51	263.2	0.56	T_L newlv TiO_2 Neph
EM-28	Measured	-9.31	0.61	1018	24	14.02	2.03	18.53	258.2	0.56	T_L newlv TiO_2 Neph
	Measured bc	-8.58	0.45	1037	38	14.62	2.14	18.19	269.1	0.58	T_L TiO_2 Neph
	Target	-9.16	0.57	1067	23	14.09	2.00	18.56	267.7	0.56	T_L newlv TiO_2 Neph
EM-29	Measured	-8.84	0.50	1034	29	13.77	1.99	17.60	262.4	0.57	T_L TiO_2 Neph
	Measured bc	-8.41	0.42	1047	41	14.72	2.15	17.74	277.0	0.58	T_L TiO_2 Neph
	Target	-9.01	0.54	1076	24	14.09	2.00	18.06	271.7	0.56	T_L newlv TiO_2 Neph
EM-30	Measured	-8.98	0.53	1034	28	14.09	2.00	17.58	270.1	0.57	T_L TiO_2 Neph
	Measured bc	-8.22	0.39	1054	43	14.69	2.11	17.18	280.6	0.58	T_L TiO_2 Neph
	Target	-8.86	0.51	1085	25	14.09	2.00	17.56	275.8	0.57	T_L newlv TiO_2 Neph

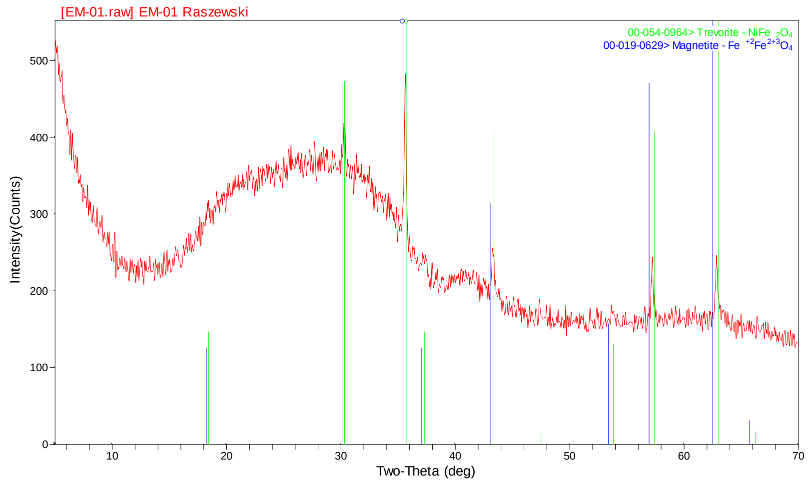
5.2.3 Matrix 2A XRD

A summary of the types of crystals present in the quenched and ccc glasses is provided in Table 20. An "X" is used to indicate those glasses in which nepheline was predicted to form during slow cooling. XRD patterns of the quenched and ccc glasses are shown in Figure 20 through Figure 49. Most of the glasses crystallized upon quenching and contained Fe-based and/or Fe/Ni-based spinels. According to the T_L predictions, all of these glasses should have melted at 1150°C without any crystals. After the ccc treatment, almost all of the glasses contained Fe-based and/or Fe/Ni-based spinels and some of the glasses contained nepheline. For the Matrix 2A glasses, the model predictions for nepheline (Table 20) may be somewhat conservative as nepheline was not detected in all of the glasses that were predicted to contain nepheline. From these data, it appears that nepheline tended to form in glasses with higher concentrations of Al_2O_3 (14.09 wt% in glass). There also does not appear to be any dependence of the nepheline formation on the frit composition.[U] In previous studies, higher concentrations of B_2O_3 (~18 wt%) have been shown to suppress nepheline[29], which is higher than the amounts used in this study. Glasses formulated with the same sludges contain nepheline with both frits.

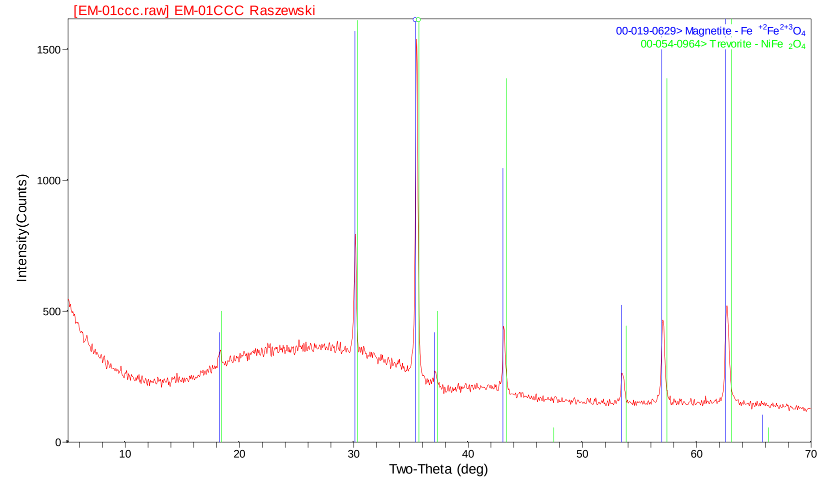
[U] Frit 418 ($8B_2O_3$-$8Li_2O$-$8Na_2O$-$76SiO_2$) was used for EM-01 through EM-15 and Frit 510 ($14B_2O_3$-$8Li_2O$-$8Na_2O$-$70SiO_2$) was used for EM-16 through EM-30.

Table 20. XRD Results of the Matrix 2A Quenched and ccc Glasses

Glass ID	Predicted T_L (°C)	XRD Results		Nepheline Prediction
		quenched	ccc	
EM-01	1042	Trevorite ($NiFe_2O_4$), Magnetite ($Fe^{+2}Fe^{2+3}O_4$)	Trevorite ($NiFe_2O_4$), Magnetite ($Fe^{+2}Fe^{2+3}O_4$)	X
EM-02	1089	Trevorite ($NiFe_2O_4$), Magnetite ($Fe^{+2}Fe^{2+3}O_4$)	Trevorite ($NiFe_2O_4$), Magnetite ($Fe_{+2}Fe_{2+3}O_4$), **Nepheline ($NaAlSiO_4$)**	X
EM-03	997	***Amorphous***	Trevorite ($NiFe_2O_4$), Magnetite ($Fe^{+2}Fe^{2+3}O_4$)	X
EM-04	959	***Amorphous***	Trevorite ($NiFe_2O_4$), Magnetite ($Fe^{+2}Fe^{2+3}O_4$)	
EM-05	1012	***Amorphous***	Trevorite ($NiFe_2O_4$), Magnetite ($Fe^{+2}Fe^{2+3}O_4$)	
EM-06	1071	Trevorite ($NiFe_2O_4$), Magnetite ($Fe^{+2}Fe^{2+3}O_4$)	Trevorite ($NiFe_2O_4$), Magnetite ($Fe^{+2}Fe^{2+3}O_4$)	
EM-07	1068	Trevorite ($NiFe_2O_4$), Magnetite ($Fe^{+2}Fe^{2+3}O_4$)	Trevorite ($NiFe_2O_4$), Magnetite ($Fe^{+2}Fe^{2+3}O_4$)	
EM-08	1066	Trevorite ($NiFe_2O_4$), Magnetite ($Fe^{+2}Fe^{2+3}O_4$)	Trevorite ($NiFe_2O_4$), Magnetite ($Fe^{+2}Fe^{2+3}O_4$)	
EM-09	1090	Trevorite ($NiFe_2O_4$), Magnetite ($Fe^{+2}Fe^{2+3}O_4$)	Trevorite ($NiFe_2O_4$), Magnetite ($Fe^{+2}Fe^{2+3}O_4$), **Nepheline ($NaAlSiO_4$)**	X
EM-10	983	Trevorite ($NiFe_2O_4$), Bunsenite (NiO)	Trevorite ($NiFe_2O_4$), Magnetite ($Fe^{+2}Fe^{2+3}O_4$), **Nepheline ($NaAlSiO_4$)**	X
EM-11	1066	Trevorite ($NiFe_2O_4$), Magnetite ($Fe^{+2}Fe^{2+3}O_4$)	Magnetite ($Fe^{+2}Fe^{2+3}O_4$)	X
EM-12	1000	Trevorite ($NiFe_2O_4$), Bunsenite (NiO)	Trevorite ($NiFe_2O_4$), Magnetite ($Fe^{+2}Fe^{2+3}O_4$), **Nepheline ($NaAlSiO_4$)**	X
EM-13	1031	Trevorite ($NiFe_2O_4$), Magnetite ($Fe^{+2}Fe^{2+3}O_4$)	Magnetite ($Fe^{+2}Fe^{2+3}O_4$), **Nepheline ($NaAlSiO_4$)**	X
EM-14	1043	Trevorite ($NiFe_2O_4$), Magnetite ($Fe^{+2}Fe^{2+3}O_4$)	Magnetite ($Fe^{+2}Fe^{2+3}O_4$), **Nepheline ($NaAlSiO_4$)**	X
EM-15	1042	Trevorite ($NiFe_2O_4$), Magnetite ($Fe^{+2}Fe^{2+3}O_4$)	Magnetite ($Fe^{+2}Fe^{2+3}O_4$), **Nepheline ($NaAlSiO_4$)**	X
EM-16	1042	Trevorite ($NiFe_2O_4$), Magnetite ($Fe^{+2}Fe^{2+3}O_4$)	Magnetite ($Fe^{+2}Fe^{2+3}O_4$)	X
EM-17	1088	Trevorite ($NiFe_2O_4$), Magnetite ($Fe^{+2}Fe^{2+3}O_4$)	Magnetite ($Fe^{+2}Fe^{2+3}O_4$)	X
EM-18	1002	***Amorphous***	Magnetite ($Fe^{+2}Fe^{2+3}O_4$)	X
EM-19	962	***Amorphous***	Magnetite ($Fe^{+2}Fe^{2+3}O_4$)	X
EM-20	1016	Hematite (Fe_2O_3)	Magnetite ($Fe^{+2}Fe^{2+3}O_4$)	
EM-21	1092	Trevorite ($NiFe_2O_4$), Magnetite ($Fe^{+2}Fe^{2+3}O_4$)	Magnetite ($Fe^{+2}Fe^{2+3}O_4$)	
EM-22	1078	Trevorite ($NiFe_2O_4$), Magnetite ($Fe^{+2}Fe^{2+3}O_4$)	Magnetite ($Fe^{+2}Fe^{2+3}O_4$)	
EM-23	1076	Trevorite ($NiFe_2O_4$), Magnetite ($Fe^{+2}Fe^{2+3}O_4$)	Magnetite ($Fe^{+2}Fe^{2+3}O_4$)	
EM-24	1099	Trevorite ($NiFe_2O_4$), Magnetite ($Fe^{+2}Fe^{2+3}O_4$)	Magnetite ($Fe^{+2}Fe^{2+3}O_4$)	X
EM-25	996	Bunsenite (NiO)	Magnetite ($Fe^{+2}Fe^{2+3}O_4$), **Nepheline ($NaAlSiO_4$)**	X
EM-26	1059	Trevorite ($NiFe_2O_4$), Magnetite ($Fe^{+2}Fe^{2+3}O_4$)	Trevorite ($NiFe_2O_4$), Magnetite ($Fe^{+2}Fe^{2+3}O_4$), **Nepheline ($NaAlSiO_4$)**	X
EM-27	1012	Bunsenite (NiO)	Magnetite ($Fe^{+2}Fe^{2+3}O_4$)	X
EM-28	1037	Trevorite ($NiFe_2O_4$), Magnetite ($Fe^{+2}Fe^{2+3}O_4$)	Magnetite ($Fe^{+2}Fe^{2+3}O_4$), **Nepheline ($NaAlSiO_4$)**	X
EM-29	1047	Trevorite ($NiFe_2O_4$), Magnetite ($Fe^{+2}Fe^{2+3}O_4$)	Magnetite ($Fe^{+2}Fe^{2+3}O_4$), **Nepheline ($NaAlSiO_4$)**	X
EM-30	1054	Trevorite ($NiFe_2O_4$), Magnetite ($Fe^{+2}Fe^{2+3}O_4$)	Magnetite ($Fe^{+2}Fe^{2+3}O_4$), **Nepheline ($NaAlSiO_4$)**	X

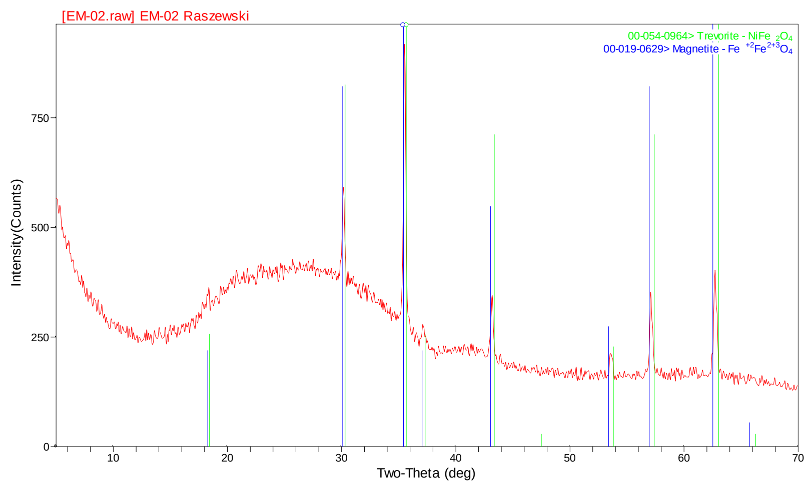


(a)

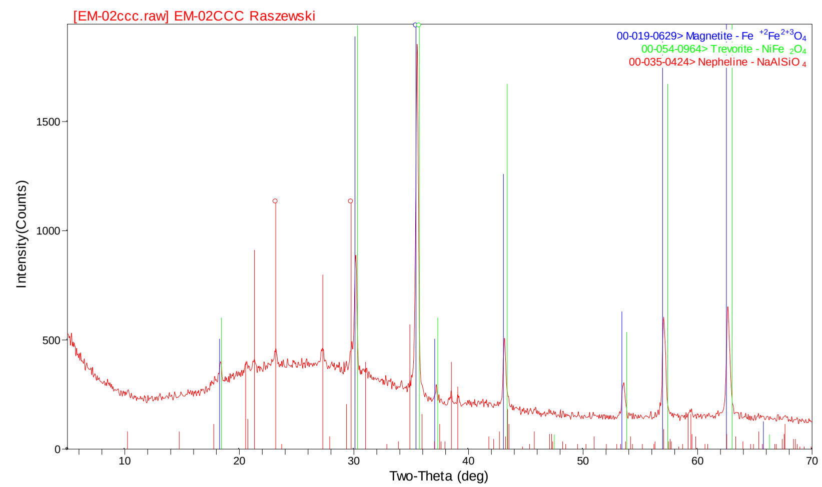


(b)

Figure 20. XRD patterns of (a) quenched and (b) ccc EM-01.

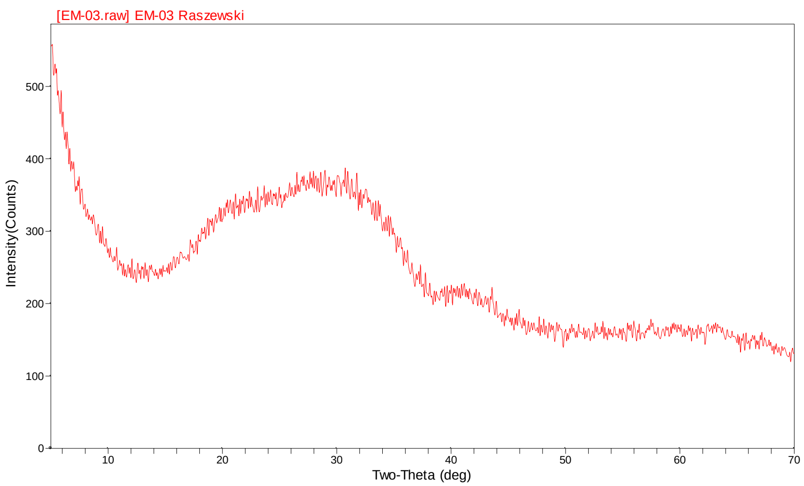


(a)

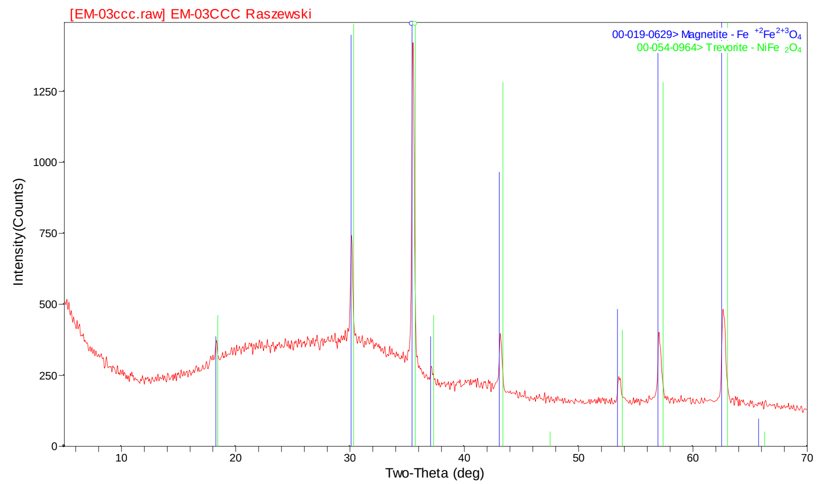


(b)

Figure 21. XRD patterns of (a) quenched and (b) ccc EM-02.

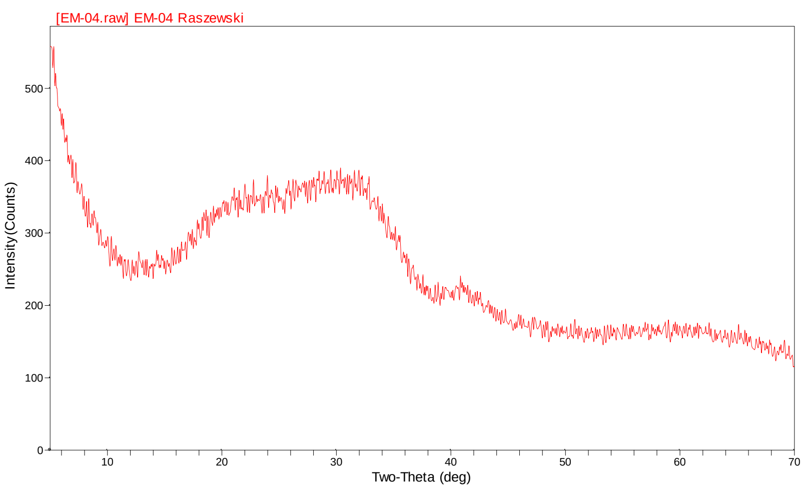


(a)

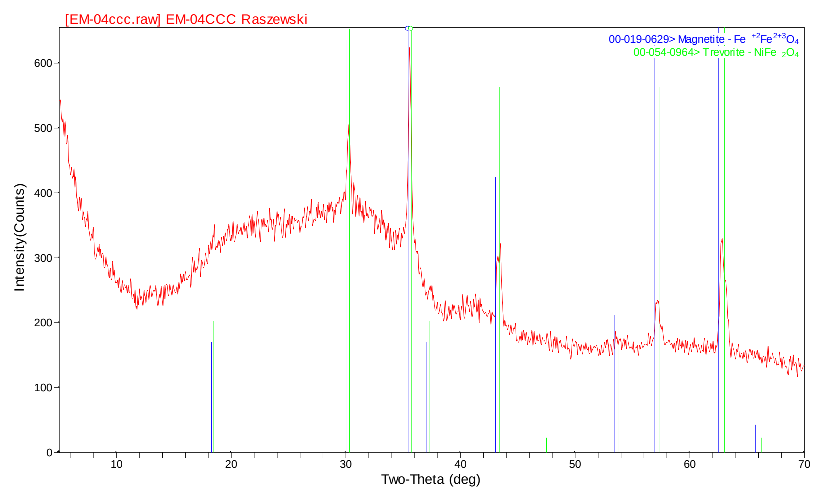


(b)

Figure 22. XRD patterns of (a) quenched and (b) ccc EM-03.

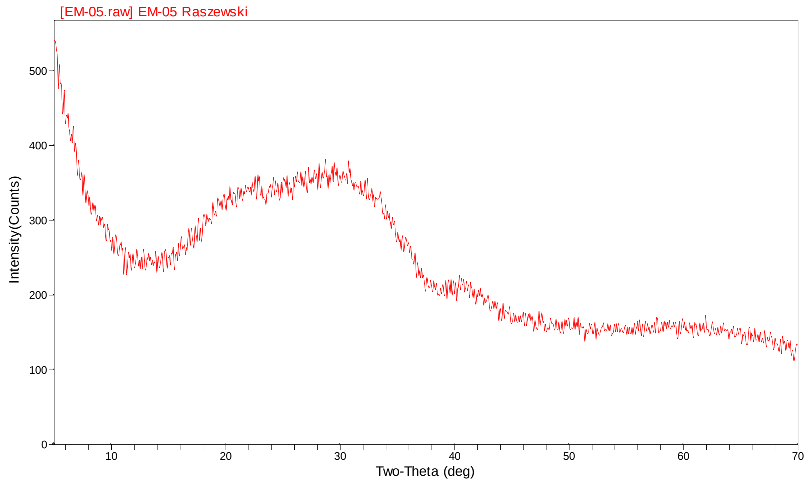


(a)

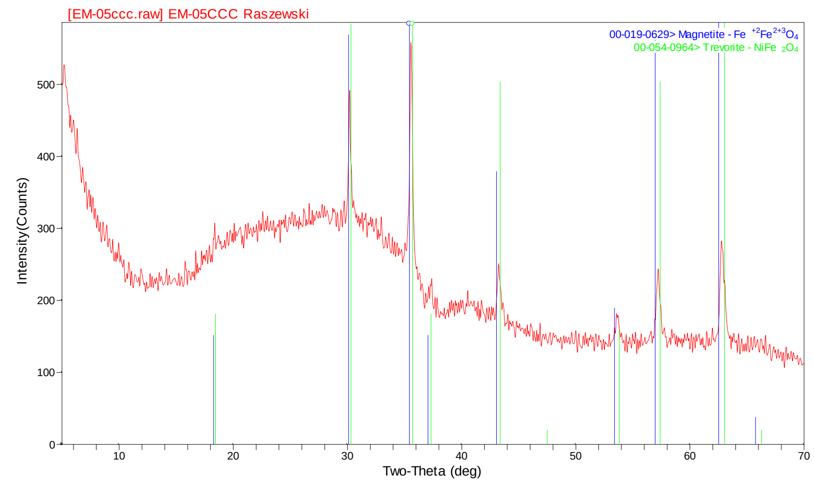


(b)

Figure 23. XRD patterns of (a) quenched and (b) ccc EM-04.

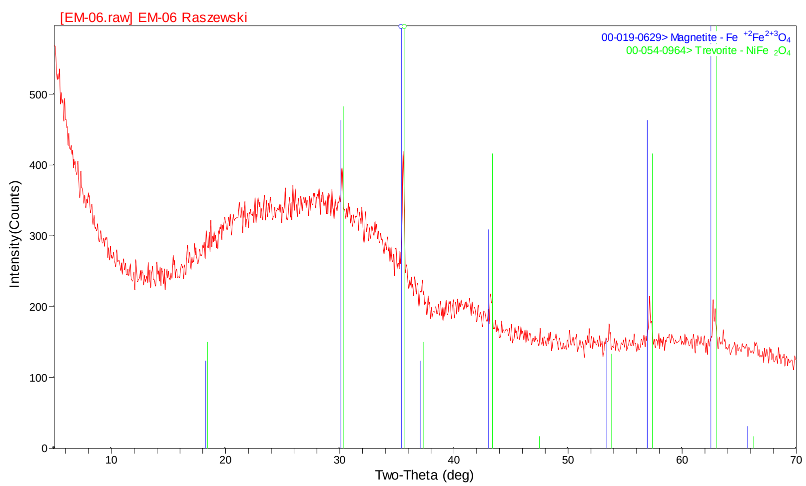


(a)

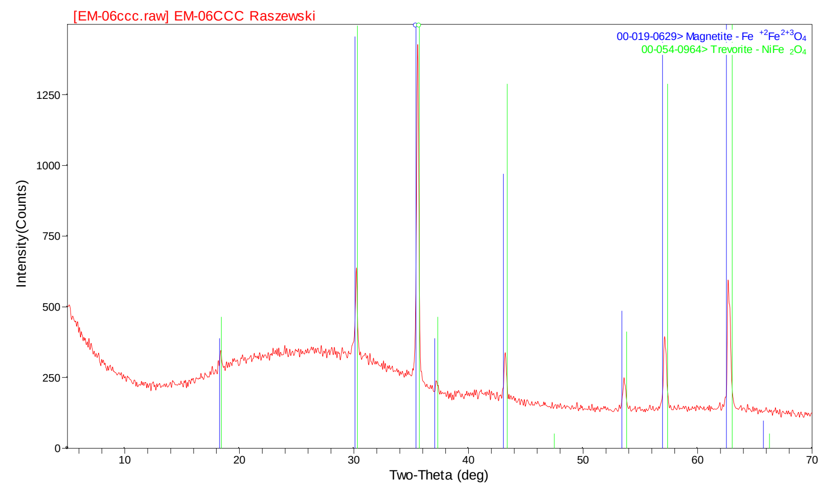


(b)

Figure 24. XRD patterns of (a) quenched and (b) ccc EM-05.

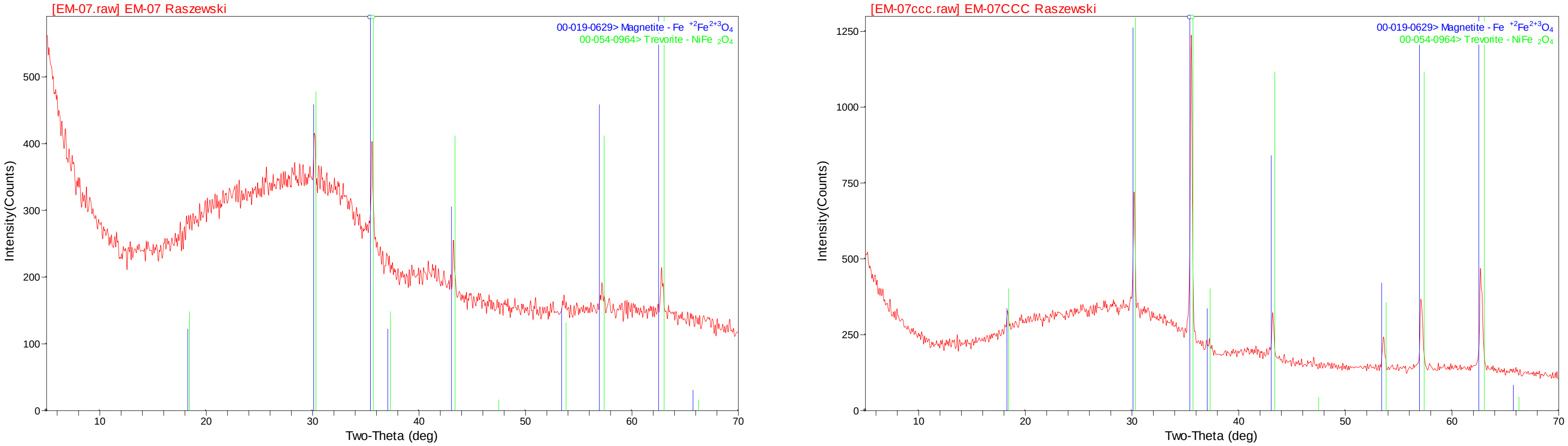


(a)



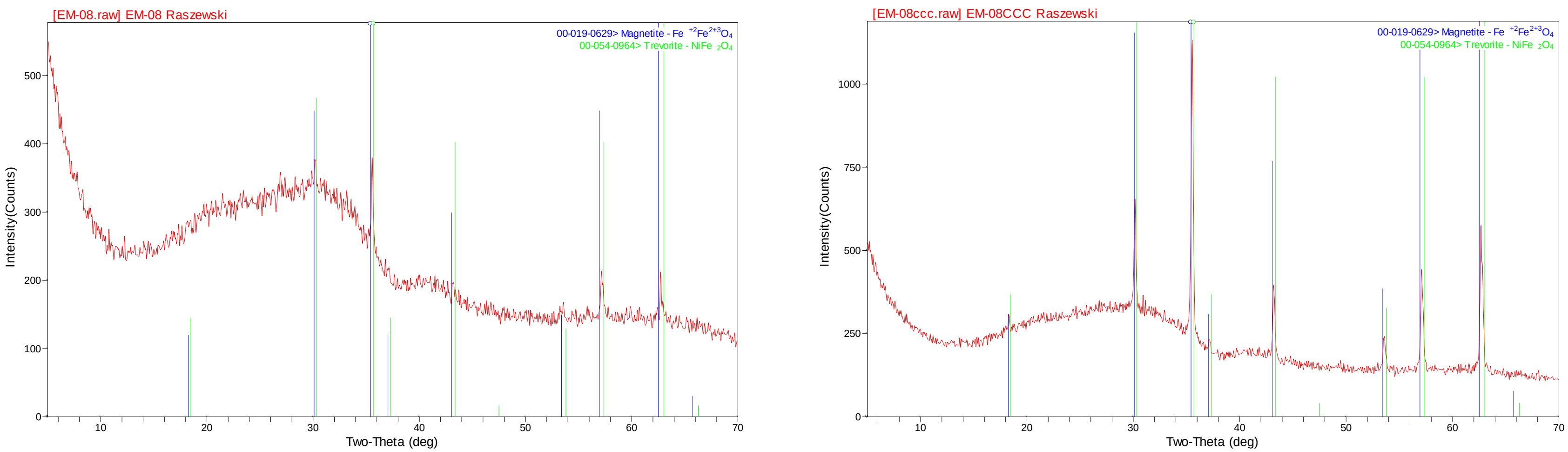
(b)

Figure 25. XRD patterns of (a) quenched and (b) ccc EM-06.



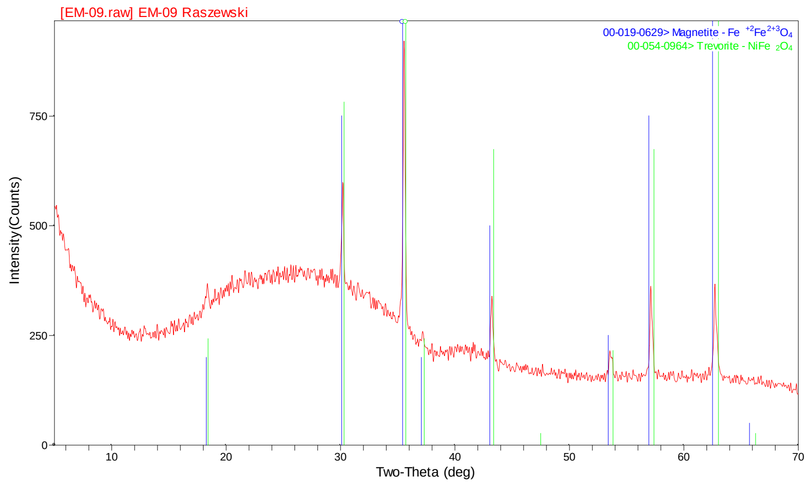
(a) (b)

Figure 26. XRD patterns of (a) quenched and (b) ccc EM-07.

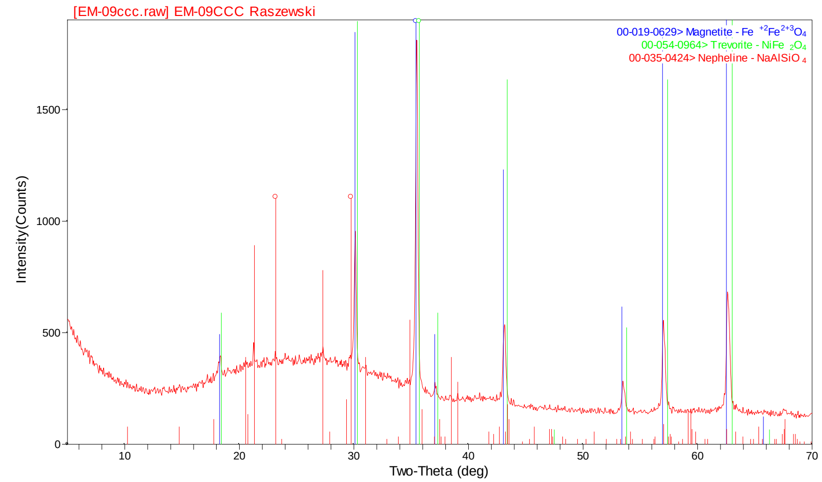


(a) (b)

Figure 27. XRD patterns of (a) quenched and (b) ccc EM-08.

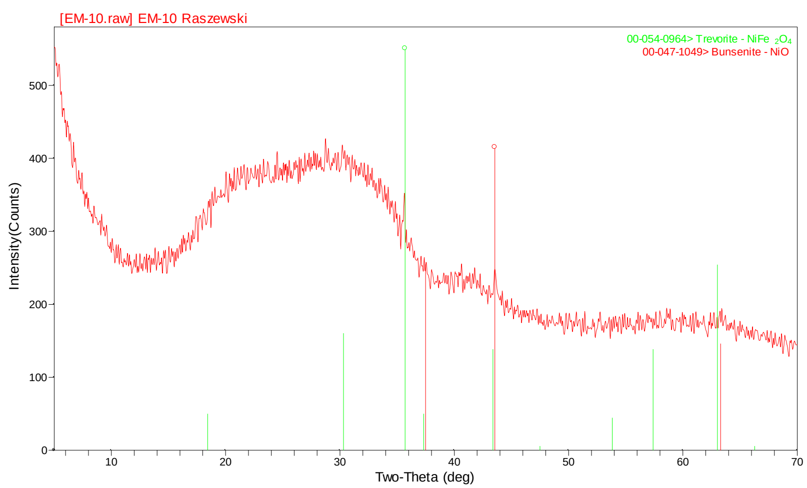


(a)

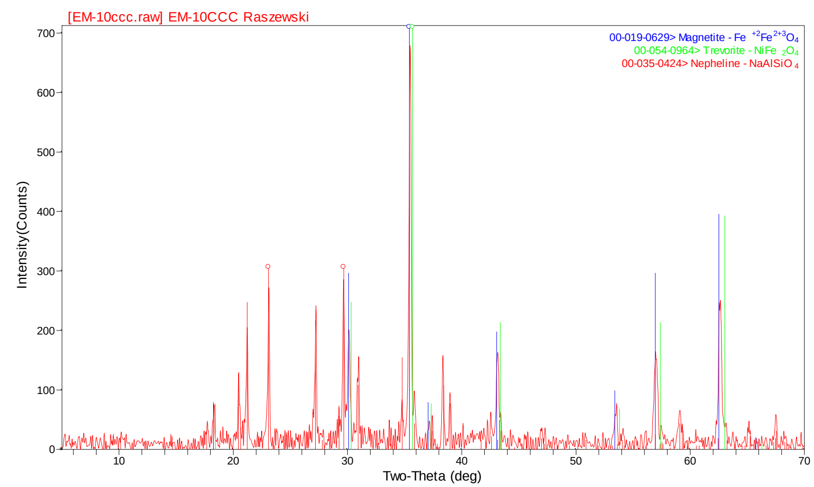


(b)

Figure 28. XRD patterns of (a) quenched and (b) ccc EM-09.

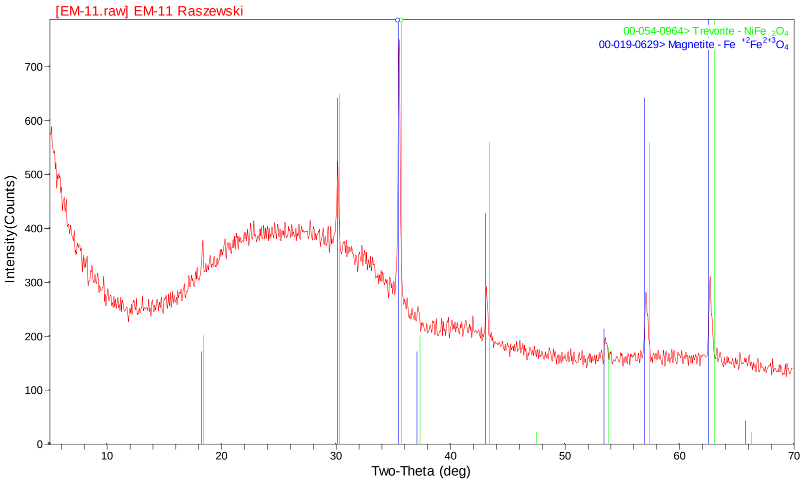


(a)

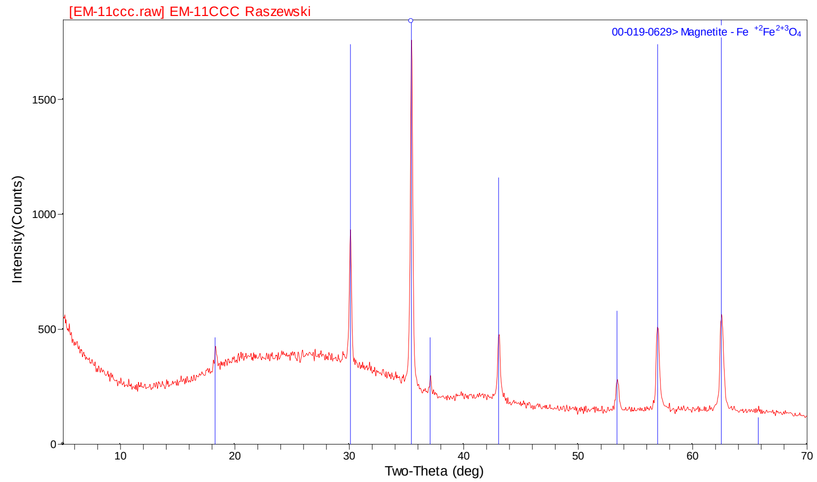


(b)

Figure 29. XRD patterns of (a) quenched and (b) ccc EM-10.

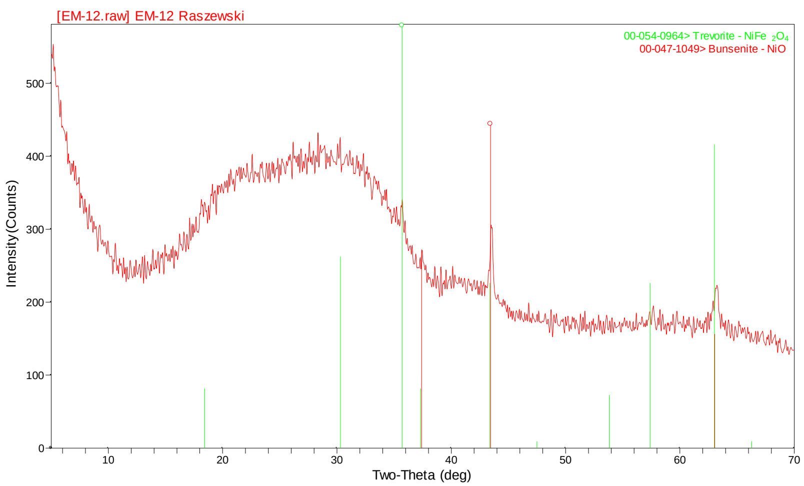


(a)

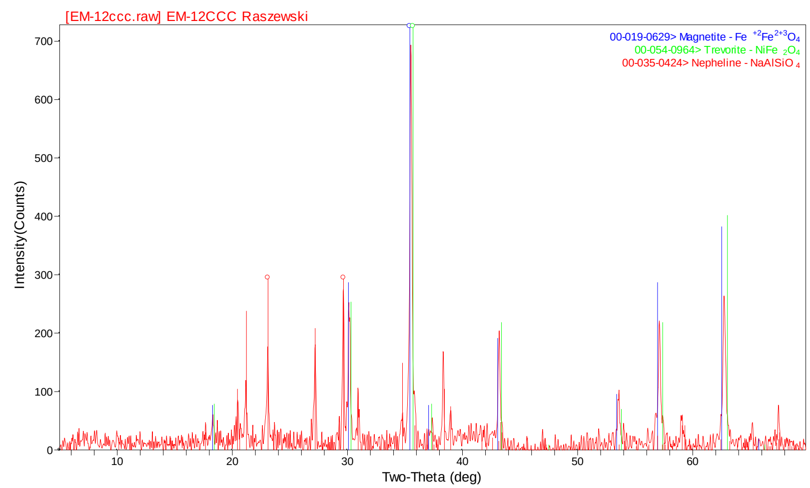


(b)

Figure 30. XRD patterns of (a) quenched and (b) ccc EM-11.

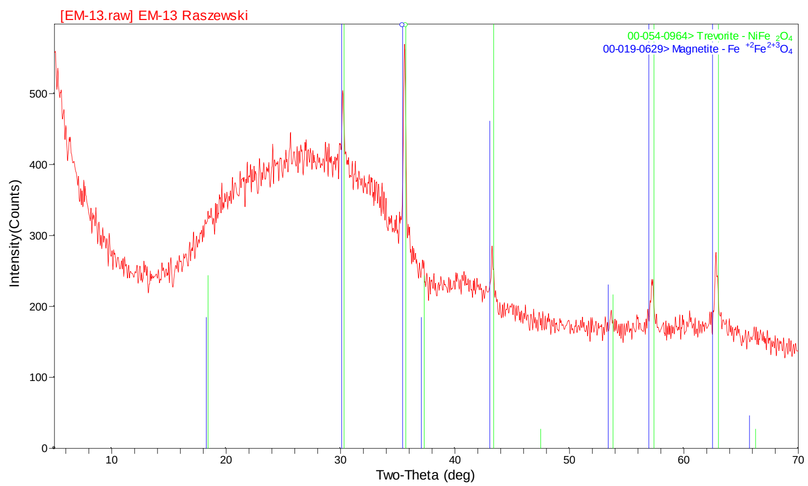


(a)

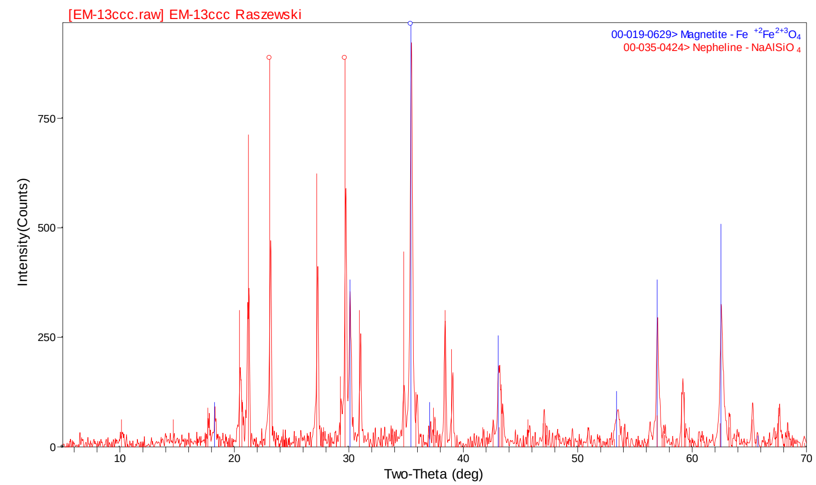


(b)

Figure 31. XRD patterns of (a) quenched and (b) ccc EM-12.

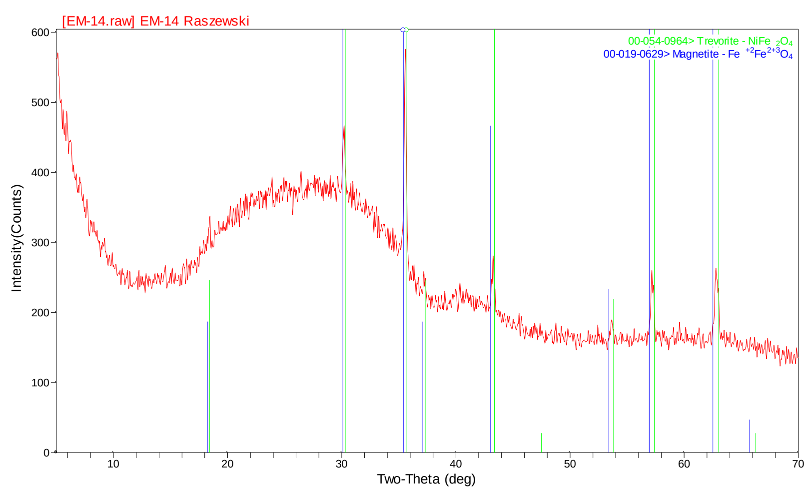


(a)

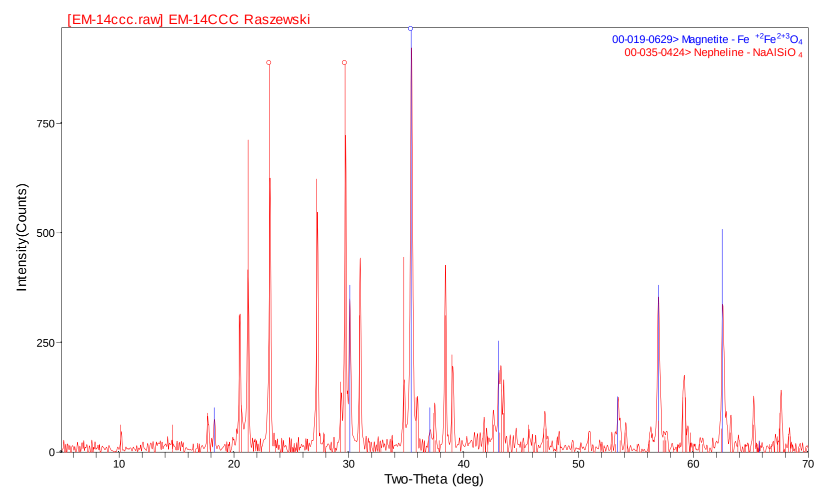


(b)

Figure 32. XRD patterns of (a) quenched and (b) ccc EM-13.

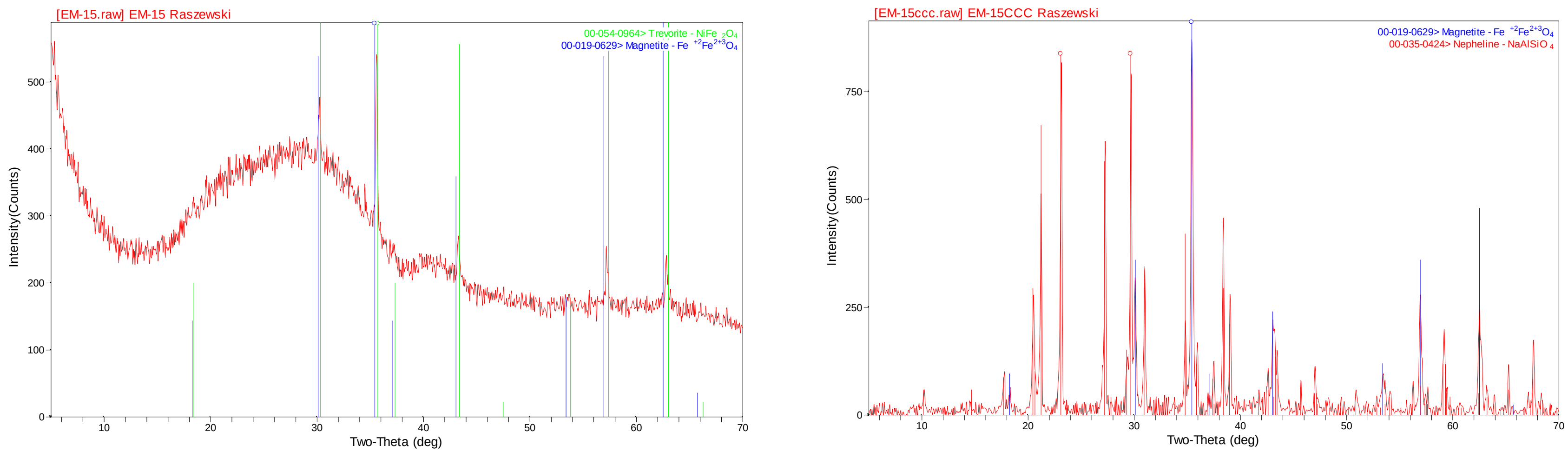


(a)



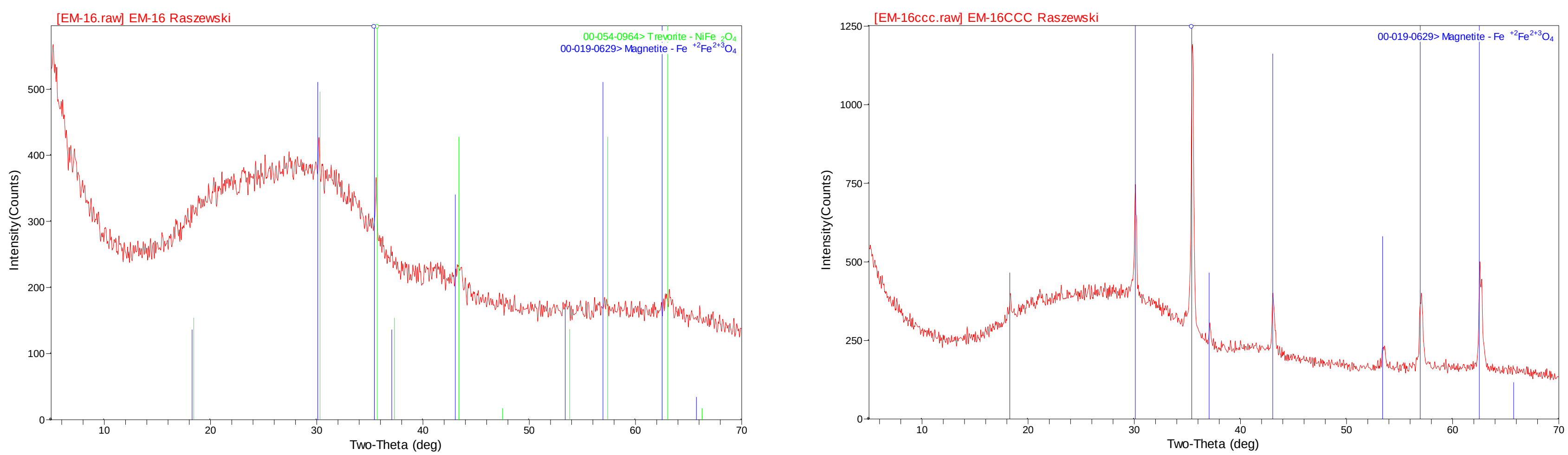
(b)

Figure 33. XRD patterns of (a) quenched and (b) ccc EM-14.



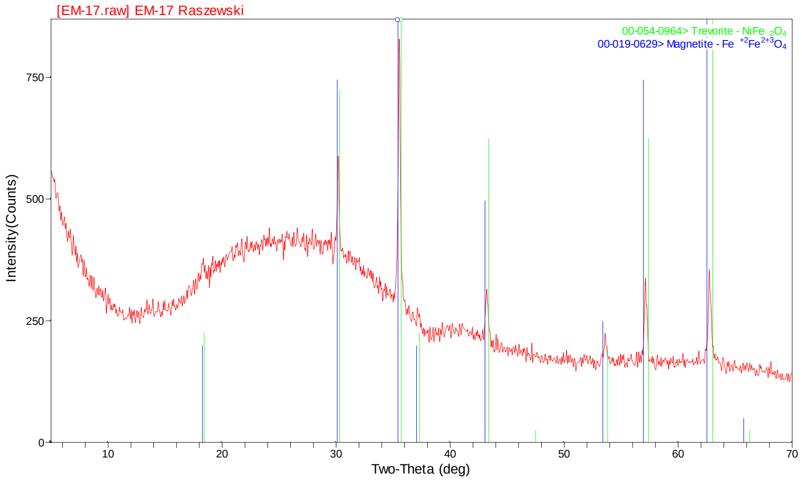
(a) (b)

Figure 34. XRD patterns of (a) quenched and (b) ccc EM-15.

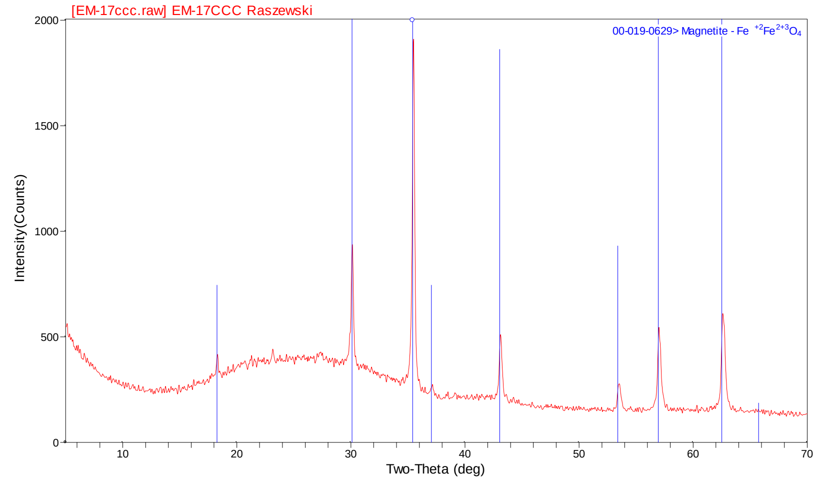


(a) (b)

Figure 35. XRD patterns of (a) quenched and (b) ccc EM-16.

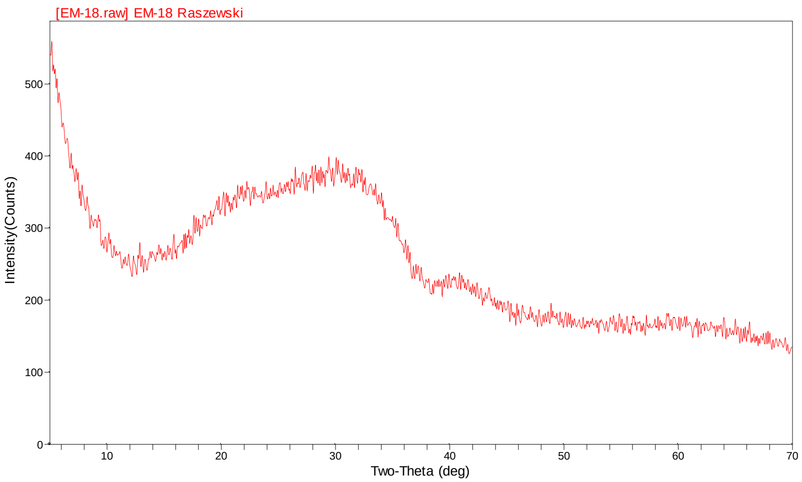


(a)

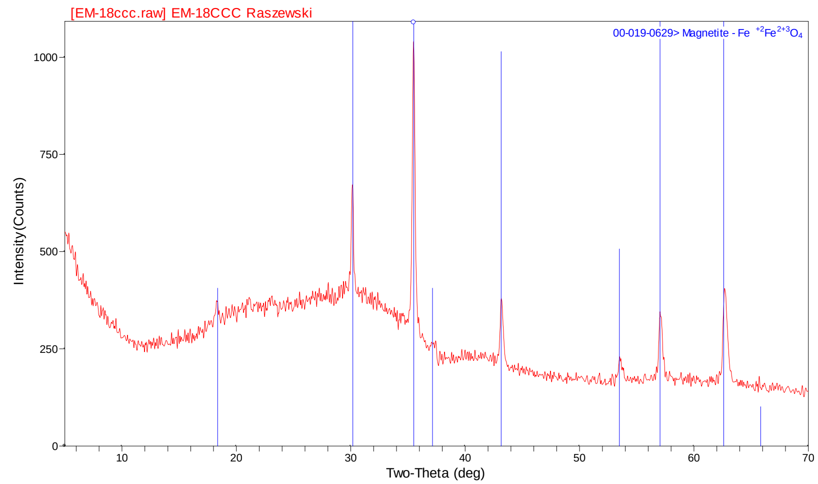


(b)

Figure 36. XRD patterns of (a) quenched and (b) ccc EM-17.

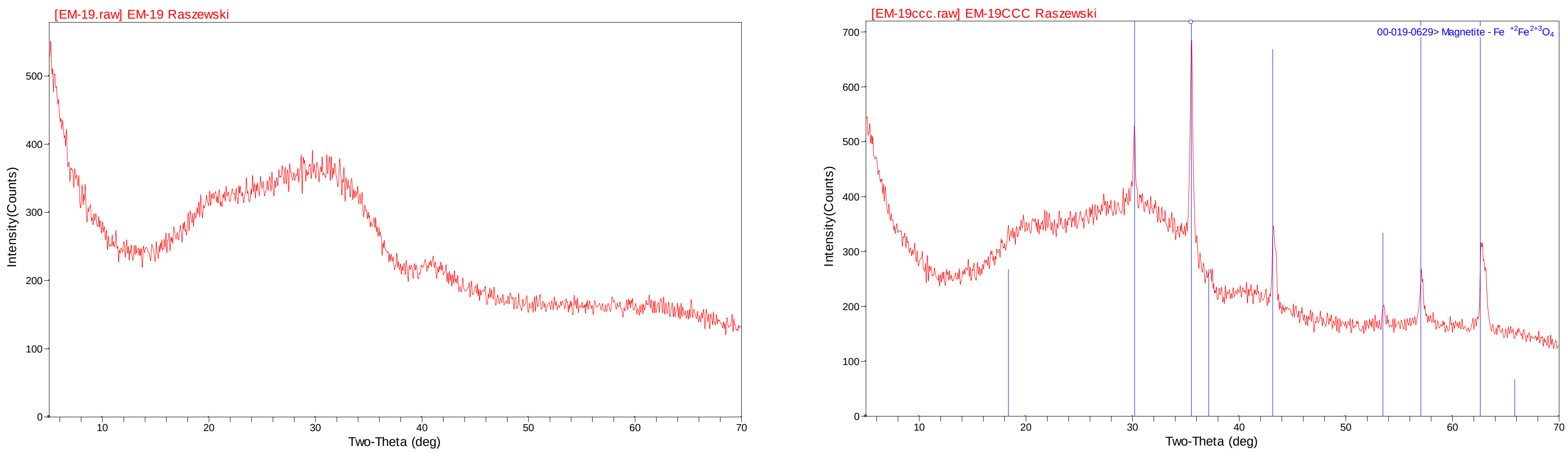


(a)



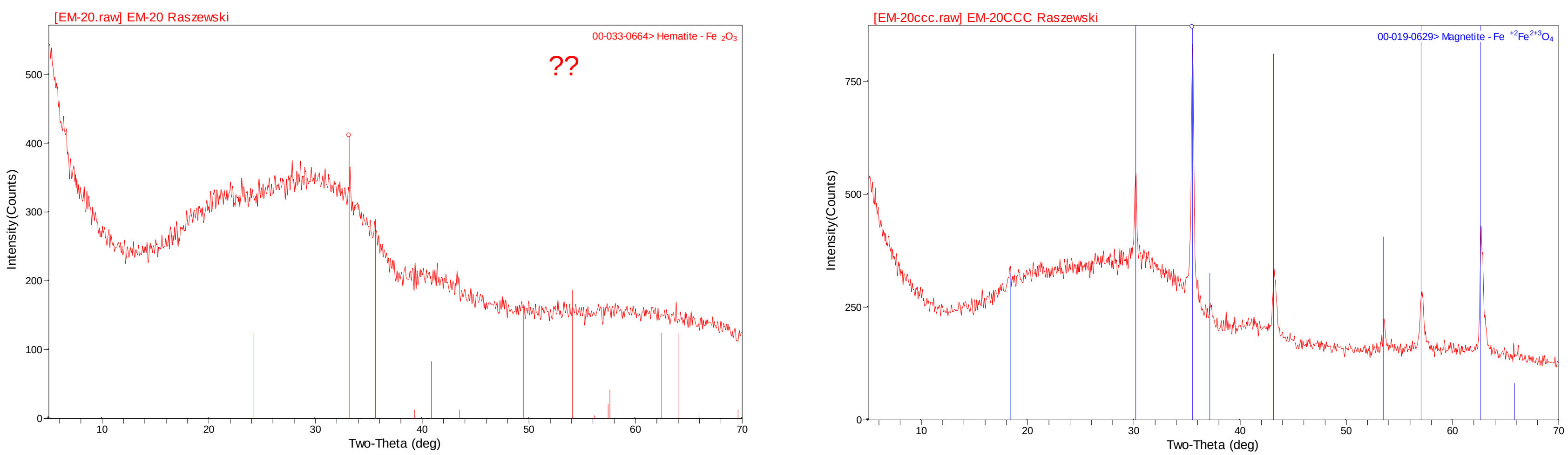
(b)

Figure 37. XRD patterns of (a) quenched and (b) ccc EM-18.



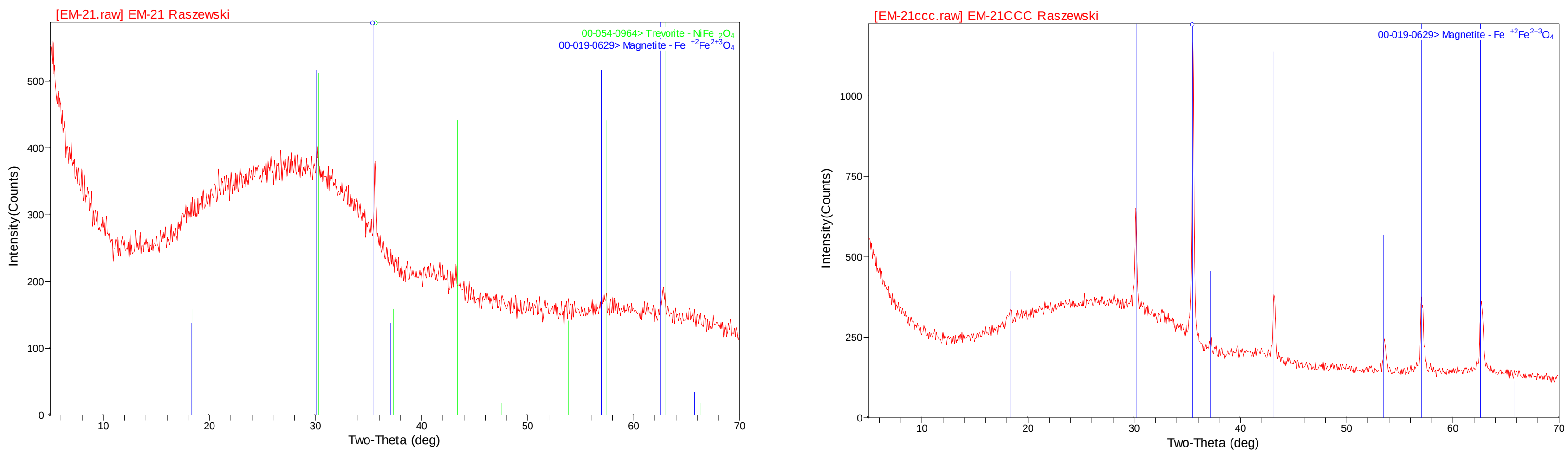
(a) (b)

Figure 38. XRD patterns of (a) quenched and (b) ccc EM-19.



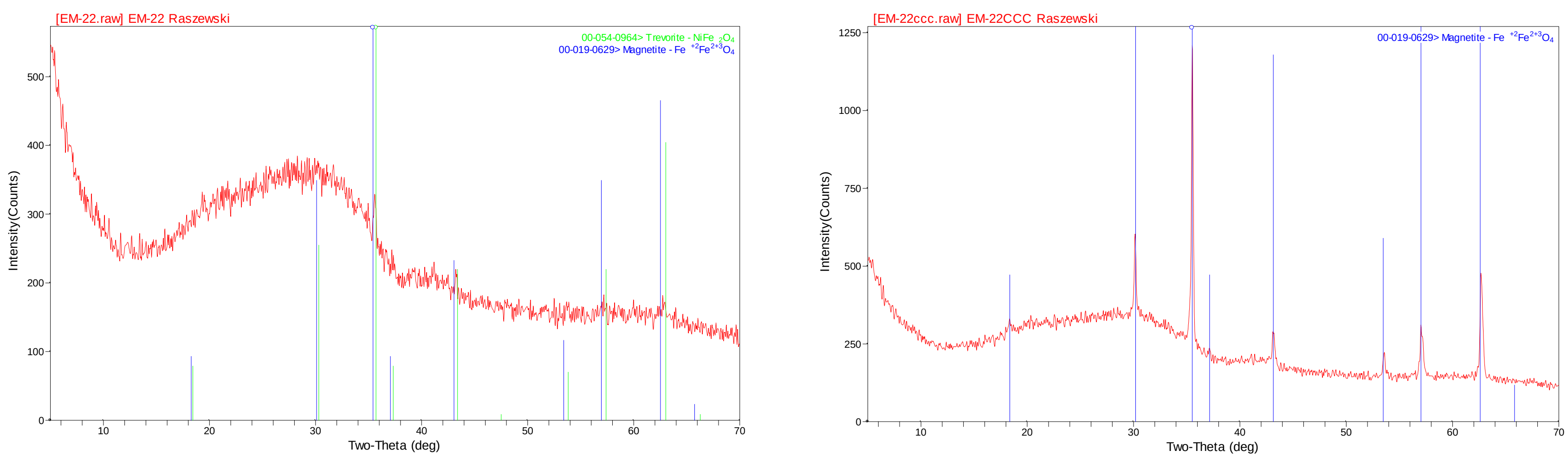
(a) (b)

Figure 39. XRD patterns of (a) quenched and (b) ccc EM-20.



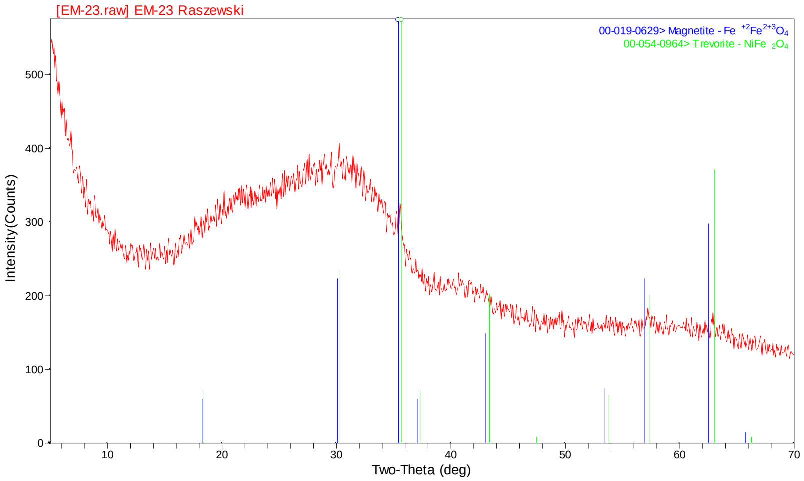
(a) (b)

Figure 40. XRD patterns of (a) quenched and (b) ccc EM-21.

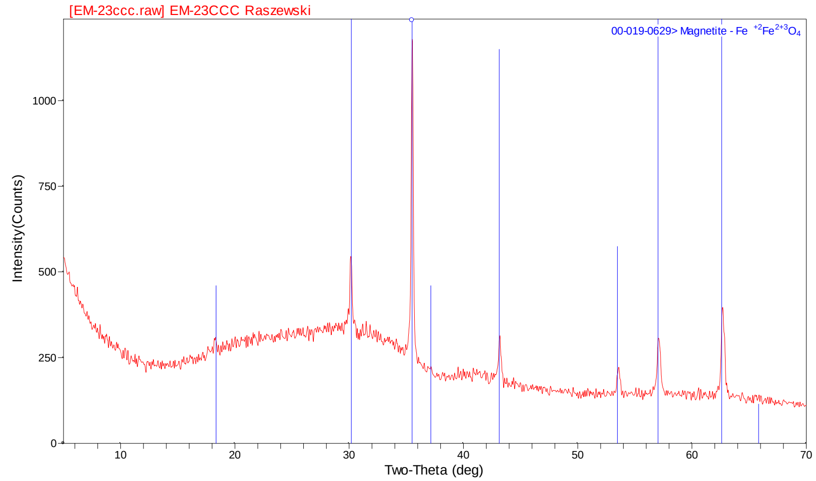


(a) (b)

Figure 41. XRD patterns of (a) quenched and (b) ccc EM-22.

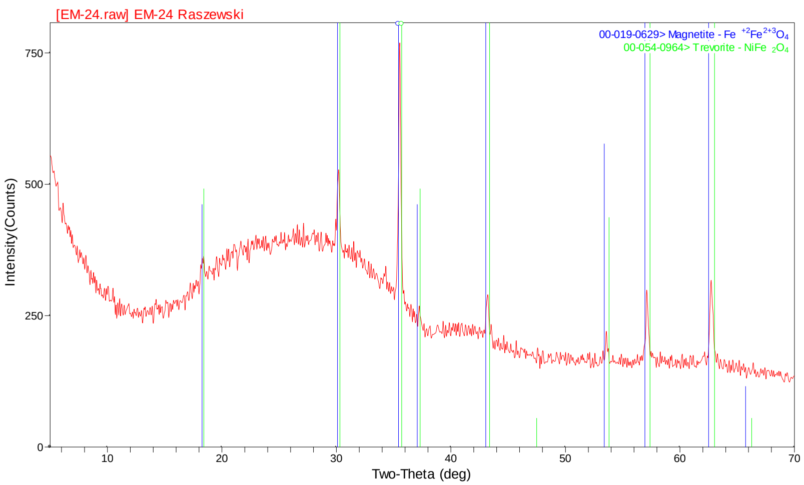


(a)

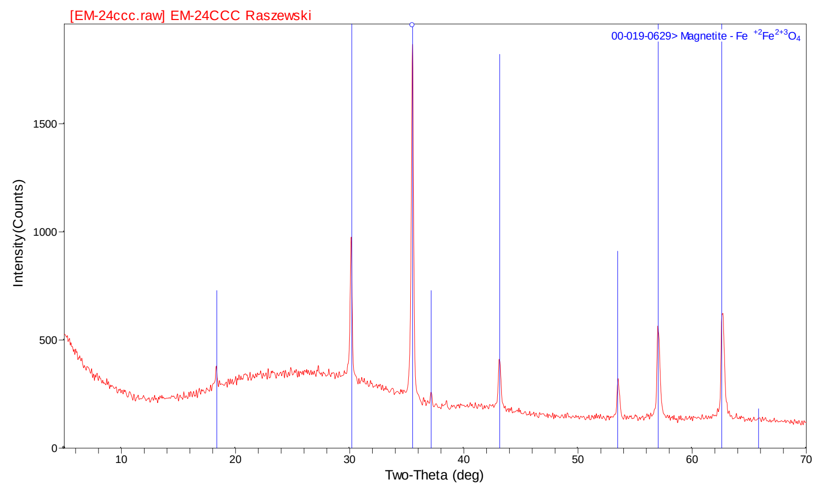


(b)

Figure 42. XRD patterns of (a) quenched and (b) ccc EM-23.



(a)



(b)

Figure 43. XRD patterns of (a) quenched and (b) ccc EM-24.

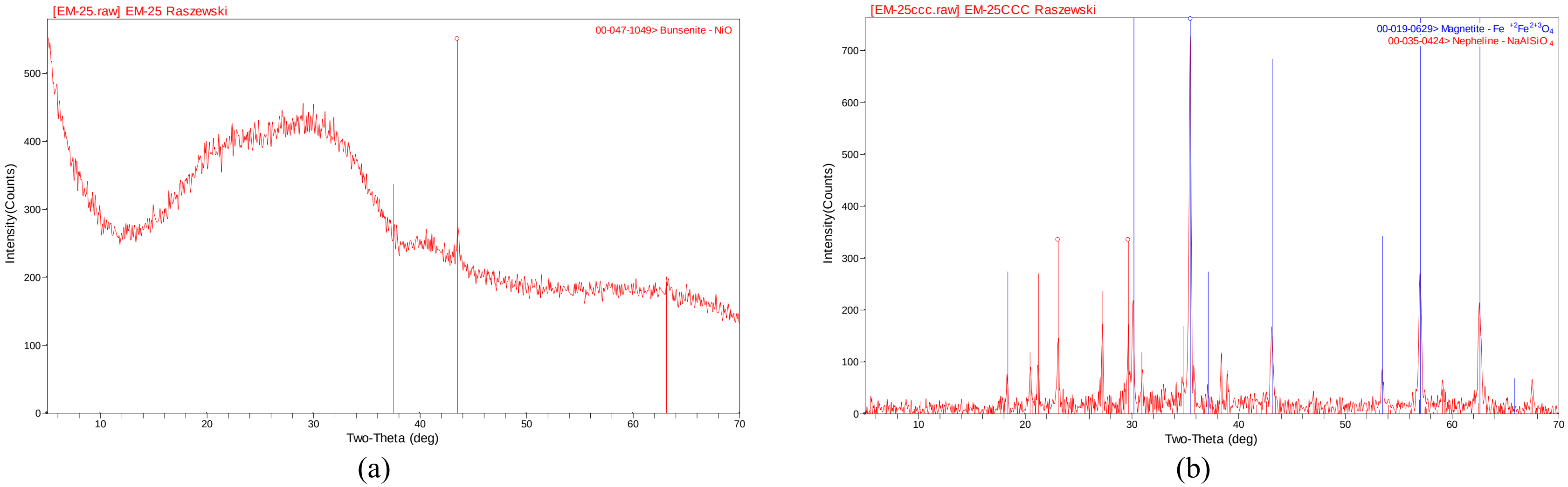


Figure 44. XRD patterns of (a) quenched and (b) ccc EM-25.

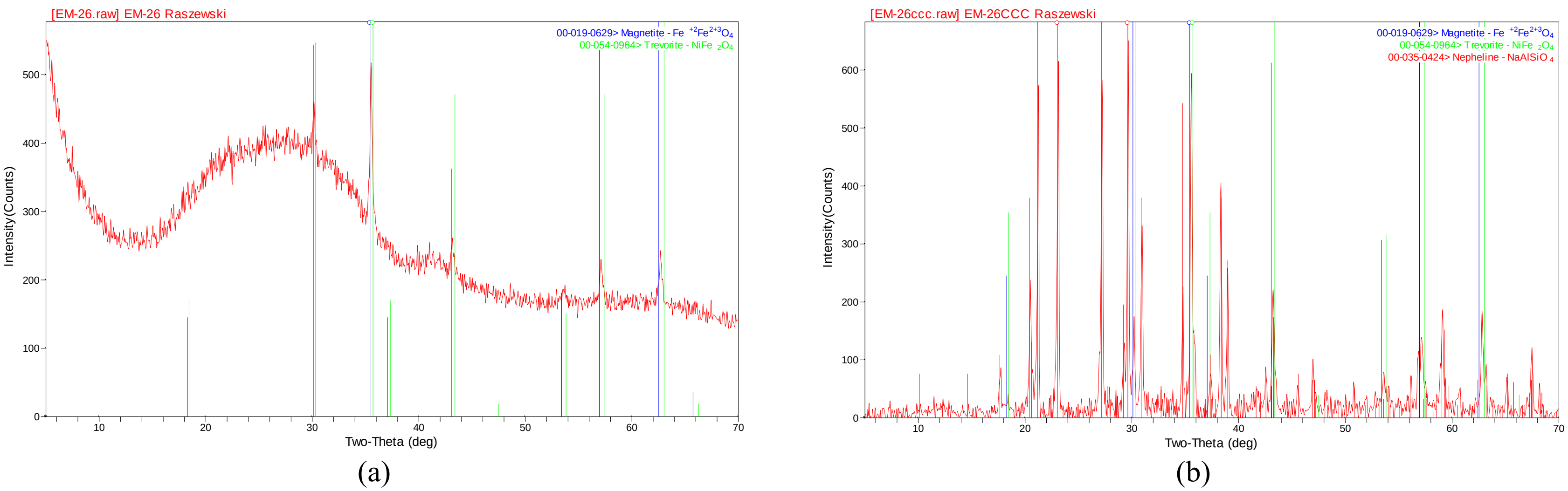
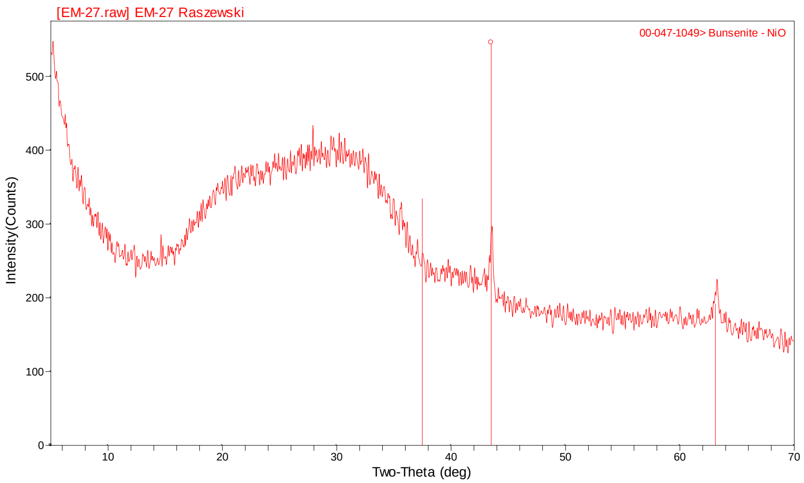
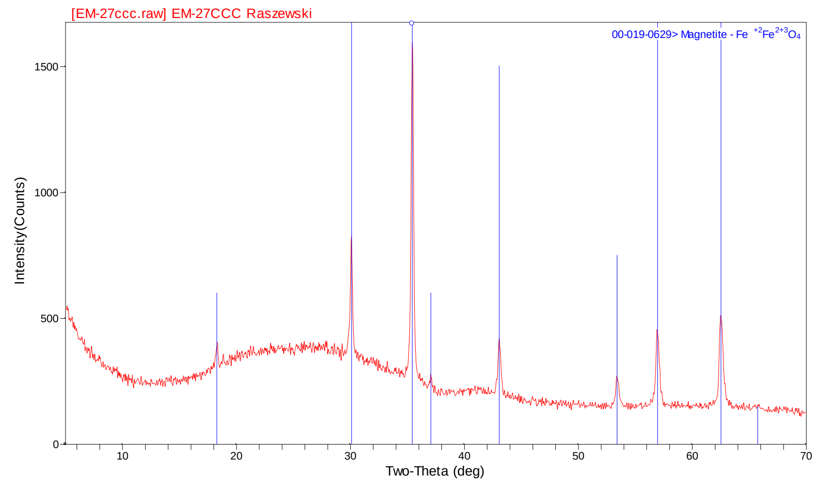


Figure 45. XRD patterns of (a) quenched and (b) ccc EM-26.

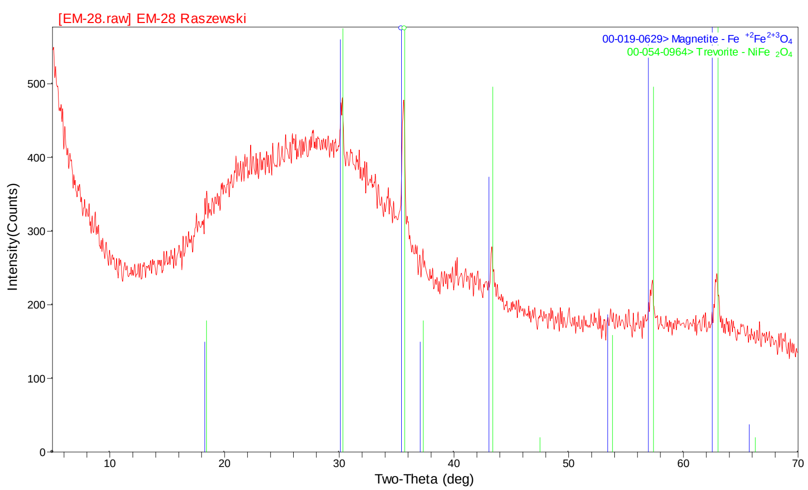


(a)

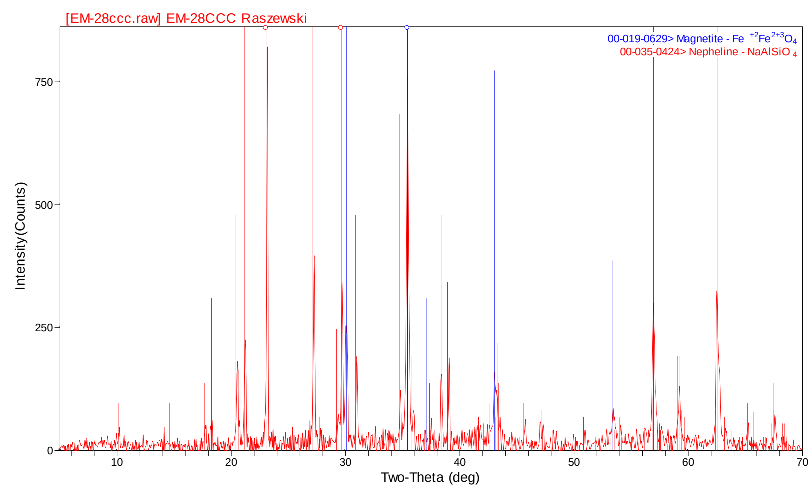


(b)

Figure 46. XRD patterns of (a) quenched and (b) ccc EM-27.

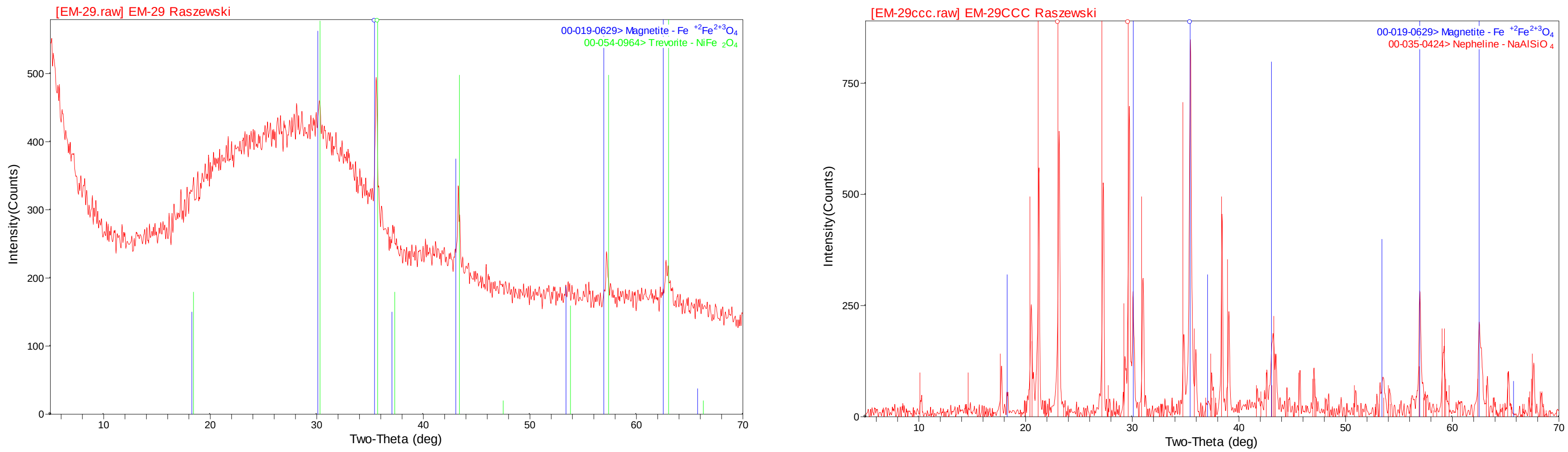


(a)



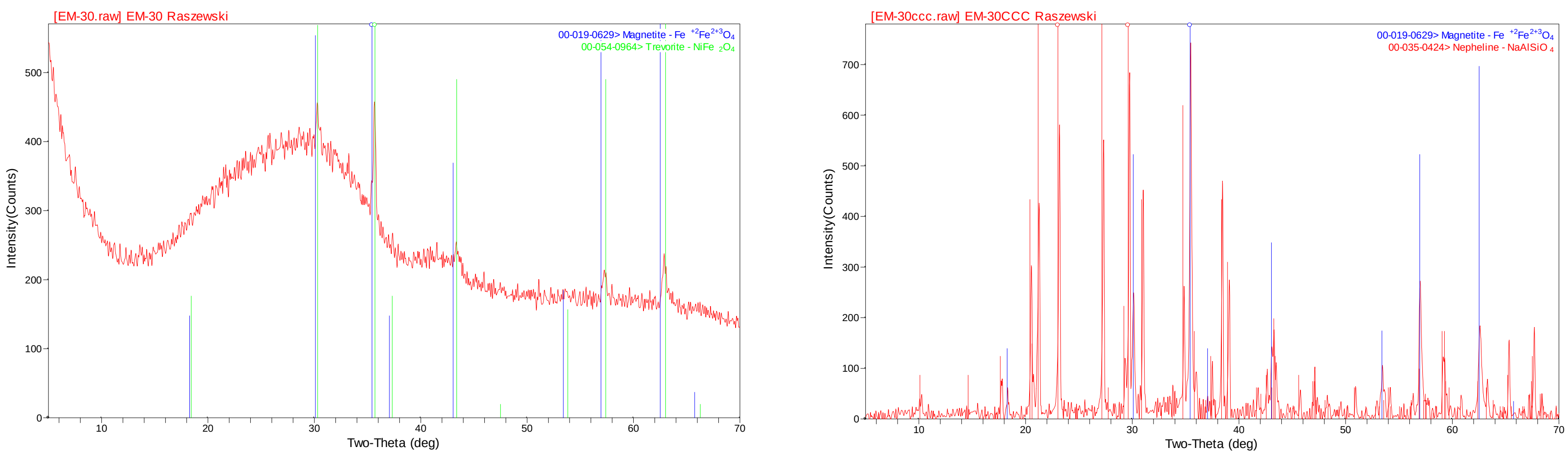
(b)

Figure 47. XRD patterns of (a) quenched and (b) ccc EM-28.



(a) (b)

Figure 48. XRD patterns of (a) quenched and (b) ccc EM-29.



(a) (b)

Figure 49. XRD patterns of (a) quenched and (b) ccc EM-30.

5.2.4 A Statistical Review of the Matrix 2A PCT Results

Table E1 in Appendix E provides the elemental leachate concentration measurements determined by the PSAL for the solution samples generated by the PCTs. Adjustments for detection limits and dilution factors are discussed in Section 5.1.4. None of the PCTs from these glasses indicated a solution-weight loss problem.

5.2.4.1 Measurements in Analytical Sequence

Exhibit E1 in Appendix E provides plots of the leachate concentrations in analytical sequence as generated by the PSAL for all of the data from all three sets of PCTs. No issues are observed in these plots.

5.2.4.2 Results of the Multi-Element Solution Standard Samples

Exhibit E2 in Appendix E provides analyses of measurements of the multi-element solution standard by analytical set/ICP-AES calibration block and an ANOVA investigation for each element of interest. A statistically significant (at a 5% level) difference among the averages of these measurements was indicated for Li and Na. No attempt was made to bias correct for these effects since averaging the ppm values for each set of triplicates helps to minimize the impact of any potential effects of the instrument.

Table 21 summarizes the average measurements and the reference values for the four elements of interest. The results indicate consistent and accurate measurements from the PSAL processes used to conduct these analyses.

Table 21. Multi-Element Solution Standard Results of the Matrix 2A Glasses

Set	Block	B (ppm)	Li (ppm)	Na (ppm)	Si (ppm)
1	1	21.5	10.0	82.7	52.7
1	1	20.5	10.0	81.9	51.5
1	1	19.9	10.0	84.0	52.1
1	2	20.4	9.9	84.4	52.5
1	2	19.2	10.0	85.1	52.6
1	2	18.2	9.6	79.9	51.3
1	3	22.0	10.2	83.4	51.9
1	3	19.9	9.9	77.7	50.6
1	3	20.4	10.1	80.6	51.5
Average		20.2	10.0	82.2	51.9
2	1	21.4	9.8	81.7	50.1
2	1	20.5	9.9	81.4	50.5
2	1	20.1	9.6	78.7	49.3
2	2	21.6	10.0	82.4	50.4
2	2	19.9	9.9	80.7	50.2
2	2	20.0	9.9	81.3	50.6
2	3	21.3	9.9	83.0	51.6
2	3	20.3	9.9	82.5	51.7
2	3	20.1	9.9	82.7	51.6
Average		20.6	9.9	81.6	50.7
3	1	21.2	10.1	83.1	51.1
3	1	20.2	9.9	82.7	49.5
3	1	20.7	10.2	86.4	50.1
3	2	21.0	10.2	81.9	51.3
3	2	20.2	10.1	80.8	50.8
3	2	20.4	10.2	81.6	51.6
3	3	20.3	10.0	82.8	50.4
3	3	20.2	10.1	83.8	50.6
3	3	22.9	10.1	82.1	50.8
Average		20.8	10.1	82.8	50.7
Grand Average		20.5	10.0	82.2	51.1
Reference Value		20	10	81	50
% difference		2.7%	-0.2%	1.5%	2.1%

5.2.4.3 Measurements by Glass Identifier

Exhibit E3 in Appendix E provides plots of the leachate concentrations for each type of submitted sample by analytical set: the study glasses by heat treatment and the standards (EA, ARM, the multi-element solution standard, and blanks). Limited scatter is observed in the triplicate values for the analytes for almost all of the glasses. An exception is the scatter in the replicate Na PCTs for the quenched version of EM-06.

5.2.4.4 Normalized PCT Results

PCT leachate concentrations were normalized using the method described in Section 5.1.4.4. Exhibit E4 in Appendix E provides scatter plots for these results and offers an opportunity to investigate the consistency in the leaching across the elements for the glasses of this study. All combinations of the normalizations of the PCTs (i.e., those generated using the target, measured, and bias-corrected compositional views) and both heat treatments are represented in the series of scatter plots. Consistency in the leaching across the elements is typically demonstrated by a high degree of linear correlation among the values for pairs of these elements. The smallest correlation in this plot is that for Li and Si, with a value of ~88.7%. It should be noted that this value is lower than values typically observed.

Table 22 summarizes the normalized PCTs for the glasses of this study. The PCTs are listed by heat treatment and compositional view for each glass.

Table 22. Normalized PCT Results of the Matrix 2A Glasses

Set	Glass ID	Heat Treatment	Comp View	log NL [B (g/L)]	log NL [Li (g/L)]	log NL [Na (g/L)]	log NL [Si (g/L)]	NL B (g/L)	NL Li (g/L)	NL Na (g/L)	NL Si (g/L)
1	**ARM**	ref	reference	-0.35	-0.28	-0.34	-0.57	0.45	0.53	0.45	0.27
2	**ARM**	ref	reference	-0.33	-0.27	-0.33	-0.57	0.47	0.54	0.47	0.27
3	**ARM**	ref	reference	-0.29	-0.23	-0.31	-0.56	0.51	0.58	0.50	0.28
1	**EA**	ref	reference	1.21	0.94	1.09	0.58	16.06	8.76	12.29	3.80
2	**EA**	ref	reference	1.19	0.94	1.08	0.57	15.47	8.79	11.94	3.76
3	**EA**	ref	reference	1.24	0.96	1.12	0.59	17.49	9.21	13.16	3.86
1	**EM-01**	quenched	Measured	-0.05	-0.12	0.00	-0.27	0.89	0.76	0.99	0.53
1			Measured bc	-0.03	-0.11	0.00	-0.30	0.93	0.78	1.01	0.50
1			Target	-0.04	-0.12	0.00	-0.27	0.92	0.76	0.99	0.54
1		ccc	Measured	-0.06	-0.08	0.00	-0.25	0.86	0.82	1.01	0.56
1			Measured bc	-0.04	-0.07	0.01	-0.27	0.90	0.84	1.03	0.53
1			Target	-0.05	-0.08	0.00	-0.24	0.90	0.83	1.01	0.57
1	**EM-02**	quenched	Measured	-0.20	-0.19	-0.14	-0.35	0.63	0.65	0.73	0.45
1			Measured bc	-0.18	-0.18	-0.13	-0.37	0.66	0.67	0.74	0.42
1			Target	-0.19	-0.19	-0.14	-0.35	0.65	0.65	0.73	0.45
1		ccc	Measured	0.37	0.35	0.12	-0.12	2.32	2.21	1.32	0.76
1			Measured bc	0.38	0.36	0.13	-0.14	2.42	2.27	1.34	0.72
1			Target	0.38	0.34	0.12	-0.12	2.38	2.19	1.32	0.77
1	**EM-03**	quenched	Measured	0.04	-0.02	0.15	-0.16	1.11	0.96	1.40	0.69
1			Measured bc	0.06	-0.01	0.15	-0.18	1.15	0.98	1.42	0.66
1			Target	0.06	-0.02	0.14	-0.16	1.14	0.95	1.38	0.69
1		ccc	Measured	0.00	0.04	0.18	-0.11	1.01	1.09	1.52	0.78
1			Measured bc	0.02	0.05	0.19	-0.13	1.05	1.12	1.53	0.74
1			Target	0.02	0.03	0.17	-0.11	1.04	1.08	1.49	0.77
1	**EM-04**	quenched	Measured	0.12	0.06	0.21	-0.08	1.32	1.14	1.62	0.84
1			Measured bc	0.13	0.06	0.21	-0.11	1.34	1.14	1.64	0.78
1			Target	0.13	0.05	0.20	-0.09	1.36	1.12	1.58	0.82
1		ccc	Measured	0.05	0.06	0.19	-0.08	1.13	1.15	1.55	0.83
1			Measured bc	0.06	0.06	0.20	-0.11	1.14	1.15	1.57	0.78
1			Target	0.06	0.05	0.18	-0.09	1.16	1.12	1.52	0.81
1	**EM-05**	quenched	Measured	0.12	0.04	0.15	-0.13	1.30	1.10	1.42	0.75
1			Measured bc	0.12	0.04	0.16	-0.15	1.32	1.10	1.44	0.70
1			Target	0.12	0.04	0.14	-0.13	1.33	1.09	1.40	0.74
1		ccc	Measured	0.05	0.05	0.15	-0.10	1.13	1.13	1.42	0.79
1			Measured bc	0.06	0.06	0.16	-0.13	1.14	1.14	1.44	0.74
1			Target	0.06	0.05	0.14	-0.11	1.16	1.12	1.39	0.78
1	**EM-06**	quenched	Measured	0.05	0.01	-0.29	-0.19	1.13	1.02	0.52	0.64
1			Measured bc	0.06	0.01	-0.28	-0.22	1.14	1.03	0.53	0.60
1			Target	0.05	0.00	-0.28	-0.20	1.13	1.01	0.53	0.64
1		ccc	Measured	-0.05	-0.06	0.01	-0.21	0.88	0.87	1.03	0.61
1			Measured bc	-0.05	-0.06	0.02	-0.24	0.89	0.88	1.04	0.58
1			Target	-0.05	-0.07	0.02	-0.22	0.88	0.86	1.04	0.61
1	**EM-07**	quenched	Measured	0.17	0.12	0.18	-0.17	1.49	1.33	1.50	0.68
1			Measured bc	0.18	0.12	0.18	-0.19	1.50	1.33	1.51	0.64
1			Target	0.19	0.12	0.17	-0.17	1.54	1.33	1.49	0.68
1		ccc	Measured	-0.05	-0.01	0.06	-0.24	0.89	0.99	1.15	0.57
1			Measured bc	-0.05	0.00	0.07	-0.27	0.90	0.99	1.17	0.54
1			Target	-0.04	0.00	0.06	-0.24	0.92	0.99	1.15	0.57
1	**EM-08**	quenched	Measured	0.17	0.15	0.19	-0.18	1.49	1.41	1.53	0.66
1			Measured bc	0.18	0.15	0.19	-0.21	1.50	1.42	1.56	0.62
1			Target	0.18	0.15	0.19	-0.19	1.51	1.40	1.56	0.65
1		ccc	Measured	-0.02	0.05	0.08	-0.26	0.96	1.12	1.21	0.56
1			Measured bc	-0.02	0.05	0.09	-0.28	0.97	1.12	1.23	0.52
1			Target	-0.01	0.04	0.09	-0.26	0.97	1.11	1.23	0.55
1	**EM-09**	quenched	Measured	-0.11	-0.13	-0.08	-0.30	0.77	0.75	0.84	0.51
1			Measured bc	-0.11	-0.12	-0.07	-0.32	0.78	0.75	0.85	0.48
1			Target	-0.11	-0.13	-0.07	-0.30	0.77	0.74	0.85	0.50
1		ccc	Measured	-0.09	-0.05	-0.06	-0.27	0.81	0.90	0.86	0.54
1			Measured bc	-0.09	-0.05	-0.06	-0.30	0.82	0.90	0.88	0.51
1			Target	-0.09	-0.05	-0.06	-0.27	0.81	0.89	0.88	0.53

Table 22 continued.

Set	Glass ID	Heat Treatment	Comp View	log NL [B (g/L)]	log NL [Li (g/L)]	log NL [Na (g/L)]	log NL [Si (g/L)]	NL B (g/L)	NL Li (g/L)	NL Na (g/L)	NL Si (g/L)
1	EM-10	quenched	Measured	-0.05	-0.10	0.07	-0.22	0.90	0.80	1.17	0.60
1			Measured bc	-0.04	-0.10	0.08	-0.25	0.91	0.80	1.19	0.57
1			Target	-0.04	-0.11	0.06	-0.23	0.91	0.77	1.16	0.59
1		ccc	Measured	1.05	0.95	0.77	0.42	11.33	8.87	5.83	2.65
1			Measured bc	1.06	0.95	0.77	0.40	11.44	8.90	5.92	2.49
1			Target	1.06	0.93	0.76	0.41	11.42	8.59	5.76	2.57
2	EM-11	quenched	Measured	-0.13	-0.15	-0.08	-0.34	0.74	0.72	0.82	0.45
2			Measured bc	-0.11	-0.14	-0.08	-0.37	0.77	0.73	0.83	0.43
2			Target	-0.12	-0.14	-0.09	-0.34	0.76	0.72	0.81	0.46
2		ccc	Measured	-0.23	-0.19	-0.08	-0.35	0.60	0.65	0.82	0.45
2			Measured bc	-0.21	-0.18	-0.08	-0.37	0.62	0.66	0.83	0.42
2			Target	-0.21	-0.19	-0.09	-0.34	0.62	0.65	0.81	0.46
2	EM-12	quenched	Measured	-0.01	-0.09	0.13	-0.20	0.98	0.82	1.35	0.64
2			Measured bc	0.01	-0.08	0.14	-0.22	1.02	0.84	1.37	0.60
2			Target	0.00	-0.09	0.13	-0.20	1.01	0.82	1.35	0.64
2		ccc	Measured	0.97	0.87	0.74	0.38	9.44	7.37	5.51	2.38
2			Measured bc	0.99	0.88	0.75	0.35	9.85	7.55	5.59	2.26
2			Target	0.99	0.87	0.74	0.38	9.74	7.37	5.50	2.38
2	EM-13	quenched	Measured	-0.16	-0.17	-0.06	-0.37	0.69	0.67	0.87	0.43
2			Measured bc	-0.14	-0.16	-0.06	-0.39	0.72	0.69	0.88	0.41
2			Target	-0.14	-0.17	-0.06	-0.36	0.72	0.67	0.88	0.43
2		ccc	Measured	0.32	0.41	0.15	-0.10	2.10	2.60	1.41	0.80
2			Measured bc	0.34	0.42	0.15	-0.12	2.19	2.66	1.43	0.76
2			Target	0.34	0.41	0.15	-0.10	2.17	2.59	1.43	0.80
2	EM-14	quenched	Measured	-0.15	-0.15	-0.07	-0.40	0.70	0.71	0.85	0.40
2			Measured bc	-0.14	-0.14	-0.06	-0.42	0.73	0.73	0.86	0.38
2			Target	-0.14	-0.15	-0.07	-0.40	0.72	0.70	0.86	0.40
2		ccc	Measured	-0.12	0.12	-0.06	-0.37	0.76	1.33	0.88	0.43
2			Measured bc	-0.10	0.13	-0.05	-0.39	0.79	1.36	0.89	0.41
2			Target	-0.11	0.12	-0.06	-0.37	0.78	1.32	0.88	0.43
2	EM-15	quenched	Measured	-0.21	-0.15	-0.07	-0.46	0.62	0.71	0.85	0.35
2			Measured bc	-0.19	-0.14	-0.06	-0.48	0.65	0.73	0.86	0.33
2			Target	-0.18	-0.14	-0.07	-0.45	0.67	0.73	0.86	0.36
2		ccc	Measured	-0.25	0.13	-0.12	-0.47	0.56	1.34	0.77	0.34
2			Measured bc	-0.23	0.14	-0.11	-0.49	0.59	1.38	0.77	0.32
2			Target	-0.22	0.14	-0.11	-0.45	0.60	1.38	0.77	0.35
2	EM-16	quenched	Measured	-0.01	-0.05	0.05	-0.26	0.99	0.89	1.13	0.54
2			Measured bc	-0.01	-0.05	0.05	-0.30	0.98	0.89	1.12	0.51
2			Target	-0.01	-0.05	0.04	-0.27	0.99	0.88	1.09	0.54
2		ccc	Measured	0.26	0.19	0.16	-0.15	1.80	1.54	1.44	0.71
2			Measured bc	0.25	0.19	0.16	-0.18	1.79	1.55	1.44	0.66
2			Target	0.26	0.18	0.15	-0.15	1.80	1.53	1.40	0.70
2	EM-17	quenched	Measured	-0.11	-0.12	-0.08	-0.34	0.78	0.76	0.84	0.46
2			Measured bc	-0.11	-0.12	-0.08	-0.37	0.77	0.76	0.83	0.43
2			Target	-0.12	-0.13	-0.10	-0.35	0.76	0.74	0.80	0.45
2		ccc	Measured	0.50	0.42	0.23	-0.09	3.13	2.65	1.69	0.81
2			Measured bc	0.49	0.42	0.23	-0.13	3.11	2.66	1.69	0.75
2			Target	0.49	0.41	0.21	-0.10	3.07	2.60	1.63	0.79
2	EM-18	quenched	Measured	0.14	0.03	0.18	-0.16	1.39	1.08	1.51	0.69
2			Measured bc	0.14	0.04	0.19	-0.19	1.38	1.09	1.55	0.64
2			Target	0.13	0.03	0.17	-0.17	1.35	1.06	1.48	0.67
2		ccc	Measured	0.53	0.43	0.41	0.04	3.36	2.67	2.55	1.10
2			Measured bc	0.52	0.43	0.42	0.01	3.35	2.69	2.62	1.02
2			Target	0.52	0.42	0.40	0.03	3.29	2.62	2.50	1.07
2	EM-19	quenched	Measured	0.17	0.07	0.23	-0.11	1.47	1.17	1.71	0.78
2			Measured bc	0.16	0.07	0.23	-0.14	1.46	1.17	1.70	0.73
2			Target	0.19	0.08	0.21	-0.12	1.55	1.20	1.63	0.77
2		ccc	Measured	0.09	0.04	0.19	-0.12	1.23	1.09	1.54	0.75
2			Measured bc	0.09	0.04	0.19	-0.15	1.22	1.10	1.53	0.70
2			Target	0.11	0.05	0.17	-0.13	1.29	1.12	1.47	0.74
2	EM-20	quenched	Measured	0.23	0.14	0.21	-0.12	1.69	1.38	1.61	0.76
2			Measured bc	0.22	0.13	0.22	-0.15	1.68	1.35	1.66	0.71
2			Target	0.22	0.12	0.20	-0.13	1.64	1.31	1.59	0.74
2		ccc	Measured	0.14	0.10	0.15	-0.13	1.38	1.26	1.41	0.75
2			Measured bc	0.14	0.09	0.16	-0.16	1.37	1.24	1.45	0.69
2			Target	0.13	0.08	0.14	-0.14	1.34	1.20	1.39	0.72

Table 22 continued.

Set	Glass ID	Heat Treatment	Comp View	log NL [B (g/L)]	log NL [Li (g/L)]	log NL [Na (g/L)]	log NL [Si (g/L)]	NL B (g/L)	NL Li (g/L)	NL Na (g/L)	NL Si (g/L)
3	EM-21	quenched	Measured	0.21	0.13	0.14	-0.17	1.62	1.36	1.38	0.67
3			Measured bc	0.21	0.12	0.15	-0.21	1.61	1.33	1.42	0.62
3			Target	0.21	0.12	0.15	-0.18	1.62	1.32	1.41	0.66
3		ccc	Measured	-0.05	-0.05	-0.03	-0.25	0.89	0.88	0.93	0.56
3			Measured bc	-0.05	-0.06	-0.02	-0.29	0.88	0.87	0.96	0.52
3			Target	-0.05	-0.07	-0.02	-0.26	0.89	0.86	0.95	0.55
3	EM-22	quenched	Measured	0.44	0.36	0.36	-0.07	2.77	2.30	2.27	0.84
3			Measured bc	0.44	0.35	0.37	-0.11	2.75	2.25	2.33	0.78
3			Target	0.45	0.35	0.36	-0.08	2.79	2.24	2.30	0.83
3		ccc	Measured	0.03	0.06	0.08	-0.23	1.07	1.14	1.19	0.59
3			Measured bc	0.03	0.05	0.09	-0.27	1.07	1.12	1.23	0.54
3			Target	0.03	0.05	0.08	-0.24	1.08	1.11	1.21	0.58
3	EM-23	quenched	Measured	0.59	0.51	0.57	-0.01	3.93	3.25	3.70	0.97
3			Measured bc	0.59	0.50	0.57	-0.05	3.91	3.18	3.68	0.90
3			Target	0.60	0.51	0.56	0.00	3.96	3.20	3.62	1.00
3		ccc	Measured	0.09	0.11	0.15	-0.23	1.23	1.29	1.41	0.59
3			Measured bc	0.09	0.10	0.15	-0.27	1.22	1.26	1.40	0.54
3			Target	0.09	0.10	0.14	-0.22	1.24	1.27	1.38	0.61
3	EM-24	quenched	Measured	-0.03	-0.05	-0.02	-0.30	0.93	0.88	0.95	0.50
3			Measured bc	-0.04	-0.05	-0.01	-0.33	0.92	0.89	0.98	0.46
3			Target	-0.03	-0.05	-0.02	-0.30	0.94	0.89	0.95	0.51
3		ccc	Measured	0.11	0.05	0.02	-0.24	1.30	1.14	1.04	0.58
3			Measured bc	0.11	0.06	0.03	-0.27	1.29	1.14	1.07	0.54
3			Target	0.12	0.06	0.02	-0.23	1.31	1.14	1.04	0.59
3	EM-25	quenched	Measured	0.08	-0.03	0.13	-0.21	1.21	0.93	1.36	0.61
3			Measured bc	0.08	-0.04	0.15	-0.25	1.20	0.91	1.40	0.57
3			Target	0.08	-0.05	0.13	-0.22	1.20	0.90	1.33	0.60
3		ccc	Measured	1.09	0.99	0.82	0.40	12.42	9.82	6.65	2.49
3			Measured bc	1.09	0.98	0.84	0.36	12.35	9.62	6.84	2.30
3			Target	1.09	0.98	0.81	0.39	12.36	9.45	6.53	2.43
3	EM-26	quenched	Measured	-0.01	-0.04	0.00	-0.30	0.98	0.91	0.99	0.51
3			Measured bc	-0.01	-0.05	-0.01	-0.33	0.97	0.89	0.99	0.47
3			Target	-0.02	-0.06	-0.02	-0.30	0.96	0.88	0.96	0.50
3		ccc	Measured	1.33	1.19	1.13	0.44	21.45	15.58	13.56	2.75
3			Measured bc	1.33	1.18	1.13	0.40	21.33	15.26	13.50	2.54
3			Target	1.33	1.18	1.12	0.43	21.17	15.03	13.17	2.70
3	EM-27	quenched	Measured	0.10	0.00	0.19	-0.18	1.25	0.99	1.55	0.66
3			Measured bc	0.10	0.00	0.19	-0.21	1.25	1.00	1.54	0.61
3			Target	0.09	-0.01	0.17	-0.19	1.24	0.99	1.49	0.65
3		ccc	Measured	-0.05	-0.03	-0.14	-0.25	0.89	0.93	0.73	0.56
3			Measured bc	-0.05	-0.03	-0.14	-0.28	0.89	0.93	0.72	0.52
3			Target	-0.05	-0.04	-0.15	-0.26	0.88	0.92	0.70	0.56
3	EM-28	quenched	Measured	-0.01	-0.04	0.02	-0.31	0.97	0.92	1.05	0.49
3			Measured bc	-0.02	-0.04	0.03	-0.34	0.96	0.90	1.08	0.46
3			Target	-0.02	-0.05	0.02	-0.32	0.96	0.88	1.06	0.48
3		ccc	Measured	0.91	0.83	0.54	0.08	8.22	6.72	3.49	1.19
3			Measured bc	0.91	0.82	0.55	0.04	8.17	6.58	3.59	1.10
3			Target	0.91	0.81	0.55	0.07	8.12	6.44	3.52	1.17
3	EM-29	quenched	Measured	0.01	-0.01	0.05	-0.35	1.03	0.97	1.11	0.45
3			Measured bc	0.01	-0.02	0.04	-0.38	1.02	0.95	1.10	0.41
3			Target	0.02	-0.02	0.03	-0.35	1.05	0.95	1.08	0.45
3		ccc	Measured	0.57	0.51	0.29	-0.15	3.67	3.26	1.97	0.72
3			Measured bc	0.56	0.50	0.29	-0.18	3.65	3.19	1.96	0.66
3			Target	0.57	0.50	0.28	-0.14	3.74	3.19	1.92	0.72
3	EM-30	quenched	Measured	-0.01	0.01	0.06	-0.37	0.98	1.03	1.14	0.42
3			Measured bc	-0.01	0.02	0.07	-0.40	0.98	1.04	1.17	0.39
3			Target	-0.01	0.01	0.06	-0.37	0.98	1.03	1.14	0.43
3		ccc	Measured	0.27	0.27	0.07	-0.34	1.87	1.84	1.18	0.46
3			Measured bc	0.27	0.27	0.08	-0.37	1.86	1.85	1.22	0.42
3			Target	0.27	0.26	0.07	-0.34	1.86	1.83	1.19	0.46

5.2.4.5 Effects of Heat Treatment

Exhibit E5 in Appendix E provides a series of plots and statistical comparisons that show the effects of heat treatment on the common logarithm ppm-responses of interest of the triplicate PCTs for each element for each study glass. The quenched version of a given glass yielded measurements indicating a significantly (at the 5% significance level) different mean log(ppm) response than the ccc version of the glass for a given element if the **Prob>|t|** value in the exhibit is 0.05 or smaller. Table 23 summaries the comparisons between the quenched and ccc versions of the study glasses for the four primary elements of the PCTs.

Many of these glasses showed a statistically significant difference between the ccc versus the quenched versions for one or more of the PCT elements. In the cases where the ccc version of the glasses were determined to contain nepheline by XRD, the ccc versions of the glasses were statistically less durable than the quenched versions for all four elements (B, Li, Na and Si). Exhibit E6 in Appendix E provides plots of the normalized PCT responses between the two heat treatments. These plots provide a basis for judging the practical impact of differences in the PCT response due to the heat treatment of the glass.

The NL [B] values range from 0.65 g/L (EM-15) to 3.91 g/L (EM-23) for the quenched glasses and 0.59 g/L (EM-15) to 21.33 g/L (EM-26) for the ccc glasses. Three of the slow cooled (ccc) glasses (EM-10, -25 and -26) are unacceptable; however, this behavior is expected as all of these glasses contain nepheline. It is interesting to note that some of the ccc samples (EM-13, -14, -15, -29 and -30) completely crystallized with both magnetite and nepheline, but still had extremely low NL [B] values. These particular glasses have more CaO present than any of the other glasses in the matrix. It appears that while all of the glasses contain nepheline, the NL [B] values decrease as the CaO concentration increases from 2.3 wt% to 4.3 wt%.

5.2.4.6 Predicted versus Measured

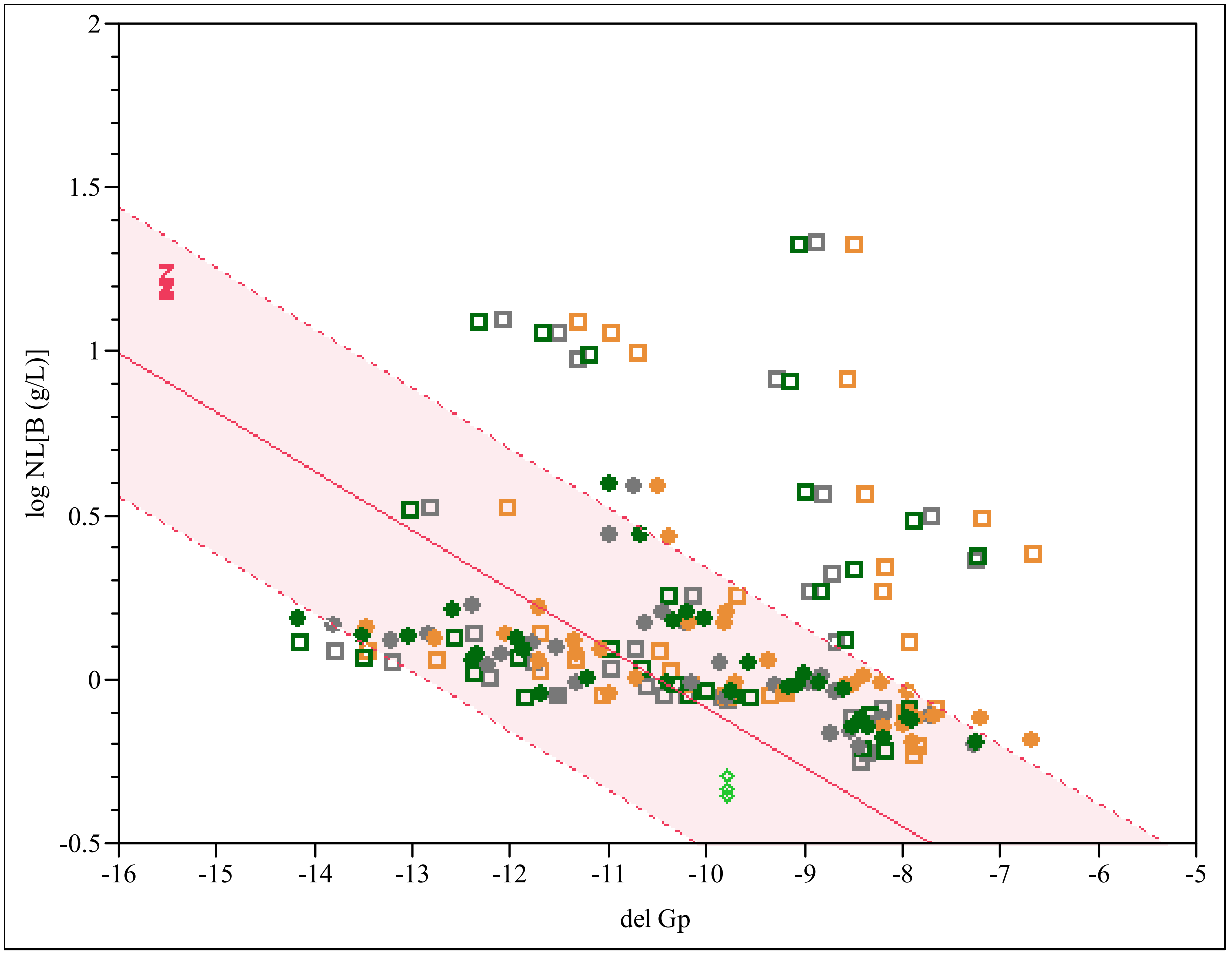
Exhibits E7 through E10 in Appendix E provide plots of the DWPF models for B, Li, Na, and Si that relate the logarithm of the normalized PCT (for each element of interest) to a linear function of a free energy of hydration term (ΔG_p, kcal/100g glass) derived for each of the compositional views and heat treatments.[27] Prediction limits (at a 95% confidence) for an individual PCT result are also plotted along with the linear fit. The EA and ARM results are also indicated on these plots.

Exhibit E7 is repeated below as Figure 50. Note that there are some points that fall above the confidence limits for the study glasses. A majority of these points correspond to glasses containing nepheline. These points have been removed in Figure 51. While some of the glasses that still remain outside of the bounds are unpredictable, they are still acceptable; none of the glasses have NL [B] values greater than 4 g/L.[22]

[22] Target EM-17, -23 and -24. Measured EM-17, -23 and -24. Measured bc EM-02, -17, -22, -23 and -24.

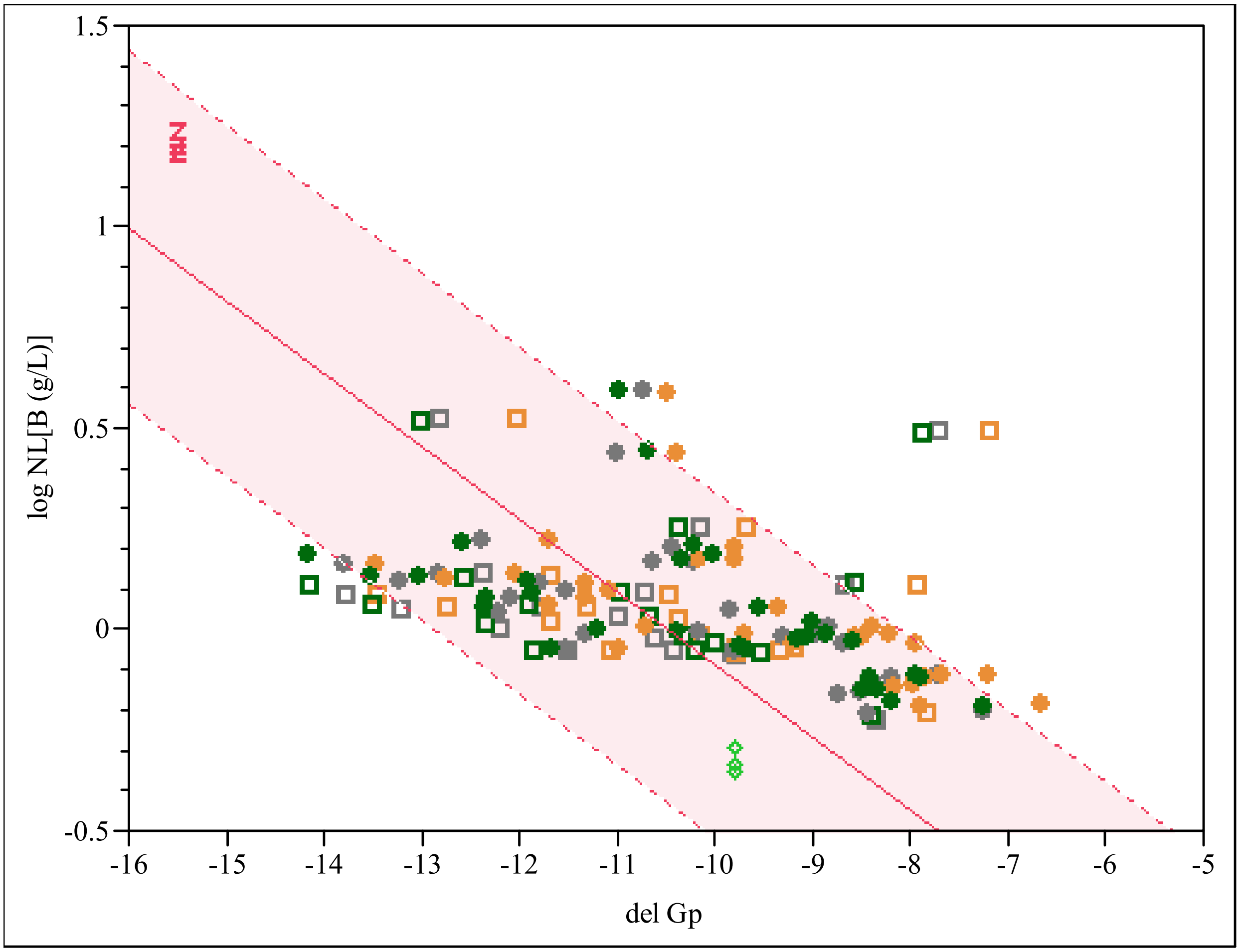
Table 23. Samples Exhibiting a Statistically Significant Difference Between the Quenched and ccc Versions of the Matrix 2A Glasses

Glass ID	B	Li	Na	Si	Nepheline for ccc Heat
EM-01		ccc			
EM-02	ccc	ccc	ccc	ccc	X
EM-03	Q	ccc	ccc	ccc	
EM-04	Q		Q		
EM-05	Q	ccc			
EM-06	Q	Q		Q	
EM-07	Q	Q	Q	Q	
EM-08	Q	Q	Q	Q	
EM-09		ccc		ccc	X
EM-10	ccc	ccc	ccc	ccc	X
EM-11	Q	Q			
EM-12	ccc	ccc	ccc	ccc	X
EM-13	ccc	ccc	ccc	ccc	X
EM-14		ccc		ccc	X
EM-15		ccc	Q		X
EM-16	ccc	ccc	ccc	ccc	
EM-17	ccc	ccc	ccc	ccc	
EM-18	ccc	ccc	ccc	ccc	
EM-19	Q		Q		
EM-20	Q	Q	Q		
EM-21	Q	Q	Q	Q	
EM-22	Q	Q	Q	Q	
EM-23	Q	Q	Q	Q	
EM-24	ccc	ccc	ccc	ccc	
EM-25	ccc	ccc	ccc	ccc	X
EM-26	ccc	ccc	ccc	ccc	X
EM-27	Q	Q	Q	Q	
EM-28	ccc	ccc	ccc	ccc	X
EM-29	ccc	ccc	ccc	ccc	X
EM-30	ccc	ccc		ccc	X



Symbol	Standard/ Comp View-Heat Treatment
z	EA
◊	ARM
□	Measured-ccc
□	Measured bc -ccc
□	Targeted-ccc
●	Measured-quenched
●	Measured bc - quenched
●	Targeted- quenched

Figure 50. log NL [B (g/L)] versus del Gp model with 95% confidence interval for individual PCTs.



Symbol	Standard/ Comp View-Heat Treatment
z	EA
◊	ARM
□	Measured-ccc
□	Measured bc -ccc
□	Targeted-ccc
●	Measured-quenched
●	Measured bc - quenched
●	Targeted- quenched

Figure 51. log NL [B (g/L)] versus del Gp model with 95% confidence interval for individual PCTs. Data points corresponding to glasses containing nepheline were removed.

5.2.5 Matrix 2A T_L Data

A comparison of the predicted and measured T_L values is shown in Table 24. There are only five samples because all of the other glasses contained crystals upon quenching (see Section 5.2.3). The measured T_L values for these glasses seem a bit high compared to the Matrix 2 glasses, which were based off of the same compositional projections. It is possible that these glasses contained a small volume percent of crystals, which was not detected by XRD. The presence of any pre-existing crystals in a liquidus sample will significantly affect the results. A sample from each glass should be viewed with optical microscopy to determine if any crystals are present. If crystals are observed, then the analyses need to be repeated.

Table 24. Matrix 2A T_L Data

Glass ID	T_L Predicted (°C)	T_L Measured	Measured - Predicted (°C)
EM-03	997	1157	160
EM-04	959	1096	137
EM-05	1012	1148	136
EM-18	1002	1148	146
EM-19	962	1147	185

6.0 COMPARISON OF DATA TO MODEL PREDICTIONS

In this section, data collected in the FY07 and FY09 tasks will be compared to the various models for T_L, viscosity and chemical durability. Note that all predicted data are with respect to the *measured* composition.

6.1 T_L

In general, the T_L model appears to be under-predicting for most of the glasses from FY07 and FY09 (Figure 52). Any glasses containing crystals other than spinel have been removed from the plot. A majority of these glasses are outside of the compositional region used to develop the current model; thus, it would not be expected to accurately predict the T_L values of higher waste loading glasses. It also appears that glasses with higher TiO_2 concentrations form crystals other than spinels, i.e. iron titanate. If future processing of these glasses is pursued, then the current T_L model will need to be modified to include crystals other than spinels. Some of the glasses from FY07 and FY09 should be re-measured and care should be taken to ensure that no crystals are present in the as-fabricated glass.

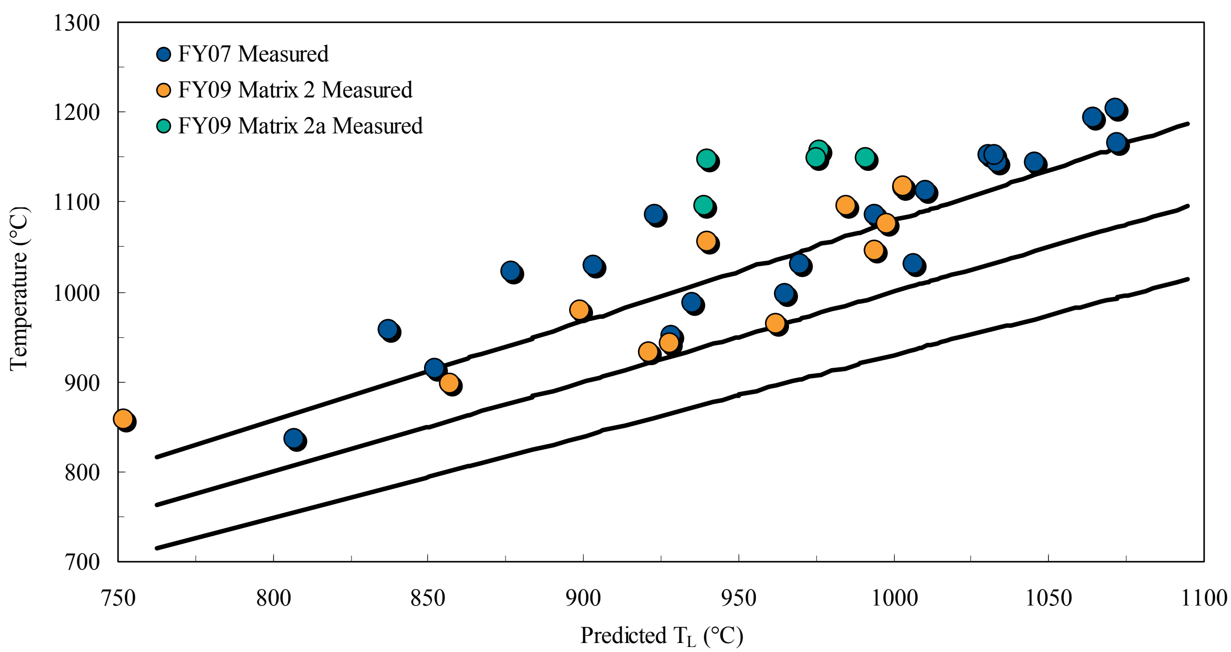


Figure 52. FY07 and FY09 T_L data.

6.2 VISCOSITY

The FY07 glasses are extremely predictable by the model.[23] There are a number of glasses from the FY09 matrix, which have much lower measured viscosities than the model development region. A calculation of the NBO ratio indicates that these glasses have much higher values of this ratio than historical glasses. These glasses also have high Fe_2O_3 concentrations compared to other glasses in the study, which accounts for the increased NBO concentration. Additional glasses would be required to determine the applicability of the viscosity model if processing were desired at lower values of viscosity.

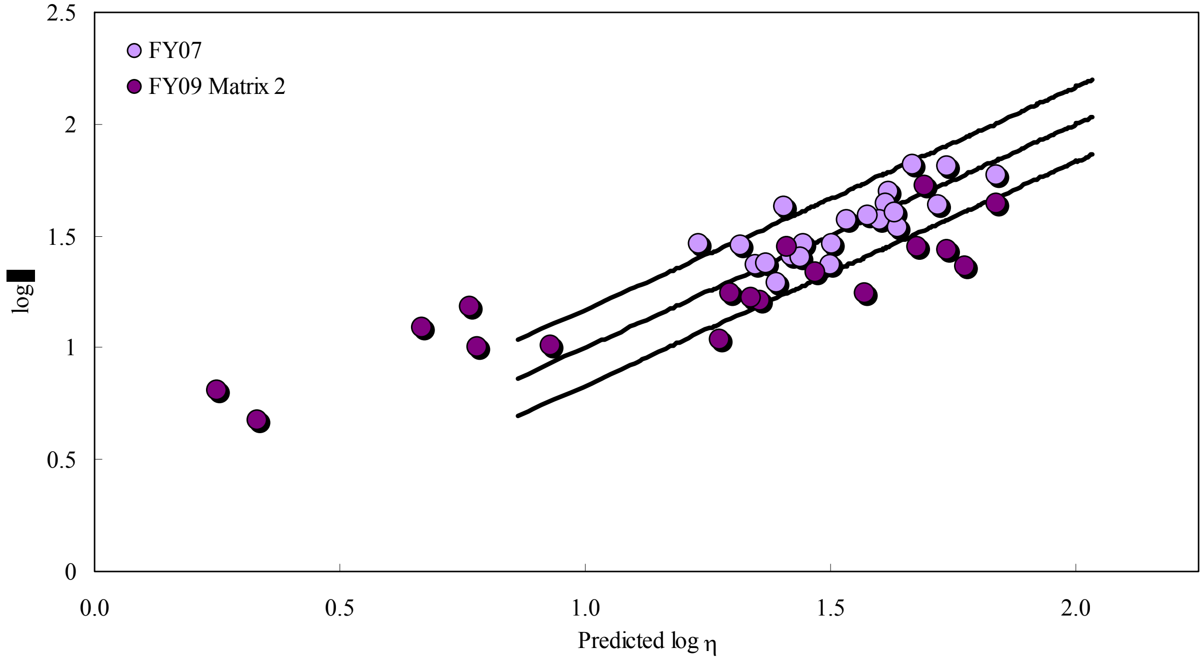


Figure 53. FY07 and FY09 viscosity data.

[23] Since the FY07 data was not presented in the FY07 report (SRNS-STI-2008-00055), the fitted data as well as the values at 1150°C are presented in Exhibits F1 through F26 in Appendix F.

6.3 CHEMICAL DURABILITY

Note that glasses containing nepheline have been removed from Figure 54 as the model applies only to homogeneous samples. In general, the FY07 glasses are well-predicted by the durability model. A small number of glasses extend beyond the prediction limits around ΔG_p values of -6 to -8, but the NL [B] values are so low that these glasses are of little concern. As stated in Section 5.1.4.5, some of the quenched glasses from the FY09 Matrix 2[24] with ΔG_p values between -14 and -12 exhibited anomalous behavior and thus have unexplained poor durabilities at this time. Further characterization of these glasses would be required to clarify these results. The questionable glasses from Matrix 2 (FY09EM21-02, -03, -07 and -21) were removed and the quenched and ccc durabilities were re-plotted in Figures Figure 55 and Figure 56. Since XRD of the ccc versions of these same glasses could not be completed, the presence of nepheline could not be verified. If nepheline is present, then the model would not be expected to predict the durabilities of these glasses and the points would be removed from this plot. A few other glasses are also under predicted by the model, but they are still acceptable with respect to the 10 g/L limit for boron release. There are a number of points that are outside of the prediction bounds at less negative ΔG_p values. These glasses are of low concern as the NL [B] values are so low. Almost all of the FY09 Matrix 2A glasses are predicted by the model, which is encouraging as all of these glasses are at 50% WL. Two of the glasses (shown in light and dark purple) are under predicted by the model, but they are still acceptable.

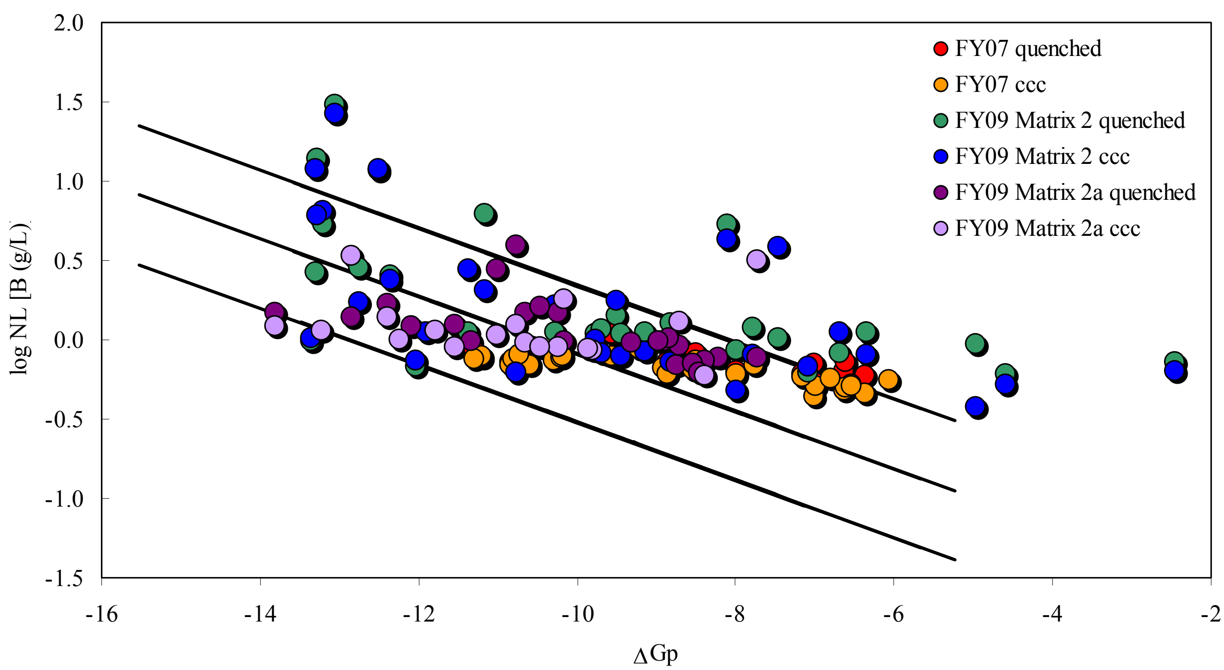


Figure 54. Comparison of durability data from the FY07 and FY09 tasks to the model predictions. Glasses containing nepheline have been removed from the plot.

[24] FY09EM21-02, -07 and -21.

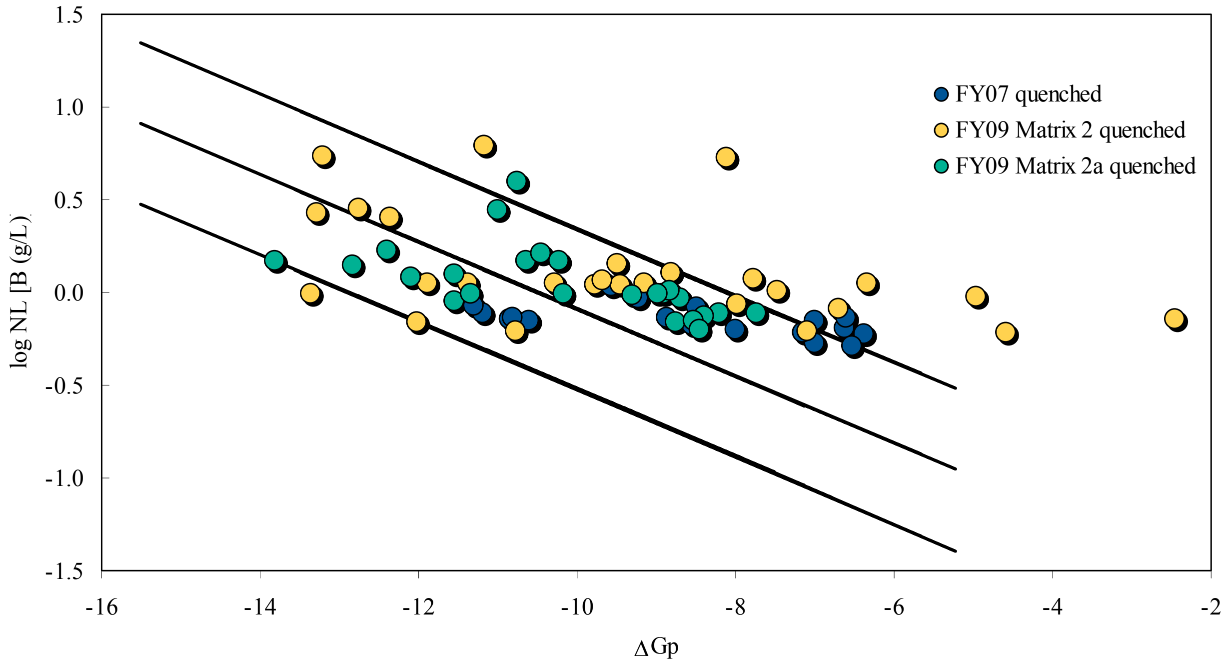


Figure 55. Comparison of quenched durability data from the FY07 and FY09 tasks to the durability model. Questionable glasses from Matrix 2 have been removed from the plot (FY09EM21-02, -03, -07 and -21).

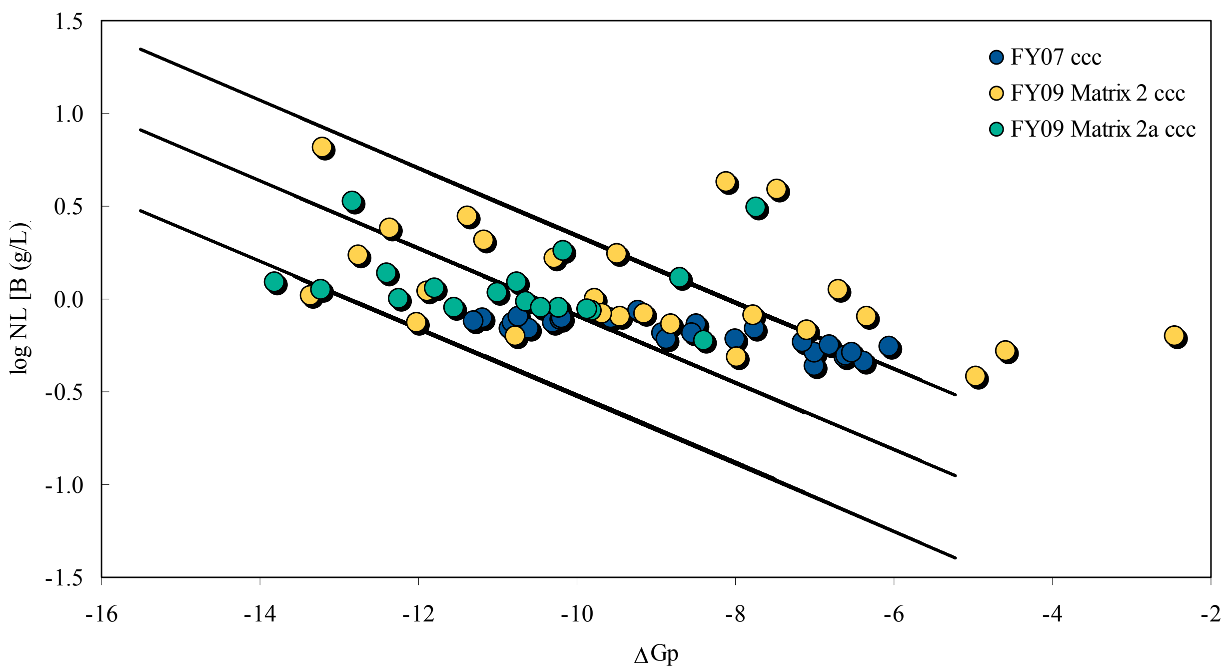


Figure 56. Figure 57. Comparison of ccc durability data from the FY07 and FY09 tasks to the durability model. Questionable glasses from Matrix 2 have been removed from the plot (FY09EM21-02, -03, -07 and -21).

7.0 SUMMARY

Sixty glass compositions were fabricated and characterized in order to generate supplemental property data (viscosity, T_L and durability) to be used to determine the applicability of the current DWPF process control models for higher waste loading glasses. Two series of glasses were developed using the HLW Revision 13 sludge projections.

The results of this study are summarized below:

- In general, the current durability model predicts the durabilities of higher waste loading glasses quite well. A few of the glasses exhibited poorer durability than predicted.
- Some of the glasses exhibited anomalous behavior with respect to durability (normalized leachate for boron (NL [B])). The quenched samples of FY09EM21-02, -07 and -21 contained no nepheline or other wasteform affecting crystals, but have unacceptable NL [B] values (> 10 g/L). The ccc sample of FY09EM21-07 has a NL [B] value that is more than one half the value of the quenched sample. These glasses also have lower concentrations of Al_2O_3 and SiO_2.
- Five of the ccc samples (EM-13, -14, -15, -29 and -30) completely crystallized with both magnetite and nepheline, and still had extremely low NL [B] values. These particular glasses have more CaO present than any of the other glasses in the matrix. It appears that while all of the glasses contain nepheline, the NL [B] values decrease as the CaO concentration increases from 2.3 wt% to 4.3 wt%. A different form of nepheline may be created at higher concentrations of CaO that does not significantly reduce glass durability.
- The T_L model appears to be under-predicting the measured values of higher waste loading glasses. Trends in T_L with composition are not evident in the data from these studies.
- A small number of glasses in the FY09 matrix have measured viscosities that are much lower than the viscosity range over which the current model was developed. The decrease in viscosity is due to a higher concentration of non-bridging oxygens (NBO). A high iron concentration is the cause of the increase in NBO.

Durability, viscosity and T_L data collected during FY07 and FY09 was compiled and assessed. It appears that additional data would be required to refit the T_L and viscosity models. In general, the compositional regions of the higher waste loading glasses are very different than those used to develop these models. On the other hand, the current durability model seems to be very applicable to the new data. At this time, there is no evidence to modify this model.

8.0 RECOMMENDATIONS/PATH FORWARD

In order to determine the cause of some of the durability anomalies and T_L issues observed in the glasses of these matrices, some additional experimental work is recommended.

- Further characterization of FY09EM21-02, -07 and -21 is recommended using scanning electron microscopy and various spectroscopy techniques (infrared, Raman and Mossbauer).

- Study the influence of increased CaO concentration on PCT response and the formation of nepheline. Determine if a different form of nepheline is being created at higher concentrations of CaO that does not significantly decrease the durability of the glass. It has been previously shown that not all nepheline is detrimental to glass durability.
- Before any T_L measurements, several fragments of each as-fabricated sample should be examined by optical microscopy to determine if crystals are present. XRD does not appear to be sensitive enough for some samples.
- Fabricate glasses to generate additional T_L data including those glasses with increased TiO_2 concentrations. Determine the crystalline phase(s) formed at the liquidus temperature and if the current model needs to be revised to include crystalline phases other than spinel.

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Appendix A:

Tables and Exhibits Supporting the Analysis of the Chemical Composition Measurements of the Matrix 2 Study Glasses

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Table A1. Targeted Oxide Concentrations (wt%) for the Non-Rad Matrix 2 Study Glasses (part 1)

Glass ID	Al2O3 wt%	B2O3 wt%	BaO wt%	CaO wt%	CdO wt%	Ce2O3 wt%	Cr2O3 wt%	CuO wt%	Fe2O3 wt%	K2O wt%	La2O3 wt%	Li2O wt%	MgO wt%
FY09EM21-01	9.969	4.500	0.000	0.000	0	0.000	0.200	0.000	18.355	0.000	0.000	4.000	0.000
FY09EM21-02	4.007	5.066	0.080	0.000	0.296474	0.361	0.000	0.128	20.631	0.000	0.098	4.000	1.500
FY09EM21-03	6.970	4.500	0.000	0.000	0	0.000	0.000	0.000	12.519	0.000	0.000	7.000	1.500
FY09EM21-04	7.027	14.000	0.000	4.000	0	0.000	0.000	0.000	16.487	0.000	0.000	7.000	1.500
FY09EM21-05	3.604	4.500	0.000	4.000	0	0.000	0.000	0.000	13.771	0.000	0.000	4.001	0.000
FY09EM21-06	4.390	11.492	0.080	0.000	0.296474	0.361	0.200	0.128	5.297	0.000	0.098	4.000	0.000
FY09EM21-07	4.866	13.924	0.000	3.922	0	0.000	0.000	0.000	17.984	0.000	0.000	4.000	1.500
FY09EM21-08	3.250	4.974	0.000	0.505	0	0.000	0.200	0.000	20.479	0.000	0.000	7.000	1.500
FY09EM21-09	12.973	9.484	0.000	3.027	0	0.000	0.200	0.000	10.960	0.000	0.000	7.000	0.000
FY09EM21-10	6.395	4.720	0.080	4.000	0.296474	0.361	0.000	0.128	17.731	0.000	0.098	4.000	0.000
FY09EM21-11	3.250	4.578	0.080	4.000	0.296474	0.361	0.000	0.128	6.040	0.000	0.098	5.627	1.500
FY09EM21-12	4.554	5.291	0.000	0.000	0	0.000	0.000	0.000	16.865	0.000	0.000	6.794	0.000
FY09EM21-13	10.378	5.883	0.080	4.000	0.296474	0.361	0.200	0.128	14.078	0.000	0.098	7.000	0.000
FY09EM21-14	3.250	13.647	0.080	0.000	0.296474	0.361	0.200	0.128	20.544	0.000	0.098	4.000	0.000
FY09EM21-15	5.323	4.500	0.080	3.190	0.296474	0.361	0.200	0.128	8.290	0.000	0.098	6.002	1.500
FY09EM21-16	3.677	6.427	0.080	3.821	0.296474	0.361	0.200	0.128	9.046	0.000	0.098	4.000	1.500
FY09EM21-17	7.193	4.500	0.080	0.104	0.296474	0.361	0.000	0.128	13.913	0.000	0.098	6.740	0.000
FY09EM21-18	10.916	4.844	0.080	0.439	0.296474	0.361	0.000	0.128	6.791	0.000	0.098	5.493	0.000
FY09EM21-19	5.719	4.501	0.000	4.000	0	0.000	0.000	0.000	5.000	0.000	0.000	4.002	0.000
FY09EM21-20	6.024	5.311	0.000	0.000	0	0.000	0.200	0.000	11.830	0.000	0.000	4.000	1.269
FY09EM21-21	4.857	9.010	0.080	0.000	0.296474	0.361	0.200	0.128	19.951	0.000	0.098	7.000	0.000
FY09EM21-22	14.041	13.199	0.080	0.000	0.296474	0.361	0.000	0.128	9.177	0.000	0.098	4.000	0.000
FY09EM21-23	13.959	5.781	0.080	0.000	0.296474	0.361	0.000	0.128	12.109	0.000	0.098	4.000	1.500
FY09EM21-24	10.506	4.500	0.080	4.000	0.296474	0.361	0.200	0.128	20.560	0.000	0.098	4.000	1.500
FY09EM21-25	6.243	4.730	0.000	4.000	0	0.000	0.200	0.000	7.830	0.000	0.000	4.000	0.000
FY09EM21-26	13.656	7.576	0.000	0.000	0	0.000	0.200	0.000	5.000	0.000	0.000	4.001	1.500
FY09EM21-27	7.192	6.978	0.043	1.808	0.15964	0.194	0.100	0.069	13.125	0.000	0.053	5.102	0.683

Table A1. Targeted Oxide Concentrations (wt%) for the Non-Rad Matrix 2 Study Glasses (part 2)

Glass ID	MnO wt%	Na2O wt%	NiO wt%	P2O5 wt%	PbO wt%	SO4 wt%	SiO2 wt%	ThO2 (wt%)	TiO2 wt%	U3O8 wt%	ZnO wt%	ZrO2 (wt%)
FY09EM21-01	5.500	11.390	2.500	0.000	0.000	0	37.988	0.000	5.599	0.000	0.000	0.000
FY09EM21-02	0.300	17.977	2.500	0.000	0.216	0.48077	40.019	0.000	2.000	0.000	0.135	0.205
FY09EM21-03	5.500	14.131	2.500	0.000	0.000	0	40.650	0.000	4.730	0.000	0.000	0.000
FY09EM21-04	0.300	10.737	2.500	0.000	0.000	0	32.449	0.000	4.000	0.000	0.000	0.000
FY09EM21-05	0.300	10.000	2.500	0.000	0.000	0	51.497	0.000	5.827	0.000	0.000	0.000
FY09EM21-06	5.500	14.784	2.500	0.000	0.216	0.48077	43.836	0.000	6.000	0.000	0.135	0.205
FY09EM21-07	5.500	12.706	0.000	0.000	0.000	0	33.598	0.000	2.000	0.000	0.000	0.000
FY09EM21-08	1.386	10.000	0.000	0.000	0.000	0	44.706	0.000	6.000	0.000	0.000	0.000
FY09EM21-09	2.013	10.001	0.685	0.000	0.000	0	41.188	0.000	2.469	0.000	0.000	0.000
FY09EM21-10	5.464	10.389	2.500	0.000	0.216	0.48077	40.404	0.000	2.397	0.000	0.135	0.205
FY09EM21-11	5.500	12.208	0.000	0.000	0.216	0.48077	49.297	0.000	6.000	0.000	0.135	0.205
FY09EM21-12	4.674	10.000	1.907	0.000	0.000	0	47.916	0.000	2.000	0.000	0.000	0.000
FY09EM21-13	0.300	10.516	2.500	0.000	0.216	0.48077	37.145	0.000	6.000	0.000	0.135	0.205
FY09EM21-14	0.300	10.000	0.000	0.000	0.216	0.48077	40.354	0.000	5.706	0.000	0.135	0.205
FY09EM21-15	5.359	10.000	2.500	0.000	0.216	0.48077	49.135	0.000	2.000	0.000	0.135	0.205
FY09EM21-16	0.300	15.820	2.500	0.000	0.216	0.48077	48.708	0.000	2.000	0.000	0.135	0.205
FY09EM21-17	5.500	14.855	0.000	0.000	0.216	0.48077	39.196	0.000	6.000	0.000	0.135	0.205
FY09EM21-18	0.835	17.019	0.000	0.000	0.216	0.48077	49.663	0.000	2.000	0.000	0.135	0.205
FY09EM21-19	0.300	18.000	0.981	0.000	0.000	0	51.497	0.000	6.000	0.000	0.000	0.000
FY09EM21-20	0.300	18.000	2.500	0.000	0.000	0	48.565	0.000	2.000	0.000	0.000	0.000
FY09EM21-21	0.997	14.667	0.000	0.000	0.216	0.48077	39.306	0.000	2.013	0.000	0.135	0.205
FY09EM21-22	0.300	10.000	2.500	0.000	0.216	0.48077	42.740	0.000	2.042	0.000	0.135	0.205
FY09EM21-23	0.300	10.000	0.000	0.000	0.216	0.48077	44.352	0.000	6.000	0.000	0.135	0.205
FY09EM21-24	0.917	10.001	0.000	0.000	0.216	0.48077	37.880	0.000	3.936	0.000	0.135	0.205
FY09EM21-25	5.500	15.464	0.000	0.000	0.000	0	50.034	0.000	2.000	0.000	0.000	0.000
FY09EM21-26	5.051	11.956	0.000	0.000	0.000	0	45.703	0.000	5.357	0.000	0.000	0.000
FY09EM21-27	2.623	12.716	1.291	0.000	0.116	0.258876	43.378	0.000	3.926	0.000	0.072	0.110

Table A2. Measured Elemental Concentrations (wt%) for the Non-Rad Matrix 2 Glasses Prepared Using Lithium Metaborate (part 1)

Set	Glass ID	Block	Sub-Block	Sequence	Lab ID	Al (wt%)	Ba (wt%)	Ca (wt%)	Cd (wt%)	Ce (wt%)	Cr (wt%)	Cu (wt%)	Fe (wt%)	La (wt%)	Mg (wt%)
1	Batch 1	1	1	1	BCHLM1111	2.45	0.125	0.818	<0.010	<0.010	0.080	0.304	8.62	<0.010	0.796
1	FY09EM21-05	1	1	2	F12LM21	1.98	<0.010	2.94	<0.010	<0.010	0.015	<0.010	9.39	<0.010	<0.010
1	FY09EM21-12	1	1	3	F05LM21	2.45	<0.010	<0.010	<0.010	0.011	0.015	<0.010	10.7	<0.010	<0.010
1	FY09EM21-12	1	1	4	F05LM11	2.44	<0.010	<0.010	<0.010	0.011	0.014	<0.010	10.9	<0.010	<0.010
1	FY09EM21-01	1	1	5	F02LM11	5.41	<0.010	<0.010	<0.010	<0.010	0.135	<0.010	12.5	<0.010	<0.010
1	FY09EM21-14	1	1	6	F09LM11	1.70	0.071	0.024	0.223	0.292	0.101	0.102	13.8	0.073	0.000
1	FY09EM21-13	1	1	7	F13LM11	5.40	0.067	2.83	0.226	0.286	0.119	0.097	9.28	0.073	<0.010
1	FY09EM21-02	1	1	8	F03LM11	2.17	0.075	<0.010	0.221	0.309	0.013	0.103	14.1	0.077	0.873
1	Batch 1	1	1	9	BCHLM1112	2.42	0.127	0.829	<0.010	<0.010	0.081	0.305	8.70	<0.010	0.807
1	FY09EM21-05	1	1	10	F12LM11	1.90	<0.010	2.88	<0.010	<0.010	0.015	<0.010	9.25	<0.010	<0.010
1	FY09EM21-01	1	1	11	F02LM21	5.25	<0.010	<0.010	<0.010	<0.010	0.136	<0.010	12.4	<0.010	<0.010
1	FY09EM21-13	1	1	12	F13LM21	5.43	0.069	2.85	0.229	0.293	0.124	0.098	9.41	0.074	<0.010
1	FY09EM21-02	1	1	13	F03LM21	2.17	0.077	<0.010	0.224	0.311	0.013	0.103	14.1	0.078	0.892
1	FY09EM21-08	1	1	14	F01LM21	1.72	<0.010	0.373	<0.010	0.012	0.109	<0.010	14.1	<0.010	0.832
1	FY09EM21-14	1	1	15	F09LM21	1.69	0.071	0.022	0.222	0.299	0.100	0.104	13.6	0.075	<0.010
1	FY09EM21-08	1	1	16	F01LM11	1.70	<0.010	0.372	<0.010	0.011	0.109	<0.010	13.9	<0.010	0.832
1	Batch 1	1	1	17	BCHLM1113	2.41	0.126	0.848	<0.010	<0.010	0.080	0.306	8.60	<0.010	0.792
1	Batch 1	1	2	1	BCHLM1121	2.50	0.123	0.836	<0.010	<0.010	0.076	0.306	8.75	<0.010	0.784
1	FY09EM21-13	1	2	2	F13LM12	5.54	0.065	2.95	0.216	0.283	0.114	0.098	9.19	0.072	<0.010
1	FY09EM21-01	1	2	3	F02LM12	5.57	<0.010	<0.010	<0.010	<0.010	0.132	<0.010	12.5	<0.010	<0.010
1	FY09EM21-05	1	2	4	F12LM22	1.98	<0.010	2.96	<0.010	<0.010	0.011	<0.010	9.43	<0.010	<0.010
1	FY09EM21-12	1	2	5	F05LM12	2.41	<0.010	<0.010	<0.010	<0.010	0.010	<0.010	10.9	<0.010	<0.010
1	FY09EM21-14	1	2	6	F09LM12	1.68	0.069	0.029	0.215	0.290	0.096	0.103	13.8	0.073	<0.010
1	FY09EM21-08	1	2	7	F01LM12	1.71	<0.010	0.366	<0.010	<0.010	0.105	<0.010	14.1	<0.010	0.841
1	FY09EM21-13	1	2	8	F13LM22	5.46	0.066	2.88	0.221	0.288	0.119	0.099	9.51	0.073	<0.010
1	Batch 1	1	2	9	BCHLM1122	2.47	0.127	0.822	<0.010	<0.010	0.078	0.301	8.91	<0.010	0.814
1	FY09EM21-08	1	2	10	F01LM22	1.76	<0.010	0.361	<0.010	0.010	0.104	<0.010	14.3	<0.010	0.830
1	FY09EM21-01	1	2	11	F02LM22	5.46	<0.010	<0.010	<0.010	<0.010	0.131	<0.010	12.5	<0.010	<0.010
1	FY09EM21-14	1	2	12	F09LM22	1.74	0.069	0.025	0.215	0.289	0.095	0.103	13.7	0.073	<0.010
1	FY09EM21-05	1	2	13	F12LM12	1.95	<0.010	2.97	<0.010	<0.010	0.011	<0.010	9.27	<0.010	<0.010
1	FY09EM21-02	1	2	14	F03LM22	2.22	0.073	<0.010	0.215	0.305	<0.010	0.103	14.2	0.076	0.875
1	FY09EM21-12	1	2	15	F05LM22	2.37	<0.010	<0.010	<0.010	<0.010	0.010	<0.010	10.5	<0.010	<0.010
1	FY09EM21-02	1	2	16	F03LM12	2.15	0.072	<0.010	0.214	0.306	<0.010	0.103	14.2	0.076	0.879
1	Batch 1	1	2	17	BCHLM1123	2.43	0.125	0.838	<0.010	<0.010	0.076	0.304	8.68	<0.010	0.806
1	Batch 1	2	1	1	BCHLM1211	2.45	0.121	0.843	<0.010	<0.010	0.076	0.302	8.85	<0.010	0.786
1	FY09EM21-04	2	1	2	F14LM21	3.71	<0.010	2.85	<0.010	<0.010	<0.010	<0.010	11.0	<0.010	0.817
1	FY09EM21-09	2	1	3	F10LM21	6.92	<0.010	2.15	<0.010	<0.010	0.092	<0.010	7.38	<0.010	<0.010
1	FY09EM21-10	2	1	4	F11LM11	3.41	0.065	2.95	0.215	0.290	0.010	0.098	11.5	0.070	<0.010
1	FY09EM21-10	2	1	5	F11LM21	3.44	0.064	2.93	0.212	0.285	0.011	0.097	11.4	0.069	<0.010
1	FY09EM21-09	2	1	6	F10LM11	7.03	<0.010	2.21	<0.010	<0.010	0.094	<0.010	7.23	<0.010	<0.010
1	FY09EM21-06	2	1	7	F08LM21	2.38	0.066	0.013	0.214	0.291	0.130	0.099	3.59	0.078	<0.010
1	FY09EM21-07	2	1	8	F04LM11	2.55	<0.010	2.82	<0.010	<0.010	<0.010	<0.010	11.4	<0.010	0.802
1	Batch 1	2	1	9	BCHLM1212	2.52	0.122	0.833	<0.010	<0.010	0.076	0.301	8.71	<0.010	0.783
1	FY09EM21-11	2	1	10	F06LM21	1.73	0.065	2.92	0.217	0.285	0.012	0.099	4.21	0.070	0.809
1	FY09EM21-07	2	1	11	F04LM21	2.61	<0.010	2.93	<0.010	<0.010	<0.010	<0.010	11.8	<0.010	0.839
1	FY09EM21-03	2	1	12	F07LM11	3.75	<0.010	0.018	<0.010	<0.010	0.011	<0.010	8.99	<0.010	0.842
1	FY09EM21-04	2	1	13	F14LM11	3.89	<0.010	3.03	<0.010	<0.010	<0.010	<0.010	10.6	<0.010	0.820
1	FY09EM21-06	2	1	14	F08LM11	2.44	0.064	0.032	0.205	0.284	0.127	0.100	3.56	0.076	<0.010

Table A2. Measured Elemental Concentrations (wt%) for the Non-Rad Matrix 2 Glasses Prepared Using Lithium Metaborate (part 1)

Set	Glass ID	Block	Sub-Block	Sequence	Lab ID	Al (wt%)	Ba (wt%)	Ca (wt%)	Cd (wt%)	Ce (wt%)	Cr (wt%)	Cu (wt%)	Fe (wt%)	La (wt%)	Mg (wt%)
1	FY09EM21-03	2	1	15	F07LM21	3.76	<0.010	0.012	<0.010	<0.010	0.011	<0.010	9.11	<0.010	0.845
1	FY09EM21-11	2	1	16	F06LM11	1.76	0.064	2.98	0.216	0.283	0.012	0.097	4.11	0.070	0.798
1	Batch 1	2	1	17	BCHLM1213	2.60	0.125	0.819	<0.010	<0.010	0.077	0.300	8.61	<0.010	0.789
1	Batch 1	2	2	1	BCHLM1221	2.50	0.125	0.839	<0.010	<0.010	0.079	0.306	8.82	<0.010	0.807
1	FY09EM21-03	2	2	2	F07LM22	3.63	<0.010	0.011	<0.010	<0.010	0.010	<0.010	9.39	<0.010	0.866
1	FY09EM21-07	2	2	3	F04LM22	2.52	<0.010	2.80	<0.010	<0.010	<0.010	<0.010	12.2	<0.010	0.838
1	FY09EM21-09	2	2	4	F10LM12	6.84	<0.010	2.17	<0.010	<0.010	0.095	<0.010	7.41	<0.010	<0.010
1	FY09EM21-11	2	2	5	F06LM22	1.67	0.064	2.80	0.221	0.286	0.012	0.099	4.22	0.072	0.817
1	FY09EM21-04	2	2	6	F14LM12	3.58	<0.010	2.77	<0.010	<0.010	<0.010	<0.010	11.0	<0.010	0.850
1	FY09EM21-09	2	2	7	F10LM22	6.66	<0.010	2.08	<0.010	<0.010	0.094	<0.010	7.43	<0.010	<0.010
1	FY09EM21-06	2	2	8	F08LM22	2.27	0.067	0.012	0.221	0.296	0.133	0.100	3.66	0.081	<0.010
1	Batch 1	2	2	9	BCHLM1222	2.43	0.123	0.836	<0.010	<0.010	0.078	0.304	8.97	<0.010	0.793
1	FY09EM21-10	2	2	10	F11LM22	3.35	0.063	2.84	0.211	0.286	0.010	0.098	11.9	0.070	<0.010
1	FY09EM21-03	2	2	11	F07LM12	3.54	<0.010	0.017	<0.010	<0.010	0.010	<0.010	9.49	<0.010	0.861
1	FY09EM21-06	2	2	12	F08LM12	2.31	0.066	0.030	0.218	0.297	0.132	0.101	3.71	0.079	<0.010
1	FY09EM21-11	2	2	13	F06LM12	1.68	0.065	2.82	0.223	0.285	0.013	0.098	4.21	0.072	0.823
1	FY09EM21-04	2	2	14	F14LM22	3.66	<0.010	2.86	<0.010	<0.010	<0.010	<0.010	11.1	<0.010	0.851
1	FY09EM21-10	2	2	15	F11LM12	3.32	0.064	2.89	0.216	0.269	0.010	0.098	11.7	0.071	<0.010
1	FY09EM21-07	2	2	16	F04LM12	2.51	<0.010	2.80	<0.010	<0.010	<0.010	<0.010	11.7	<0.010	0.829
1	Batch 1	2	2	17	BCHLM1223	2.47	0.125	0.825	<0.010	<0.010	0.078	0.303	8.89	<0.010	0.806
2	Batch 1	1	1	1	BCHLM2111	2.50	0.125	0.850	<0.010	<0.010	0.078	0.303	8.72	<0.010	0.803
2	FY09EM21-16	1	1	2	G01LM11	1.96	0.066	2.73	0.188	0.297	0.102	0.102	6.05	0.073	0.819
2	FY09EM21-23	1	1	3	G06LM11	7.33	0.069	<0.010	0.229	0.304	0.011	0.102	7.94	0.075	0.844
2	FY09EM21-26	1	1	4	G11LM11	7.19	<0.010	0.006	<0.010	<0.010	0.094	<0.010	3.36	<0.010	0.878
2	FY09EM21-22	1	1	5	G12LM21	7.51	0.070	<0.010	0.236	0.302	0.013	0.104	6.04	0.075	<0.010
2	FY09EM21-21	1	1	6	G09LM21	2.54	0.076	<0.010	0.260	0.316	0.137	0.104	13.1	0.077	<0.010
2	FY09EM21-16	1	1	7	G01LM21	1.97	0.072	2.74	0.210	0.311	0.110	0.104	6.01	0.077	0.884
2	FY09EM21-21	1	1	8	G09LM11	2.58	0.072	<0.010	0.243	0.307	0.129	0.106	13.1	0.075	<0.010
2	Batch 1	1	1	9	BCHLM2112	2.53	0.126	0.871	<0.010	<0.010	0.079	0.305	8.63	<0.010	0.812
2	FY09EM21-25	1	1	10	G04LM21	3.36	<0.010	2.90	<0.010	<0.010	0.116	0.013	5.27	<0.010	<0.010
2	FY09EM21-23	1	1	11	G06LM21	7.35	0.069	<0.010	0.235	0.298	0.012	0.098	7.89	0.075	0.862
2	FY09EM21-17	1	1	12	G05LM21	4.04	0.096	0.078	0.242	0.335	0.011	0.109	9.72	0.095	<0.010
2	FY09EM21-22	1	1	13	G12LM11	7.56	0.069	<0.010	0.236	0.304	0.013	0.102	5.96	0.075	<0.010
2	FY09EM21-17	1	1	14	G05LM11	4.03	0.066	0.089	0.243	0.315	0.011	0.118	9.58	0.078	<0.010
2	FY09EM21-25	1	1	15	G04LM11	3.38	<0.010	2.95	<0.010	<0.010	0.112	0.011	5.22	<0.010	<0.010
2	FY09EM21-26	1	1	16	G11LM21	7.31	<0.010	<0.010	<0.010	<0.010	0.094	<0.010	3.30	<0.010	0.877
2	Batch 1	1	1	17	BCHLM2113	2.56	0.128	0.872	<0.010	<0.010	0.080	0.304	8.62	<0.010	0.814
2	Batch 1	1	2	1	BCHLM2121	2.50	0.124	0.803	<0.010	<0.010	0.076	0.290	8.74	<0.010	0.812
2	FY09EM21-26	1	2	2	G11LM22	7.29	<0.010	<0.010	<0.010	<0.010	0.091	<0.010	3.41	<0.010	0.888
2	FY09EM21-21	1	2	3	G09LM22	2.58	0.071	<0.010	0.250	0.308	0.130	0.098	13.4	0.073	<0.010
2	FY09EM21-23	1	2	4	G06LM22	7.45	0.066	<0.010	0.227	0.284	<0.010	0.093	7.94	0.070	0.851
2	FY09EM21-16	1	2	5	G01LM22	2.00	0.068	2.77	0.202	0.296	0.104	0.099	6.19	0.073	0.858
2	FY09EM21-16	1	2	6	G01LM12	1.98	0.065	2.75	0.194	0.284	0.101	0.097	6.20	0.071	0.838
2	FY09EM21-23	1	2	7	G06LM12	7.47	0.069	<0.010	0.242	0.306	<0.010	0.097	8.01	0.073	0.898
2	FY09EM21-22	1	2	8	G12LM12	7.52	0.066	<0.010	0.231	0.294	<0.010	0.097	6.14	0.071	<0.010
2	Batch 1	1	2	9	BCHLM2122	2.53	0.122	0.826	<0.010	<0.010	0.075	0.296	8.68	<0.010	0.798
2	FY09EM21-17	1	2	10	G05LM22	4.09	0.090	0.075	0.230	0.324	<0.010	0.103	9.58	0.089	<0.010
2	FY09EM21-22	1	2	11	G12LM22	7.60	0.065	<0.010	0.228	0.289	<0.010	0.097	5.98	0.069	<0.010

Table A2. Measured Elemental Concentrations (wt%) for the Non-Rad Matrix 2 Glasses Prepared Using Lithium Metaborate (part 1)

Set	Glass ID	Block	Sub-Block	Sequence	Lab ID	Al (wt%)	Ba (wt%)	Ca (wt%)	Cd (wt%)	Ce (wt%)	Cr (wt%)	Cu (wt%)	Fe (wt%)	La (wt%)	Mg (wt%)
2	FY09EM21-25	1	2	12	G04LM12	3.42	<0.010	3.00	<0.010	<0.010	0.109	<0.010	5.33	<0.010	<0.010
2	FY09EM21-17	1	2	13	G05LM12	4.07	0.063	0.084	0.243	0.302	<0.010	0.111	9.77	0.074	<0.010
2	FY09EM21-26	1	2	14	G11LM12	7.28	<0.010	<0.010	<0.010	<0.010	0.091	<0.010	3.33	<0.010	0.877
2	FY09EM21-25	1	2	15	G04LM22	3.41	<0.010	2.97	<0.010	<0.010	0.113	0.011	5.24	<0.010	<0.010
2	FY09EM21-21	1	2	16	G09LM12	2.59	0.068	<0.010	0.241	0.292	0.125	0.099	13.1	0.070	<0.010
2	Batch 1	1	2	17	BCHLM2123	2.55	0.122	0.830	<0.010	<0.010	0.075	0.293	8.68	<0.010	0.803
2	Batch 1	2	1	1	BCHLM2211	2.49	0.127	0.827	<0.010	<0.010	0.079	0.298	8.74	<0.010	0.812
2	FY09EM21-19	2	1	2	G07LM21	3.11	<0.010	2.95	<0.010	<0.010	0.013	<0.010	3.47	<0.010	<0.010
2	FY09EM21-15	2	1	3	G03LM11	2.87	0.079	2.30	0.190	0.302	0.098	0.098	5.49	0.078	0.810
2	FY09EM21-27	2	1	4	G13LM11	3.83	0.035	1.30	0.119	0.159	0.063	0.053	8.83	0.040	0.406
2	FY09EM21-20	2	1	5	G02LM21	3.24	<0.010	<0.010	<0.010	<0.010	0.110	<0.010	7.96	<0.010	0.713
2	FY09EM21-18	2	1	6	G10LM11	5.79	0.075	0.287	0.182	0.297	0.013	0.099	4.60	0.073	<0.010
2	FY09EM21-24	2	1	7	G08LM11	5.55	0.069	2.88	0.225	0.293	0.105	0.095	13.1	0.074	0.831
2	FY09EM21-18	2	1	8	G10LM21	5.87	0.075	0.293	0.180	0.298	0.013	0.100	4.66	0.073	<0.010
2	Batch 1	2	1	9	BCHLM2212	2.56	0.125	0.824	<0.010	<0.010	0.077	0.304	9.01	<0.010	0.791
2	FY09EM21-27	2	1	10	G13LM21	3.80	0.035	1.26	0.116	0.158	0.062	0.053	8.99	0.040	0.399
2	FY09EM21-20	2	1	11	G02LM11	3.21	<0.010	<0.010	<0.010	<0.010	0.109	<0.010	8.00	<0.010	0.708
2	FY09EM21-24	2	1	12	G08LM21	5.49	0.069	2.85	0.222	0.292	0.136	0.099	13.5	0.073	0.826
2	FY09EM21-19	2	1	13	G07LM11	3.07	<0.010	2.88	<0.010	<0.010	0.013	<0.010	3.45	<0.010	<0.010
2	FY09EM21-15	2	1	14	G03LM21	2.84	0.079	2.25	0.185	0.299	0.096	0.105	5.51	0.078	0.799
2	Batch 1	2	1	15	BCHLM2213	2.46	0.124	0.829	<0.010	<0.010	0.077	0.304	8.87	<0.010	0.783
2	Batch 1	2	2	1	BCHLM2221	2.43	0.122	0.820	<0.010	<0.010	0.075	0.302	8.79	<0.010	0.782
2	FY09EM21-19	2	2	2	G07LM22	3.08	<0.010	2.89	<0.010	<0.010	0.012	<0.010	3.53	<0.010	<0.010
2	FY09EM21-24	2	2	3	G08LM22	5.56	0.069	2.87	0.220	0.288	0.134	0.098	13.7	0.072	0.822
2	FY09EM21-20	2	2	4	G02LM12	3.29	<0.010	<0.010	<0.010	<0.010	0.108	<0.010	7.88	<0.010	0.709
2	FY09EM21-27	2	2	5	G13LM22	3.90	0.037	1.29	0.120	0.156	0.063	0.052	8.80	0.040	0.410
2	FY09EM21-18	2	2	6	G10LM22	5.93	0.074	0.286	0.178	0.291	0.013	0.099	4.70	0.072	<0.010
2	FY09EM21-27	2	2	7	G13LM12	3.90	0.036	1.28	0.118	0.157	0.063	0.053	8.87	0.040	0.405
2	FY09EM21-18	2	2	8	G10LM12	5.84	0.073	0.286	0.175	0.293	0.012	0.099	4.70	0.072	<0.010
2	Batch 1	2	2	9	BCHLM2222	2.57	0.121	0.807	<0.010	<0.010	0.076	0.301	8.99	<0.010	0.779
2	FY09EM21-15	2	2	10	G03LM22	2.81	0.078	2.19	0.184	0.282	0.094	0.103	5.49	0.076	0.798
2	FY09EM21-15	2	2	11	G03LM12	2.84	0.079	2.22	0.189	0.297	0.097	0.098	5.52	0.077	0.815
2	FY09EM21-20	2	2	12	G02LM22	3.30	<0.010	<0.010	<0.010	<0.010	0.109	<0.010	8.02	<0.010	0.712
2	FY09EM21-19	2	2	13	G07LM12	3.10	<0.010	2.90	<0.010	<0.010	0.012	<0.010	3.49	<0.010	<0.010
2	FY09EM21-24	2	2	14	G08LM12	5.68	0.067	2.92	0.219	0.293	0.102	0.096	13.1	0.073	0.816
2	Batch 1	2	2	15	BCHLM2223	2.58	0.123	0.813	<0.010	<0.010	0.076	0.303	9.12	<0.010	0.783

Table A2. Measured Elemental Concentrations (wt%) for the Non-Rad Matrix 2 Glasses Prepared Using Lithium Metaborate (part 2)

Set	Glass ID	Block	Sub-Block	Sequence	Lab ID	Mn (wt%)	Na (wt%)	Ni (wt%)	Pb (wt%)	S (wt%)	Si (wt%)	Ti (wt%)	Zn (wt%)	Zr (wt%)
1	Batch 1	1	1	1	BCHLM1111	1.31	6.56	0.524	<0.010	<0.050	22.9	0.382	<0.010	0.064
1	FY09EM21-05	1	1	2	F12LM21	0.244	7.46	1.83	<0.010	<0.050	23.5	3.52	<0.010	<0.010
1	FY09EM21-12	1	1	3	F05LM21	3.60	7.39	1.33	<0.010	<0.050	21.8	1.20	<0.010	<0.010
1	FY09EM21-12	1	1	4	F05LM11	3.68	7.36	1.36	<0.010	<0.050	22.0	1.21	<0.010	<0.010
1	FY09EM21-01	1	1	5	F02LM11	4.40	8.66	<0.010	<0.010	<0.050	18.0	3.38	<0.010	<0.010
1	FY09EM21-14	1	1	6	F09LM11	0.234	7.23	<0.010	0.174	0.142	18.5	3.38	0.105	0.143
1	FY09EM21-13	1	1	7	F13LM11	0.225	7.62	1.75	0.171	0.151	17.1	3.55	0.110	0.143
1	FY09EM21-02	1	1	8	F03LM11	0.244	12.63	<0.010	0.172	0.163	18.8	1.23	0.109	0.148
1	Batch 1	1	1	9	BCHLM1112	1.33	6.46	0.533	<0.010	<0.050	22.8	0.380	<0.010	0.065
1	FY09EM21-05	1	1	10	F12LM11	0.241	7.21	1.80	<0.010	<0.050	23.1	3.48	<0.010	<0.010
1	FY09EM21-01	1	1	11	F02LM21	4.36	8.31	<0.010	<0.010	<0.050	17.7	3.34	<0.010	<0.010
1	FY09EM21-13	1	1	12	F13LM21	0.230	7.72	1.78	0.177	0.151	17.2	3.59	0.111	0.145
1	FY09EM21-02	1	1	13	F03LM21	0.247	12.59	<0.010	0.175	0.168	19.0	1.24	0.110	0.152
1	FY09EM21-08	1	1	14	F01LM21	1.11	7.14	0.014	<0.010	<0.050	20.0	3.56	<0.010	<0.010
1	FY09EM21-14	1	1	15	F09LM21	0.235	7.17	<0.010	0.175	0.144	18.3	3.34	0.104	0.146
1	FY09EM21-08	1	1	16	F01LM11	1.10	7.06	0.014	<0.010	<0.050	19.8	3.55	<0.010	<0.010
1	Batch 1	1	1	17	BCHLM1113	1.32	6.45	0.526	<0.010	<0.050	22.7	0.390	<0.010	0.065
1	Batch 1	1	2	1	BCHLM1121	1.32	6.76	0.517	<0.010	<0.050	23.3	0.386	<0.010	0.063
1	FY09EM21-13	1	2	2	F13LM12	0.220	7.91	1.71	0.165	0.146	17.1	3.56	0.107	0.142
1	FY09EM21-01	1	2	3	F02LM12	4.41	8.97	<0.010	<0.010	<0.050	18.2	3.39	<0.010	<0.010
1	FY09EM21-05	1	2	4	F12LM22	0.239	7.46	1.82	<0.010	<0.050	23.3	3.51	<0.010	<0.010
1	FY09EM21-12	1	2	5	F05LM12	3.650	7.27	1.33	<0.010	<0.050	21.7	1.20	<0.010	<0.010
1	FY09EM21-14	1	2	6	F09LM12	0.229	7.19	<0.010	0.171	0.147	18.3	3.33	0.101	0.143
1	FY09EM21-08	1	2	7	F01LM12	1.09	7.11	0.010	<0.010	<0.050	19.8	3.55	<0.010	<0.010
1	FY09EM21-13	1	2	8	F13LM22	0.224	7.78	1.77	0.171	0.144	17.2	3.61	0.107	0.144
1	Batch 1	1	2	9	BCHLM1122	1.34	6.58	0.531	<0.010	<0.050	23.2	0.386	<0.010	0.064
1	FY09EM21-08	1	2	10	F01LM22	1.11	7.35	0.010	<0.010	<0.050	20.3	3.61	<0.010	<0.010
1	FY09EM21-01	1	2	11	F02LM22	4.40	8.68	<0.010	<0.010	<0.050	18.0	3.37	<0.010	<0.010
1	FY09EM21-14	1	2	12	F09LM22	0.229	7.41	<0.010	0.171	0.140	18.6	3.37	0.101	0.143
1	FY09EM21-05	1	2	13	F12LM12	0.239	7.39	1.76	<0.010	<0.050	23.1	3.46	<0.010	<0.010
1	FY09EM21-02	1	2	14	F03LM22	0.240	12.79	<0.010	0.169	0.161	19.0	1.24	0.107	0.149
1	FY09EM21-12	1	2	15	F05LM22	3.54	7.08	1.29	<0.010	<0.050	21.0	1.17	<0.010	<0.010
1	FY09EM21-02	1	2	16	F03LM12	0.240	12.59	<0.010	0.169	0.156	18.7	1.23	0.106	0.146
1	Batch 1	1	2	17	BCHLM1123	1.31	6.48	0.523	<0.010	<0.050	22.7	0.382	<0.010	0.064
1	Batch 1	2	1	1	BCHLM1211	1.35	6.60	0.511	<0.010	<0.050	23.3	0.378	<0.010	0.063
1	FY09EM21-04	2	1	2	F14LM21	0.225	7.89	1.80	<0.010	<0.050	15.0	2.380	<0.010	<0.010
1	FY09EM21-09	2	1	3	F10LM21	1.60	7.51	0.449	<0.010	<0.050	19.0	1.50	<0.010	<0.010
1	FY09EM21-10	2	1	4	F11LM11	4.19	8.02	1.72	0.173	0.267	18.6	1.45	0.111	0.142
1	FY09EM21-10	2	1	5	F11LM21	4.16	8.07	1.72	0.171	0.263	18.6	1.45	0.110	0.141
1	FY09EM21-09	2	1	6	F10LM11	1.58	7.65	0.462	0.003	<0.050	19.0	1.49	<0.010	<0.010
1	FY09EM21-06	2	1	7	F08LM21	4.25	11.07	1.86	0.173	0.148	20.1	3.52	0.108	0.143
1	FY09EM21-07	2	1	8	F04LM11	4.10	9.50	0.091	<0.010	<0.050	15.5	1.17	<0.010	<0.010
1	Batch 1	2	1	9	BCHLM1212	1.34	6.77	0.514	<0.010	<0.050	23.4	0.373	<0.010	0.063
1	FY09EM21-11	2	1	10	F06LM21	4.20	9.24	<0.010	0.164	0.154	22.6	4.08	0.108	0.141
1	FY09EM21-07	2	1	11	F04LM21	4.22	9.84	<0.010	<0.010	<0.050	15.6	1.20	<0.010	<0.010
1	FY09EM21-03	2	1	12	F07LM11	4.27	11.11	<0.010	<0.010	<0.050	18.7	2.96	<0.010	<0.010
1	FY09EM21-04	2	1	13	F14LM11	0.223	8.35	1.72	<0.010	<0.050	15.2	2.37	<0.010	<0.010
1	FY09EM21-06	2	1	14	F08LM11	4.22	11.49	1.85	0.165	0.141	20.3	3.54	0.109	0.140

Table A2. Measured Elemental Concentrations (wt%) for the Non-Rad Matrix 2 Glasses Prepared Using Lithium Metaborate (part 2)

Set	Glass ID	Block	Sub-Block	Sequence	Lab ID	Mn (wt%)	Na (wt%)	Ni (wt%)	Pb (wt%)	S (wt%)	Si (wt%)	Ti (wt%)	Zn (wt%)	Zr (wt%)
1	FY09EM21-03	2	1	15	F07LM21	4.30	11.17	<0.010	<0.010	<0.050	18.9	2.98	<0.010	<0.010
1	FY09EM21-11	2	1	16	F06LM11	4.14	9.45	<0.010	0.161	0.149	22.5	4.04	0.105	0.140
1	Batch 1	2	1	17	BCHLM1213	1.33	7.08	0.522	<0.010	<0.050	23.8	0.376	<0.010	0.064
1	Batch 1	2	2	1	BCHLM1221	1.34	6.81	0.529	<0.010	<0.050	23.4	0.383	<0.010	0.064
1	FY09EM21-03	2	2	2	F07LM22	4.42	10.59	<0.010	<0.010	<0.050	18.8	3.00	<0.010	<0.010
1	FY09EM21-07	2	2	3	F04LM22	4.34	9.40	<0.010	<0.010	<0.050	15.5	1.21	<0.010	<0.010
1	FY09EM21-09	2	2	4	F10LM12	1.60	7.50	0.462	<0.010	<0.050	18.9	1.50	<0.010	<0.010
1	FY09EM21-11	2	2	5	F06LM22	4.21	8.90	<0.010	0.166	0.149	22.0	4.05	0.109	0.142
1	FY09EM21-04	2	2	6	F14LM12	0.231	7.66	1.78	<0.010	<0.050	14.8	2.35	<0.010	<0.010
1	FY09EM21-09	2	2	7	F10LM22	1.61	7.24	0.468	<0.010	<0.050	18.7	1.49	<0.010	<0.010
1	FY09EM21-06	2	2	8	F08LM22	4.31	10.52	1.90	0.178	0.142	19.8	3.51	0.112	0.146
1	Batch 1	2	2	9	BCHLM1222	1.36	6.54	0.520	<0.010	<0.050	23.2	0.382	<0.010	0.064
1	FY09EM21-10	2	2	10	F11LM22	4.32	7.81	1.79	0.169	0.262	18.7	1.48	0.109	0.141
1	FY09EM21-03	2	2	11	F07LM12	4.41	10.38	0.003	<0.010	<0.050	18.6	3.01	<0.010	<0.010
1	FY09EM21-06	2	2	12	F08LM12	4.35	10.85	1.91	0.172	0.145	20.1	3.57	0.114	0.143
1	FY09EM21-11	2	2	13	F06LM12	4.20	8.89	<0.010	0.166	0.147	22.1	4.04	0.107	0.142
1	FY09EM21-04	2	2	14	F14LM22	0.232	7.81	1.80	0.005	<0.050	14.9	2.38	<0.010	<0.010
1	FY09EM21-10	2	2	15	F11LM12	4.24	7.83	1.75	0.173	0.269	18.5	1.46	0.111	0.143
1	FY09EM21-07	2	2	16	F04LM12	4.17	9.33	0.094	<0.010	<0.050	15.4	1.19	<0.010	<0.010
1	Batch 1	2	2	17	BCHLM1223	1.35	6.65	0.528	<0.010	<0.050	23.3	0.386	<0.010	0.064
2	Batch 1	1	1	1	BCHLM2111	1.32	6.49	0.520	<0.010	<0.050	23.5	0.377	<0.010	0.063
2	FY09EM21-16	1	1	2	G01LM11	0.230	11.1	1.82	0.166	0.144	22.4	1.16	0.109	0.142
2	FY09EM21-23	1	1	3	G06LM11	0.234	7.13	<0.010	0.181	0.128	20.3	3.40	0.102	0.146
2	FY09EM21-26	1	1	4	G11LM11	4.01	8.62	<0.010	<0.010	<0.050	21.0	2.90	<0.010	<0.010
2	FY09EM21-22	1	1	5	G12LM21	0.242	7.27	1.74	0.184	0.141	19.8	1.20	0.115	0.148
2	FY09EM21-21	1	1	6	G09LM21	0.808	10.4	<0.010	0.205	0.165	17.8	1.17	0.110	0.152
2	FY09EM21-16	1	1	7	G01LM21	0.249	11.1	1.80	0.181	0.155	22.2	1.16	0.117	0.149
2	FY09EM21-21	1	1	8	G09LM11	0.770	10.5	<0.010	0.193	0.165	17.9	1.18	0.107	0.147
2	Batch 1	1	1	9	BCHLM2112	1.31	6.61	0.530	<0.010	<0.050	23.6	0.390	<0.010	0.063
2	FY09EM21-25	1	1	10	G04LM21	4.36	11.1	<0.010	<0.010	<0.050	22.1	1.19	<0.010	0.015
2	FY09EM21-23	1	1	11	G06LM21	0.237	7.13	<0.010	0.179	0.130	20.1	3.37	0.107	0.142
2	FY09EM21-17	1	1	12	G05LM21	0.457	10.9	<0.010	0.192	0.170	19.1	3.65	0.115	0.156
2	FY09EM21-22	1	1	13	G12LM11	0.243	7.36	1.73	0.184	0.142	19.7	1.18	0.115	0.149
2	FY09EM21-17	1	1	14	G05LM11	0.466	11.0	<0.010	0.195	0.173	18.9	3.64	0.114	0.155
2	FY09EM21-25	1	1	15	G04LM11	4.34	11.2	<0.010	<0.010	<0.050	22.2	1.19	<0.010	<0.010
2	FY09EM21-26	1	1	16	G11LM21	3.97	8.73	<0.010	<0.010	<0.050	21.0	2.87	<0.010	<0.010
2	Batch 1	1	1	17	BCHLM2113	1.31	6.63	0.540	<0.010	<0.050	23.6	0.385	<0.010	0.063
2	Batch 1	1	2	1	BCHLM2121	1.33	6.65	0.530	<0.010	<0.050	23.1	0.374	<0.010	0.060
2	FY09EM21-26	1	2	2	G11LM22	4.08	8.97	<0.010	<0.010	<0.050	20.9	2.96	<0.010	<0.010
2	FY09EM21-21	1	2	3	G09LM22	0.790	10.9	<0.010	0.197	0.150	17.9	1.20	0.104	0.146
2	FY09EM21-23	1	2	4	G06LM22	0.229	7.49	<0.010	0.172	0.119	20.0	3.43	0.100	0.137
2	FY09EM21-16	1	2	5	G01LM22	0.241	11.5	1.87	0.175	0.138	22.4	1.20	0.111	0.144
2	FY09EM21-16	1	2	6	G01LM12	0.233	11.6	1.87	0.167	0.139	22.4	1.20	0.108	0.141
2	FY09EM21-23	1	2	7	G06LM12	0.240	7.46	<0.010	0.185	0.126	20.3	3.48	0.104	0.146
2	FY09EM21-22	1	2	8	G12LM12	0.238	7.55	1.79	0.178	0.130	19.6	1.21	0.109	0.144
2	Batch 1	1	2	9	BCHLM2122	1.33	6.83	0.522	<0.010	<0.050	23.3	0.379	<0.010	0.061
2	FY09EM21-17	1	2	10	G05LM22	0.442	11.3	<0.010	0.183	0.155	18.8	3.68	0.106	0.150
2	FY09EM21-22	1	2	11	G12LM22	0.233	7.66	1.75	0.176	0.129	19.6	1.21	0.108	0.141

Table A2. Measured Elemental Concentrations (wt%) for the Non-Rad Matrix 2 Glasses Prepared Using Lithium Metaborate (part 2)

Set	Glass ID	Block	Sub-Block	Sequence	Lab ID	Mn (wt%)	Na (wt%)	Ni (wt%)	Pb (wt%)	S (wt%)	Si (wt%)	Ti (wt%)	Zn (wt%)	Zr (wt%)
2	FY09EM21-25	1	2	12	G04LM12	4.43	11.8	<0.010	<0.010	<0.050	22.3	1.22	<0.010	<0.010
2	FY09EM21-17	1	2	13	G05LM12	0.463	11.4	<0.010	0.192	0.157	19.0	3.72	0.111	0.150
2	FY09EM21-26	1	2	14	G11LM12	4.00	9.07	<0.010	<0.010	<0.050	20.8	2.92	<0.010	<0.010
2	FY09EM21-25	1	2	15	G04LM22	4.36	11.6	<0.010	<0.010	<0.050	21.9	1.21	<0.010	0.013
2	FY09EM21-21	1	2	16	G09LM12	0.760	11.0	<0.010	0.188	0.153	17.8	1.19	0.102	0.140
2	Batch 1	1	2	17	BCHLM2123	1.33	6.85	0.524	<0.010	<0.050	23.4	0.381	<0.010	0.060
2	Batch 1	2	1	1	BCHLM2211	1.32	6.60	0.533	<0.010	<0.050	23.1	0.384	<0.010	0.064
2	FY09EM21-19	2	1	2	G07LM21	0.238	12.4	0.712	<0.010	<0.050	23.7	3.52	<0.010	<0.010
2	FY09EM21-15	2	1	3	G03LM11	4.13	7.44	1.77	0.170	0.147	22.8	1.12	0.107	0.140
2	FY09EM21-27	2	1	4	G13LM11	2.07	9.35	0.884	0.097	0.086	19.9	2.31	0.055	0.081
2	FY09EM21-20	2	1	5	G02LM21	0.233	12.5	1.80	<0.010	<0.050	22.2	1.18	<0.010	<0.010
2	FY09EM21-18	2	1	6	G10LM11	0.629	11.9	<0.010	0.179	0.147	22.8	1.16	0.100	0.144
2	FY09EM21-24	2	1	7	G08LM11	0.651	7.39	<0.010	0.178	0.133	17.6	2.11	0.101	0.142
2	FY09EM21-18	2	1	8	G10LM21	0.624	11.9	<0.010	0.177	0.148	22.9	1.17	0.102	0.153
2	Batch 1	2	1	9	BCHLM2212	1.35	6.77	0.519	<0.010	<0.050	23.8	0.386	<0.010	0.064
2	FY09EM21-27	2	1	10	G13LM21	2.11	9.12	0.869	0.094	0.085	19.9	2.34	0.054	0.080
2	FY09EM21-20	2	1	11	G02LM11	0.230	12.3	1.82	<0.010	<0.050	22.1	1.18	<0.010	<0.010
2	FY09EM21-24	2	1	12	G08LM21	0.664	7.28	<0.010	0.176	0.133	17.3	2.11	0.104	0.141
2	FY09EM21-19	2	1	13	G07LM11	0.237	12.3	0.711	<0.010	<0.050	23.5	3.49	<0.010	<0.010
2	FY09EM21-15	2	1	14	G03LM21	4.13	7.38	1.78	0.166	0.149	22.7	1.11	0.107	0.138
2	Batch 1	2	1	15	BCHLM2213	1.33	6.49	0.518	<0.010	<0.050	23.1	0.383	<0.010	0.063
2	Batch 1	2	2	1	BCHLM2221	1.33	6.43	0.511	<0.010	<0.050	23.0	0.384	<0.010	0.062
2	FY09EM21-19	2	2	2	G07LM22	0.231	12.5	0.688	<0.010	<0.050	23.8	3.52	<0.010	<0.010
2	FY09EM21-24	2	2	3	G08LM22	0.661	7.39	<0.010	0.174	0.129	17.5	2.14	0.103	0.141
2	FY09EM21-20	2	2	4	G02LM12	0.231	12.7	1.81	<0.010	<0.050	22.3	1.18	<0.010	<0.010
2	FY09EM21-27	2	2	5	G13LM22	2.08	9.52	0.892	0.098	0.081	20.1	2.34	0.055	0.080
2	FY09EM21-18	2	2	6	G10LM22	0.620	12.0	<0.010	0.175	0.140	23.1	1.19	0.100	0.152
2	FY09EM21-27	2	2	7	G13LM12	2.10	9.49	0.892	0.097	0.078	20.1	2.34	0.054	0.081
2	FY09EM21-18	2	2	8	G10LM12	0.610	12.0	<0.010	0.174	0.142	23.0	1.18	0.097	0.143
2	Batch 1	2	2	9	BCHLM2222	1.36	6.83	0.509	<0.010	<0.050	23.9	0.383	<0.010	0.062
2	FY09EM21-15	2	2	10	G03LM22	4.12	7.28	1.79	0.165	0.144	22.6	1.12	0.106	0.137
2	FY09EM21-15	2	2	11	G03LM12	4.13	7.30	1.80	0.171	0.142	22.7	1.12	0.105	0.139
2	FY09EM21-20	2	2	12	G02LM22	0.236	12.8	1.84	<0.010	<0.050	22.6	1.20	<0.010	<0.010
2	FY09EM21-19	2	2	13	G07LM12	0.234	12.4	0.705	<0.010	<0.050	23.8	3.50	<0.010	<0.010
2	FY09EM21-24	2	2	14	G08LM12	0.646	7.54	<0.010	0.175	0.134	17.8	2.13	0.098	0.142
2	Batch 1	2	2	15	BCHLM2223	1.38	6.82	0.513	<0.010	<0.050	24.1	0.380	<0.010	0.063

Table A3. Measured Elemental Concentrations (wt%) for the Non-Rad Matrix 2 Glasses Prepared Using Peroxide Fusion

Set	Glass ID	Block	Sub-Block	Sequence	Lab ID	B (wt%)	Li (wt%)	Si (wt%)
1	Batch 1	1	1	1	BCHPF1111	2.57	2.04	23.3
1	FY09EM21-14	1	1	2	F09PF11	4.25	1.80	19.1
1	FY09EM21-11	1	1	3	F06PF21	1.46	2.55	22.6
1	FY09EM21-14	1	1	4	F09PF21	5.08	2.23	18.9
1	FY09EM21-02	1	1	5	F03PF11	1.64	1.88	18.9
1	FY09EM21-03	1	1	6	F07PF11	1.47	3.18	19.0
1	FY09EM21-11	1	1	7	F06PF11	1.29	2.53	21.0
1	FY09EM21-06	1	1	8	F08PF21	3.48	1.78	19.8
1	Batch 1	1	1	9	BCHPF1112	2.38	2.05	23.2
1	FY09EM21-02	1	1	10	F03PF21	1.70	1.87	19.2
1	FY09EM21-04	1	1	11	F14PF11	4.40	3.23	15.1
1	FY09EM21-06	1	1	12	F08PF11	3.60	1.77	20.1
1	FY09EM21-13	1	1	13	F13PF21	1.88	3.20	17.6
1	FY09EM21-13	1	1	14	F13PF11	1.83	3.20	17.2
1	FY09EM21-04	1	1	15	F14PF21	4.25	3.18	14.8
1	FY09EM21-03	1	1	16	F07PF21	1.38	3.06	18.5
1	Batch 1	1	1	17	BCHPF1113	2.36	2.02	23.3
1	Batch 1	1	2	1	BCHPF1121	2.61	2.02	24.2
1	FY09EM21-03	1	2	2	F07PF22	1.43	3.13	18.8
1	FY09EM21-02	1	2	3	F03PF12	1.61	1.89	19.8
1	FY09EM21-14	1	2	4	F09PF12	4.27	1.84	19.3
1	FY09EM21-13	1	2	5	F13PF22	1.84	3.26	18.1
1	FY09EM21-13	1	2	6	F13PF12	1.76	3.18	17.5
1	FY09EM21-11	1	2	7	F06PF22	1.27	2.54	22.3
1	FY09EM21-02	1	2	8	F03PF22	1.49	1.84	19.1
1	Batch 1	1	2	9	BCHPF1122	2.30	2.03	23.8
1	FY09EM21-03	1	2	10	F07PF12	1.47	3.16	19.2
1	FY09EM21-04	1	2	11	F14PF12	4.37	3.25	15.5
1	FY09EM21-06	1	2	12	F08PF12	3.60	1.81	20.7
1	FY09EM21-06	1	2	13	F08PF22	3.58	1.80	20.8
1	FY09EM21-11	1	2	14	F06PF12	1.30	2.57	22.3
1	FY09EM21-04	1	2	15	F14PF22	4.36	3.24	15.6
1	FY09EM21-14	1	2	16	F09PF22	5.00	2.20	19.1
1	Batch 1	1	2	17	BCHPF1123	2.39	2.04	24.0
1	Batch 1	2	1	1	BCHPF1211	2.70	2.05	23.6
1	FY09EM21-10	2	1	2	F11PF21	1.63	1.79	18.6
1	FY09EM21-12	2	1	3	F05PF21	1.75	3.06	21.8
1	FY09EM21-08	2	1	4	F01PF21	1.58	3.20	19.8
1	FY09EM21-05	2	1	5	F12PF21	1.43	1.85	22.9
1	FY09EM21-01	2	1	6	F02PF11	1.43	1.86	17.4
1	FY09EM21-05	2	1	7	F12PF11	1.40	1.83	23.0
1	FY09EM21-08	2	1	8	F01PF11	1.52	3.07	19.5
1	Batch 1	2	1	9	BCHPF2112	2.36	2.04	22.9
1	FY09EM21-09	2	1	10	F10PF11	2.95	3.15	18.3
1	FY09EM21-01	2	1	11	F02PF21	1.50	1.84	17.5
1	FY09EM21-09	2	1	12	F10PF21	2.95	3.10	18.6
1	FY09EM21-10	2	1	13	F11PF11	1.52	1.80	18.5
1	FY09EM21-12	2	1	14	F05PF11	1.68	3.11	21.6
1	FY09EM21-07	2	1	15	F04PF21	4.30	1.82	15.3
1	FY09EM21-07	2	1	16	F04PF11	4.30	1.77	15.2
1	Batch 1	2	1	17	BCHPF1213	2.40	2.05	22.6
1	Batch 1	2	2	1	BCHPF1221	2.59	2.05	24.0
1	FY09EM21-09	2	2	2	F10PF12	3.02	3.18	19.5
1	FY09EM21-09	2	2	3	F10PF22	2.93	3.19	19.3
1	FY09EM21-01	2	2	4	F02PF12	1.37	1.84	18.2
1	FY09EM21-08	2	2	5	F01PF22	1.47	3.14	20.8
1	FY09EM21-12	2	2	6	F05PF22	1.56	3.06	22.7
1	FY09EM21-08	2	2	7	F01PF12	1.43	3.09	20.5
1	FY09EM21-07	2	2	8	F04PF12	4.22	1.81	15.9
1	Batch 1	2	2	9	BCHPF1222	2.36	2.05	24.1
1	FY09EM21-01	2	2	10	F02PF22	1.43	1.88	18.5
1	FY09EM21-05	2	2	11	F12PF12	1.30	1.81	23.8
1	FY09EM21-12	2	2	12	F05PF12	1.51	3.06	22.0
1	FY09EM21-10	2	2	13	F11PF12	1.33	1.81	19.1
1	FY09EM21-10	2	2	14	F11PF22	1.31	1.79	19.0
1	FY09EM21-05	2	2	15	F12PF22	1.25	1.85	24.1
1	FY09EM21-07	2	2	16	F04PF22	4.20	1.79	15.9
1	Batch 1	2	2	17	BCHPF2113	2.29	2.04	23.8
2	Batch 1	1	1	1	BCHPF2111	2.57	2.04	23.6
2	FY09EM21-23	1	1	2	G06PF21	1.91	1.82	21.5
2	FY09EM21-24	1	1	3	G08PF11	1.48	1.85	18.5
2	FY09EM21-21	1	1	4	G09PF11	2.85	3.24	18.8
2	FY09EM21-19	1	1	5	G07PF21	1.46	1.88	25.1

Table A3. Measured Elemental Concentrations (wt%) for the Non-Rad Matrix 2 Glasses Prepared Using Peroxide Fusion

Set	Glass ID	Block	Sub-Block	Sequence	Lab ID	B (wt%)	Li (wt%)	Si (wt%)
2	FY09EM21-19	1	1	6	G07PF11	1.41	1.84	24.3
2	FY09EM21-21	1	1	7	G09PF21	2.83	3.17	18.5
2	FY09EM21-18	1	1	8	G10PF11	1.53	2.46	23.5
2	Batch 1	1	1	9	BCHPF2112	2.40	2.02	23.9
2	FY09EM21-24	1	1	10	G08PF21	1.49	1.83	18.3
2	FY09EM21-23	1	1	11	G06PF11	1.83	1.82	21.1
2	FY09EM21-18	1	1	12	G10PF21	1.57	2.50	23.9
2	FY09EM21-27	1	1	13	G13PF11	2.18	2.32	20.5
2	FY09EM21-15	1	1	14	G03PF21	1.46	2.69	23.3
2	FY09EM21-27	1	1	15	G13PF21	2.16	2.30	20.3
2	FY09EM21-15	1	1	16	G03PF11	1.48	2.69	23.6
2	Batch 1	1	1	17	BCHPF2113	2.41	2.04	24.0
2	Batch 1	1	2	1	BCHPF2121	2.46	2.02	22.7
2	FY09EM21-19	1	2	2	G07PF22	1.44	1.82	23.5
2	FY09EM21-23	1	2	3	G06PF22	1.79	1.80	20.2
2	FY09EM21-21	1	2	4	G09PF22	2.76	3.17	17.9
2	FY09EM21-19	1	2	5	G07PF12	1.38	1.83	23.3
2	FY09EM21-18	1	2	6	G10PF22	1.48	2.48	22.8
2	FY09EM21-18	1	2	7	G10PF12	1.46	2.46	22.8
2	FY09EM21-21	1	2	8	G09PF12	2.68	3.21	18.0
2	Batch 1	1	2	9	BCHPF2122	2.35	2.04	23.6
2	FY09EM21-24	1	2	10	G08PF12	1.43	1.79	17.5
2	FY09EM21-27	1	2	11	G13PF12	2.09	2.28	19.6
2	FY09EM21-23	1	2	12	G06PF12	1.69	1.77	19.6
2	FY09EM21-24	1	2	13	G08PF22	1.34	1.80	17.5
2	FY09EM21-15	1	2	14	G03PF12	1.39	2.71	22.8
2	FY09EM21-27	1	2	15	G13PF22	2.10	2.29	20.1
2	FY09EM21-15	1	2	16	G03PF22	1.39	2.70	22.8
2	Batch 1	1	2	17	BCHPF2123	2.30	2.02	23.4
2	Batch 1	2	1	1	BCHPF2211	2.58	2.03	23.8
2	FY09EM21-16	2	1	2	G01PF11	2.04	1.85	22.4
2	FY09EM21-25	2	1	3	G04PF21	1.52	1.85	23.1
2	FY09EM21-20	2	1	4	G02PF21	1.64	1.88	22.5
2	FY09EM21-26	2	1	5	G11PF11	2.30	1.90	21.3
2	FY09EM21-17	2	1	6	G05PF11	1.43	3.28	19.6
2	FY09EM21-22	2	1	7	G12PF21	4.08	1.89	20.7
2	FY09EM21-17	2	1	8	G05PF21	1.43	3.26	19.3
2	Batch 1	2	1	9	BCHPF2212	2.32	2.10	23.8
2	FY09EM21-20	2	1	10	G02PF11	1.67	1.87	22.6
2	FY09EM21-22	2	1	11	G12PF11	4.09	1.85	20.4
2	FY09EM21-16	2	1	12	G01PF21	2.01	1.84	22.9
2	FY09EM21-25	2	1	13	G04PF11	1.49	1.88	23.2
2	FY09EM21-26	2	1	14	G11PF21	2.30	1.90	21.5
2	Batch 1	2	1	15	BCHPF2213	2.37	2.09	24.1
2	Batch 1	2	2	1	BCHPF2221	2.66	2.09	23.7
2	FY09EM21-16	2	2	2	G01PF22	2.11	1.86	22.4
2	FY09EM21-17	2	2	3	G05PF22	1.56	3.24	19.2
2	FY09EM21-17	2	2	4	G05PF12	1.54	3.22	19.1
2	FY09EM21-26	2	2	5	G11PF22	2.40	1.91	21.2
2	FY09EM21-22	2	2	6	G12PF12	4.20	1.88	20.3
2	FY09EM21-16	2	2	7	G01PF12	2.06	1.86	22.2
2	FY09EM21-26	2	2	8	G11PF12	2.36	1.89	20.9
2	Batch 1	2	2	9	BCHPF2212	2.40	2.09	23.2
2	FY09EM21-25	2	2	10	G04PF12	1.63	1.86	22.3
2	FY09EM21-20	2	2	11	G02PF22	1.72	1.86	22.2
2	FY09EM21-25	2	2	12	G04PF22	1.55	1.86	22.7
2	FY09EM21-20	2	2	13	G02PF12	1.69	1.85	22.2
2	FY09EM21-22	2	2	14	G12PF22	4.14	1.92	20.2
2	Batch 1	2	2	15	BCHPF2223	2.46	2.10	23.8

Table A4. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by Glass ID for the Non-Rad Matrix 2 Study

Set	Glass #	Oxide	Measured (wt%)	Measured Bias-Corrected (BC) (wt%)	Targeted (wt%)	Difference of Measured	Difference of Meas BC	% Difference Measured	% Difference Meas BC
1	Batch 1	Al2O3	4.6686	4.8770	4.8770	-0.2084	0.0000	-4.3%	0.0%
1	Batch 1	B2O3	7.8646	7.7770	7.7770	0.0876	0.0000	1.1%	0.0%
1	Batch 1	BaO	0.1390	0.1510	0.1510	-0.0120	0.0000	-7.9%	0.0%
1	Batch 1	CaO	1.1644	1.2200	1.2200	-0.0556	0.0000	-4.6%	0.0%
1	Batch 1	CdO	0.0057	0.0057	0.0000	0.0057	0.0057		
1	Batch 1	Ce2O3	0.0059	0.0059	0.0000	0.0059	0.0059		
1	Batch 1	Cr2O3	0.1139	0.1070	0.1070	0.0069	0.0000	6.4%	0.0%
1	Batch 1	CuO	0.3799	0.3990	0.3990	-0.0191	0.0000	-4.8%	0.0%
1	Batch 1	Fe2O3	12.5230	12.8390	12.8390	-0.3160	0.0000	-2.5%	0.0%
1	Batch 1	La2O3	0.0059	0.0059	0.0000	0.0059	0.0059		
1	Batch 1	Li2O	4.3919	4.4290	4.4290	-0.0371	0.0000	-0.8%	0.0%
1	Batch 1	MgO	1.3215	1.4190	1.4190	-0.0975	0.0000	-6.9%	0.0%
1	Batch 1	MnO	1.7216	1.7260	1.7260	-0.0044	0.0000	-0.3%	0.0%
1	Batch 1	Na2O	8.9575	9.0030	9.0030	-0.0455	0.0000	-0.5%	0.0%
1	Batch 1	NiO	0.6657	0.7510	0.7510	-0.0853	0.0000	-11.4%	0.0%
1	Batch 1	PbO	0.0054	0.0054	0.0000	0.0054	0.0054		
1	Batch 1	SiO2	49.5605	50.2200	50.2200	-0.6595	0.0000	-1.3%	0.0%
1	Batch 1	SO4	0.0749	0.0749	0.0000	0.0749	0.0749		
1	Batch 1	TiO2	0.6372	0.6770	0.6770	-0.0398	0.0000	-5.9%	0.0%
1	Batch 1	ZnO	0.0062	0.0062	0.0000	0.0062	0.0062		
1	Batch 1	ZrO2	0.0863	0.0863	0.0980	-0.0117	-0.0117	-11.9%	-11.9%
1	Batch 1	Sum	94.2995	95.7853	95.6930	-1.3935	0.0923	-1.5%	0.1%
1	FY09EM21-01	Al2O3	10.2458	10.8080	9.9690	0.2768	0.8390	2.8%	8.4%
1	FY09EM21-01	B2O3	4.6125	4.5466	4.5000	0.1125	0.0466	2.5%	1.0%
1	FY09EM21-01	BaO	0.0056	0.0060	0.0000	0.0056	0.0060		
1	FY09EM21-01	CaO	0.0070	0.0073	0.0000	0.0070	0.0073		
1	FY09EM21-01	CdO	0.0057	0.0057	0.0000	0.0057	0.0057		
1	FY09EM21-01	Ce2O3	0.0059	0.0059	0.0000	0.0059	0.0059		
1	FY09EM21-01	Cr2O3	0.1951	0.1820	0.2000	-0.0049	-0.0180	-2.4%	-9.0%
1	FY09EM21-01	CuO	0.0063	0.0066	0.0000	0.0063	0.0066		
1	FY09EM21-01	Fe2O3	17.8355	18.3897	18.3546	-0.5191	0.0351	-2.8%	0.2%
1	FY09EM21-01	La2O3	0.0059	0.0059	0.0000	0.0059	0.0059		
1	FY09EM21-01	Li2O	3.9936	4.0142	4.0000	-0.0064	0.0142	-0.2%	0.4%
1	FY09EM21-01	MgO	0.0083	0.0089	0.0000	0.0083	0.0089		
1	FY09EM21-01	MnO	5.6716	5.7363	5.5000	0.1716	0.2363	3.1%	4.3%
1	FY09EM21-01	Na2O	11.6669	11.8982	11.3900	0.2769	0.5082	2.4%	4.5%
1	FY09EM21-01	NiO	0.0064	0.0071	2.5000	-2.4936	-2.4929	-99.7%	-99.7%
1	FY09EM21-01	PbO	0.0054	0.0054	0.0000	0.0054	0.0054		
1	FY09EM21-01	SiO2	38.4539	39.3619	37.9878	0.4661	1.3741	1.2%	3.6%
1	FY09EM21-01	SO4	0.0749	0.0749	0.0000	0.0749	0.0749		
1	FY09EM21-01	TiO2	5.6212	5.9362	5.5985	0.0226	0.3377	0.4%	6.0%
1	FY09EM21-01	ZnO	0.0062	0.0062	0.0000	0.0062	0.0062		
1	FY09EM21-01	ZrO2	0.0068	0.0068	0.0000	0.0068	0.0068		
1	FY09EM21-01	Sum	98.4404	101.0198	100.0000	-1.5596	1.0198	-1.6%	1.0%
1	FY09EM21-02	Al2O3	4.1144	4.3406	4.0071	0.1073	0.3336	2.7%	8.3%
1	FY09EM21-02	B2O3	5.1840	5.1420	5.0660	0.1180	0.0760	2.3%	1.5%
1	FY09EM21-02	BaO	0.0829	0.0893	0.0801	0.0028	0.0092	3.5%	11.5%
1	FY09EM21-02	CaO	0.0070	0.0073	0.0000	0.0070	0.0073		
1	FY09EM21-02	CdO	0.2496	0.2496	0.2965	-0.0469	-0.0469	-15.8%	-15.8%
1	FY09EM21-02	Ce2O3	0.3605	0.3605	0.3606	-0.0001	-0.0001	0.0%	0.0%
1	FY09EM21-02	Cr2O3	0.0132	0.0121	0.0000	0.0132	0.0121		
1	FY09EM21-02	CuO	0.1289	0.1350	0.1282	0.0007	0.0068	0.6%	5.3%
1	FY09EM21-02	Fe2O3	20.2303	20.8586	20.6311	-0.4008	0.2275	-1.9%	1.1%
1	FY09EM21-02	La2O3	0.0900	0.0900	0.0978	-0.0077	-0.0077	-7.9%	-7.9%
1	FY09EM21-02	Li2O	4.0259	4.0732	4.0000	0.0259	0.0732	0.6%	1.8%
1	FY09EM21-02	MgO	1.4589	1.5608	1.5000	-0.0411	0.0608	-2.7%	4.1%
1	FY09EM21-02	MnO	0.3134	0.3170	0.3000	0.0134	0.0170	4.5%	5.7%
1	FY09EM21-02	Na2O	17.0522	17.3928	17.9769	-0.9247	-0.5841	-5.1%	-3.2%
1	FY09EM21-02	NiO	0.0064	0.0071	2.5000	-2.4936	-2.4929	-99.7%	-99.7%
1	FY09EM21-02	PbO	0.1845	0.1845	0.2163	-0.0319	-0.0319	-14.7%	-14.7%

Table A4. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by Glass ID for the Non-Rad Matrix 2 Study

Set	Glass #	Oxide	Measured (wt%)	Measured Bias-Corrected (BC) (wt%)	Targeted (wt%)	Difference of Measured	Difference of Meas BC	% Difference Measured	% Difference Meas BC
1	FY09EM21-02	SiO2	40.3793	41.3347	40.0190	0.3603	1.3157	0.9%	3.3%
1	FY09EM21-02	SO4	0.4853	0.4853	0.4808	0.0046	0.0046	0.9%	0.9%
1	FY09EM21-02	TiO2	2.0600	2.1754	2.0000	0.0600	0.1754	3.0%	8.8%
1	FY09EM21-02	ZnO	0.1344	0.1344	0.1346	-0.0002	-0.0002	-0.1%	-0.1%
1	FY09EM21-02	ZrO2	0.2009	0.2009	0.2051	-0.0042	-0.0042	-2.0%	-2.0%
1	FY09EM21-02	Sum	96.7620	99.1514	100.0000	-3.2380	-0.8486	-3.2%	-0.8%
1	FY09EM21-03	Al2O3	6.9345	7.1728	6.9696	-0.0351	0.2032	-0.5%	2.9%
1	FY09EM21-03	B2O3	4.6286	4.5912	4.5000	0.1286	0.0912	2.9%	2.0%
1	FY09EM21-03	BaO	0.0056	0.0061	0.0000	0.0056	0.0061		
1	FY09EM21-03	CaO	0.0203	0.0212	0.0000	0.0203	0.0212		
1	FY09EM21-03	CdO	0.0057	0.0057	0.0000	0.0057	0.0057		
1	FY09EM21-03	Ce2O3	0.0059	0.0059	0.0000	0.0059	0.0059		
1	FY09EM21-03	Cr2O3	0.0153	0.0145	0.0000	0.0153	0.0145		
1	FY09EM21-03	CuO	0.0063	0.0066	0.0000	0.0063	0.0066		
1	FY09EM21-03	Fe2O3	13.2176	13.4740	12.5192	0.6984	0.9549	5.6%	7.6%
1	FY09EM21-03	La2O3	0.0059	0.0059	0.0000	0.0059	0.0059		
1	FY09EM21-03	Li2O	6.7440	6.8233	7.0000	-0.2560	-0.1767	-3.7%	-2.5%
1	FY09EM21-03	MgO	1.4154	1.5253	1.5000	-0.0846	0.0253	-5.6%	1.7%
1	FY09EM21-03	MnO	5.6167	5.5820	5.5000	0.1167	0.0820	2.1%	1.5%
1	FY09EM21-03	Na2O	14.5753	14.4362	14.1314	0.4438	0.3048	3.1%	2.2%
1	FY09EM21-03	NiO	0.0057	0.0065	2.5000	-2.4943	-2.4935	-99.8%	-99.7%
1	FY09EM21-03	PbO	0.0054	0.0054	0.0000	0.0054	0.0054		
1	FY09EM21-03	SiO2	40.1119	40.2406	40.6502	-0.5383	-0.4095	-1.3%	-1.0%
1	FY09EM21-03	SO4	0.0749	0.0749	0.0000	0.0749	0.0749		
1	FY09EM21-03	TiO2	4.9832	5.3274	4.7297	0.2535	0.5977	5.4%	12.6%
1	FY09EM21-03	ZnO	0.0062	0.0062	0.0000	0.0062	0.0062		
1	FY09EM21-03	ZrO2	0.0068	0.0068	0.0000	0.0068	0.0068		
1	FY09EM21-03	Sum	98.3909	99.3385	100.0000	-1.6091	-0.6615	-1.6%	-0.7%
1	FY09EM21-04	Al2O3	7.0100	7.2509	7.0273	-0.0172	0.2236	-0.2%	3.2%
1	FY09EM21-04	B2O3	13.9905	13.8773	14.0000	-0.0095	-0.1227	-0.1%	-0.9%
1	FY09EM21-04	BaO	0.0056	0.0061	0.0000	0.0056	0.0061		
1	FY09EM21-04	CaO	4.0262	4.2170	4.0000	0.0262	0.2170	0.7%	5.4%
1	FY09EM21-04	CdO	0.0057	0.0057	0.0000	0.0057	0.0057		
1	FY09EM21-04	Ce2O3	0.0059	0.0059	0.0000	0.0059	0.0059		
1	FY09EM21-04	Cr2O3	0.0073	0.0069	0.0000	0.0073	0.0069		
1	FY09EM21-04	CuO	0.0063	0.0066	0.0000	0.0063	0.0066		
1	FY09EM21-04	Fe2O3	15.6195	15.9240	16.4866	-0.8671	-0.5626	-5.3%	-3.4%
1	FY09EM21-04	La2O3	0.0059	0.0059	0.0000	0.0059	0.0059		
1	FY09EM21-04	Li2O	6.9431	7.0248	7.0000	-0.0569	0.0248	-0.8%	0.4%
1	FY09EM21-04	MgO	1.3839	1.4912	1.5000	-0.1161	-0.0088	-7.7%	-0.6%
1	FY09EM21-04	MnO	0.2941	0.2923	0.3000	-0.0059	-0.0077	-2.0%	-2.6%
1	FY09EM21-04	Na2O	10.6863	10.5850	10.7374	-0.0512	-0.1524	-0.5%	-1.4%
1	FY09EM21-04	NiO	2.2587	2.5603	2.5000	-0.2413	0.0603	-9.7%	2.4%
1	FY09EM21-04	PbO	0.0054	0.0054	0.0000	0.0054	0.0054		
1	FY09EM21-04	SiO2	32.0360	32.1381	32.4487	-0.4127	-0.3107	-1.3%	-1.0%
1	FY09EM21-04	SO4	0.0749	0.0749	0.0000	0.0749	0.0749		
1	FY09EM21-04	TiO2	3.9532	4.2266	4.0000	-0.0468	0.2266	-1.2%	5.7%
1	FY09EM21-04	ZnO	0.0062	0.0062	0.0000	0.0062	0.0062		
1	FY09EM21-04	ZrO2	0.0068	0.0068	0.0000	0.0068	0.0068		
1	FY09EM21-04	Sum	98.3312	99.7177	100.0000	-1.6688	-0.2823	-1.7%	-0.3%
1	FY09EM21-05	Al2O3	3.6892	3.8920	3.6040	0.0852	0.2880	2.4%	8.0%
1	FY09EM21-05	B2O3	4.3308	4.2670	4.5000	-0.1692	-0.2330	-3.8%	-5.2%
1	FY09EM21-05	BaO	0.0056	0.0060	0.0000	0.0056	0.0060		
1	FY09EM21-05	CaO	4.1102	4.3083	4.0000	0.1102	0.3083	2.8%	7.7%
1	FY09EM21-05	CdO	0.0057	0.0057	0.0000	0.0057	0.0057		
1	FY09EM21-05	Ce2O3	0.0059	0.0059	0.0000	0.0059	0.0059		
1	FY09EM21-05	Cr2O3	0.0190	0.0177	0.0000	0.0190	0.0177		
1	FY09EM21-05	CuO	0.0063	0.0066	0.0000	0.0063	0.0066		
1	FY09EM21-05	Fe2O3	13.3462	13.7610	13.7706	-0.4244	-0.0096	-3.1%	-0.1%
1	FY09EM21-05	La2O3	0.0059	0.0059	0.0000	0.0059	0.0059		

Table A4. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by Glass ID for the Non-Rad Matrix 2 Study

Set	Glass #	Oxide	Measured (wt%)	Measured Bias-Corrected (BC) (wt%)	Targeted (wt%)	Difference of Measured	Difference of Meas BC	% Difference Measured	% Difference Meas BC
1	FY09EM21-05	Li2O	3.9506	3.9710	4.0010	-0.0504	-0.0300	-1.3%	-0.8%
1	FY09EM21-05	MgO	0.0083	0.0089	0.0000	0.0083	0.0089		
1	FY09EM21-05	MnO	0.3109	0.3144	0.3000	0.0109	0.0144	3.6%	4.8%
1	FY09EM21-05	Na2O	9.9482	10.1467	10.0000	-0.0518	0.1467	-0.5%	1.5%
1	FY09EM21-05	NiO	2.2937	2.5751	2.5000	-0.2063	0.0751	-8.3%	3.0%
1	FY09EM21-05	PbO	0.0054	0.0054	0.0000	0.0054	0.0054		
1	FY09EM21-05	SiO2	49.7387	50.9158	51.4971	-1.7584	-0.5813	-3.4%	-1.1%
1	FY09EM21-05	SO4	0.0749	0.0749	0.0000	0.0749	0.0749		
1	FY09EM21-05	TiO2	5.8255	6.1520	5.8273	-0.0018	0.3248	0.0%	5.6%
1	FY09EM21-05	ZnO	0.0062	0.0062	0.0000	0.0062	0.0062		
1	FY09EM21-05	ZrO2	0.0068	0.0068	0.0000	0.0068	0.0068		
1	FY09EM21-05	Sum	97.6938	100.4531	100.0000	-2.3062	0.4531	-2.3%	0.5%
1	FY09EM21-06	Al2O3	4.4403	4.5928	4.3905	0.0498	0.2023	1.1%	4.6%
1	FY09EM21-06	B2O3	11.4789	11.3861	11.4921	-0.0132	-0.1060	-0.1%	-0.9%
1	FY09EM21-06	BaO	0.0734	0.0804	0.0801	-0.0067	0.0003	-8.4%	0.3%
1	FY09EM21-06	CaO	0.0304	0.0319	0.0000	0.0304	0.0319		
1	FY09EM21-06	CdO	0.2450	0.2450	0.2965	-0.0515	-0.0515	-17.4%	-17.4%
1	FY09EM21-06	Ce2O3	0.3420	0.3420	0.3606	-0.0186	-0.0186	-5.1%	-5.1%
1	FY09EM21-06	Cr2O3	0.1907	0.1806	0.2000	-0.0093	-0.0194	-4.6%	-9.7%
1	FY09EM21-06	CuO	0.1252	0.1318	0.1282	-0.0030	0.0036	-2.4%	2.8%
1	FY09EM21-06	Fe2O3	5.1898	5.2908	5.2967	-0.1069	-0.0059	-2.0%	-0.1%
1	FY09EM21-06	La2O3	0.0921	0.0921	0.0978	-0.0057	-0.0057	-5.8%	-5.8%
1	FY09EM21-06	Li2O	3.8537	3.8990	4.0000	-0.1463	-0.1010	-3.7%	-2.5%
1	FY09EM21-06	MgO	0.0083	0.0089	0.0000	0.0083	0.0089		
1	FY09EM21-06	MnO	5.5296	5.4955	5.5000	0.0296	-0.0045	0.5%	-0.1%
1	FY09EM21-06	Na2O	14.8044	14.6637	14.7842	0.0202	-0.1205	0.1%	-0.8%
1	FY09EM21-06	NiO	2.3923	2.7116	2.5000	-0.1077	0.2116	-4.3%	8.5%
1	FY09EM21-06	PbO	0.1853	0.1853	0.2163	-0.0311	-0.0311	-14.4%	-14.4%
1	FY09EM21-06	SiO2	42.9464	43.0837	43.8365	-0.8900	-0.7528	-2.0%	-1.7%
1	FY09EM21-06	SO4	0.4314	0.4314	0.4808	-0.0494	-0.0494	-10.3%	-10.3%
1	FY09EM21-06	TiO2	5.8964	6.3040	6.0000	-0.1036	0.3040	-1.7%	5.1%
1	FY09EM21-06	ZnO	0.1379	0.1379	0.1346	0.0032	0.0032	2.4%	2.4%
1	FY09EM21-06	ZrO2	0.1932	0.1932	0.2051	-0.0120	-0.0120	-5.8%	-5.8%
1	FY09EM21-06	Sum	98.5867	99.4876	100.0000	-1.4133	-0.5124	-1.4%	-0.5%
1	FY09EM21-07	Al2O3	4.8135	4.9795	4.8660	-0.0525	0.1135	-1.1%	2.3%
1	FY09EM21-07	B2O3	13.7007	13.5075	13.9244	-0.2237	-0.4169	-1.6%	-3.0%
1	FY09EM21-07	BaO	0.0056	0.0061	0.0000	0.0056	0.0061		
1	FY09EM21-07	CaO	3.9702	4.1583	3.9217	0.0485	0.2366	1.2%	6.0%
1	FY09EM21-07	CdO	0.0057	0.0057	0.0000	0.0057	0.0057		
1	FY09EM21-07	Ce2O3	0.0059	0.0059	0.0000	0.0059	0.0059		
1	FY09EM21-07	Cr2O3	0.0073	0.0069	0.0000	0.0073	0.0069		
1	FY09EM21-07	CuO	0.0063	0.0066	0.0000	0.0063	0.0066		
1	FY09EM21-07	Fe2O3	16.8347	17.1624	17.9841	-1.1494	-0.8217	-6.4%	-4.6%
1	FY09EM21-07	La2O3	0.0059	0.0059	0.0000	0.0059	0.0059		
1	FY09EM21-07	Li2O	3.8698	3.8898	4.0000	-0.1302	-0.1102	-3.3%	-2.8%
1	FY09EM21-07	MgO	1.3714	1.4780	1.5000	-0.1286	-0.0220	-8.6%	-1.5%
1	FY09EM21-07	MnO	5.4327	5.3992	5.5000	-0.0673	-0.1008	-1.2%	-1.8%
1	FY09EM21-07	Na2O	12.8296	12.7092	12.7062	0.1234	0.0030	1.0%	0.0%
1	FY09EM21-07	NiO	0.0620	0.0703	0.0000	0.0620	0.0703		
1	FY09EM21-07	PbO	0.0054	0.0054	0.0000	0.0054	0.0054		
1	FY09EM21-07	SiO2	33.1592	33.2655	33.5976	-0.4385	-0.3321	-1.3%	-1.0%
1	FY09EM21-07	SO4	0.0749	0.0749	0.0000	0.0749	0.0749		
1	FY09EM21-07	TiO2	1.9891	2.1265	2.0000	-0.0109	0.1265	-0.5%	6.3%
1	FY09EM21-07	ZnO	0.0062	0.0062	0.0000	0.0062	0.0062		
1	FY09EM21-07	ZrO2	0.0068	0.0068	0.0000	0.0068	0.0068		
1	FY09EM21-07	Sum	98.1628	98.8766	100.0000	-1.8372	-1.1234	-1.8%	-1.1%
1	FY09EM21-08	Al2O3	3.2547	3.4335	3.2500	0.0047	0.1835	0.1%	5.6%
1	FY09EM21-08	B2O3	4.8299	4.7601	4.9741	-0.1443	-0.2140	-2.9%	-4.3%
1	FY09EM21-08	BaO	0.0056	0.0060	0.0000	0.0056	0.0060		
1	FY09EM21-08	CaO	0.5149	0.5397	0.5047	0.0102	0.0350	2.0%	6.9%

Table A4. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by Glass ID for the Non-Rad Matrix 2 Study

Set	Glass #	Oxide	Measured (wt%)	Measured Bias-Corrected (BC) (wt%)	Targeted (wt%)	Difference of Measured	Difference of Meas BC	% Difference Measured	% Difference Meas BC
1	FY09EM21-08	CdO	0.0057	0.0057	0.0000	0.0057	0.0057		
1	FY09EM21-08	Ce2O3	0.0111	0.0111	0.0000	0.0111	0.0111		
1	FY09EM21-08	Cr2O3	0.1560	0.1455	0.2000	-0.0440	-0.0545	-22.0%	-27.2%
1	FY09EM21-08	CuO	0.0063	0.0066	0.0000	0.0063	0.0066		
1	FY09EM21-08	Fe2O3	20.1588	20.7843	20.4787	-0.3200	0.3056	-1.6%	1.5%
1	FY09EM21-08	La2O3	0.0059	0.0059	0.0000	0.0059	0.0059		
1	FY09EM21-08	Li2O	6.7278	6.7625	7.0000	-0.2722	-0.2375	-3.9%	-3.4%
1	FY09EM21-08	MgO	1.3826	1.4792	1.5000	-0.1174	-0.0208	-7.8%	-1.4%
1	FY09EM21-08	MnO	1.4235	1.4398	1.3863	0.0373	0.0535	2.7%	3.9%
1	FY09EM21-08	Na2O	9.6584	9.8508	10.0000	-0.3416	-0.1492	-3.4%	-1.5%
1	FY09EM21-08	NiO	0.0153	0.0171	0.0000	0.0153	0.0171		
1	FY09EM21-08	PbO	0.0054	0.0054	0.0000	0.0054	0.0054		
1	FY09EM21-08	SiO2	42.7325	43.7423	44.7062	-1.9737	-0.9639	-4.4%	-2.2%
1	FY09EM21-08	SO4	0.0749	0.0749	0.0000	0.0749	0.0749		
1	FY09EM21-08	TiO2	5.9506	6.2841	6.0000	-0.0494	0.2841	-0.8%	4.7%
1	FY09EM21-08	ZnO	0.0062	0.0062	0.0000	0.0062	0.0062		
1	FY09EM21-08	ZrO2	0.0068	0.0068	0.0000	0.0068	0.0068		
1	FY09EM21-08	Sum	96.9328	99.3675	100.0000	-3.0672	-0.6325	-3.1%	-0.6%
1	FY09EM21-09	Al2O3	12.9667	13.4134	12.9733	-0.0066	0.4401	-0.1%	3.4%
1	FY09EM21-09	B2O3	9.5390	9.4065	9.4842	0.0548	-0.0777	0.6%	-0.8%
1	FY09EM21-09	BaO	0.0056	0.0061	0.0000	0.0056	0.0061		
1	FY09EM21-09	CaO	3.0118	3.1545	3.0266	-0.0148	0.1278	-0.5%	4.2%
1	FY09EM21-09	CdO	0.0057	0.0057	0.0000	0.0057	0.0057		
1	FY09EM21-09	Ce2O3	0.0059	0.0059	0.0000	0.0059	0.0059		
1	FY09EM21-09	Cr2O3	0.1370	0.1297	0.2000	-0.0630	-0.0703	-31.5%	-35.1%
1	FY09EM21-09	CuO	0.0063	0.0066	0.0000	0.0063	0.0066		
1	FY09EM21-09	Fe2O3	10.5262	10.7318	10.9602	-0.4341	-0.2285	-4.0%	-2.1%
1	FY09EM21-09	La2O3	0.0059	0.0059	0.0000	0.0059	0.0059		
1	FY09EM21-09	Li2O	6.7924	6.8274	7.0000	-0.2076	-0.1726	-3.0%	-2.5%
1	FY09EM21-09	MgO	0.0083	0.0089	0.0000	0.0083	0.0089		
1	FY09EM21-09	MnO	2.0627	2.0500	2.0133	0.0494	0.0367	2.5%	1.8%
1	FY09EM21-09	Na2O	10.0763	9.9820	10.0010	0.0753	-0.0190	0.8%	-0.2%
1	FY09EM21-09	NiO	0.5857	0.6639	0.6848	-0.0992	-0.0210	-14.5%	-3.1%
1	FY09EM21-09	PbO	0.0048	0.0048	0.0000	0.0048	0.0048		
1	FY09EM21-09	SiO2	40.4328	40.5621	41.1878	-0.7550	-0.6257	-1.8%	-1.5%
1	FY09EM21-09	SO4	0.0749	0.0749	0.0000	0.0749	0.0749		
1	FY09EM21-09	TiO2	2.4937	2.6661	2.4687	0.0250	0.1974	1.0%	8.0%
1	FY09EM21-09	ZnO	0.0062	0.0062	0.0000	0.0062	0.0062		
1	FY09EM21-09	ZrO2	0.0068	0.0068	0.0000	0.0068	0.0068		
1	FY09EM21-09	Sum	98.7544	99.7192	100.0000	-1.2456	-0.2808	-1.2%	-0.3%
1	FY09EM21-10	Al2O3	6.3865	6.6068	6.3955	-0.0090	0.2113	-0.1%	3.3%
1	FY09EM21-10	B2O3	4.6608	4.5897	4.7196	-0.0588	-0.1299	-1.2%	-2.8%
1	FY09EM21-10	BaO	0.0715	0.0783	0.0801	-0.0087	-0.0019	-10.8%	-2.3%
1	FY09EM21-10	CaO	4.0612	4.2536	4.0000	0.0612	0.2536	1.5%	6.3%
1	FY09EM21-10	CdO	0.2439	0.2439	0.2965	-0.0526	-0.0526	-17.7%	-17.7%
1	FY09EM21-10	Ce2O3	0.3309	0.3309	0.3606	-0.0297	-0.0297	-8.2%	-8.2%
1	FY09EM21-10	Cr2O3	0.0150	0.0142	0.0000	0.0150	0.0142		
1	FY09EM21-10	CuO	0.1224	0.1289	0.1282	-0.0058	0.0007	-4.6%	0.5%
1	FY09EM21-10	Fe2O3	16.6203	16.9437	17.7314	-1.1111	-0.7877	-6.3%	-4.4%
1	FY09EM21-10	La2O3	0.0821	0.0821	0.0978	-0.0157	-0.0157	-16.0%	-16.0%
1	FY09EM21-10	Li2O	3.8698	3.8898	4.0000	-0.1302	-0.1102	-3.3%	-2.8%
1	FY09EM21-10	MgO	0.0083	0.0089	0.0000	0.0083	0.0089		
1	FY09EM21-10	MnO	5.4585	5.4249	5.4644	-0.0059	-0.0396	-0.1%	-0.7%
1	FY09EM21-10	Na2O	10.6930	10.5929	10.3889	0.3041	0.2040	2.9%	2.0%
1	FY09EM21-10	NiO	2.2205	2.5168	2.5000	-0.2795	0.0168	-11.2%	0.7%
1	FY09EM21-10	PbO	0.1847	0.1847	0.2163	-0.0316	-0.0316	-14.6%	-14.6%
1	FY09EM21-10	SiO2	39.7910	39.9192	40.4036	-0.6126	-0.4845	-1.5%	-1.2%
1	FY09EM21-10	SO4	0.7947	0.7947	0.4808	0.3139	0.3139	65.3%	65.3%
1	FY09EM21-10	TiO2	2.4353	2.6035	2.3966	0.0386	0.2069	1.6%	8.6%
1	FY09EM21-10	ZnO	0.1372	0.1372	0.1346	0.0026	0.0026	1.9%	1.9%

Table A4. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by Glass ID for the Non-Rad Matrix 2 Study

Set	Glass #	Oxide	Measured (wt%)	Measured Bias-Corrected (BC) (wt%)	Targeted (wt%)	Difference of Measured	Difference of Meas BC	% Difference Measured	% Difference Meas BC
1	FY09EM21-10	ZrO2	0.1915	0.1915	0.2051	-0.0137	-0.0137	-6.7%	-6.7%
1	FY09EM21-10	Sum	98.3790	99.5361	100.0000	-1.6210	-0.4640	-1.6%	-0.5%
1	FY09EM21-11	Al2O3	3.2310	3.3422	3.2500	-0.0190	0.0922	-0.6%	2.8%
1	FY09EM21-11	B2O3	4.2825	4.2477	4.5777	-0.2952	-0.3300	-6.4%	-7.2%
1	FY09EM21-11	BaO	0.0720	0.0789	0.0801	-0.0081	-0.0013	-10.1%	-1.6%
1	FY09EM21-11	CaO	4.0297	4.2206	4.0000	0.0297	0.2206	0.7%	5.5%
1	FY09EM21-11	CdO	0.2504	0.2504	0.2965	-0.0460	-0.0460	-15.5%	-15.5%
1	FY09EM21-11	Ce2O3	0.3335	0.3335	0.3606	-0.0270	-0.0270	-7.5%	-7.5%
1	FY09EM21-11	Cr2O3	0.0179	0.0169	0.0000	0.0179	0.0169		
1	FY09EM21-11	CuO	0.1230	0.1295	0.1282	-0.0052	0.0013	-4.1%	1.0%
1	FY09EM21-11	Fe2O3	5.9869	6.1039	6.0404	-0.0535	0.0635	-0.9%	1.1%
1	FY09EM21-11	La2O3	0.0833	0.0833	0.0978	-0.0145	-0.0145	-14.8%	-14.8%
1	FY09EM21-11	Li2O	5.4845	5.5490	5.6270	-0.1425	-0.0780	-2.5%	-1.4%
1	FY09EM21-11	MgO	1.3461	1.4507	1.5000	-0.1539	-0.0493	-10.3%	-3.3%
1	FY09EM21-11	MnO	5.4069	5.3737	5.5000	-0.0931	-0.1263	-1.7%	-2.3%
1	FY09EM21-11	Na2O	12.2938	12.1772	12.2079	0.0859	-0.0307	0.7%	-0.3%
1	FY09EM21-11	NiO	0.0064	0.0072	0.0000	0.0064	0.0072		
1	FY09EM21-11	PbO	0.1769	0.1769	0.2163	-0.0394	-0.0394	-18.2%	-18.2%
1	FY09EM21-11	SiO2	47.7064	47.8578	49.2970	-1.5906	-1.4392	-3.2%	-2.9%
1	FY09EM21-11	SO4	0.4486	0.4486	0.4808	-0.0321	-0.0321	-6.7%	-6.7%
1	FY09EM21-11	TiO2	6.7596	7.2271	6.0000	0.7596	1.2271	12.7%	20.5%
1	FY09EM21-11	ZnO	0.1335	0.1335	0.1346	-0.0011	-0.0011	-0.8%	-0.8%
1	FY09EM21-11	ZrO2	0.1908	0.1908	0.2051	-0.0143	-0.0143	-7.0%	-7.0%
1	FY09EM21-11	Sum	98.3637	99.3997	100.0000	-1.6363	-0.6003	-1.6%	-0.6%
1	FY09EM21-12	Al2O3	4.5679	4.8196	4.5542	0.0136	0.2654	0.3%	5.8%
1	FY09EM21-12	B2O3	5.2323	5.1551	5.2908	-0.0585	-0.1357	-1.1%	-2.6%
1	FY09EM21-12	BaO	0.0056	0.0060	0.0000	0.0056	0.0060		
1	FY09EM21-12	CaO	0.0070	0.0073	0.0000	0.0070	0.0073		
1	FY09EM21-12	CdO	0.0057	0.0057	0.0000	0.0057	0.0057		
1	FY09EM21-12	Ce2O3	0.0094	0.0094	0.0000	0.0094	0.0094		
1	FY09EM21-12	Cr2O3	0.0179	0.0166	0.0000	0.0179	0.0166		
1	FY09EM21-12	CuO	0.0063	0.0066	0.0000	0.0063	0.0066		
1	FY09EM21-12	Fe2O3	15.3693	15.8477	16.8649	-1.4957	-1.0173	-8.9%	-6.0%
1	FY09EM21-12	La2O3	0.0059	0.0059	0.0000	0.0059	0.0059		
1	FY09EM21-12	Li2O	6.6148	6.6489	6.7937	-0.1789	-0.1448	-2.6%	-2.1%
1	FY09EM21-12	MgO	0.0083	0.0089	0.0000	0.0083	0.0089		
1	FY09EM21-12	MnO	4.6709	4.7242	4.6737	-0.0028	0.0506	-0.1%	1.1%
1	FY09EM21-12	Na2O	9.8067	10.0041	10.0000	-0.1933	0.0041	-1.9%	0.0%
1	FY09EM21-12	NiO	1.6892	1.8965	1.9071	-0.2179	-0.0106	-11.4%	-0.6%
1	FY09EM21-12	PbO	0.0054	0.0054	0.0000	0.0054	0.0054		
1	FY09EM21-12	SiO2	46.2624	47.3601	47.9155	-1.6532	-0.5554	-3.5%	-1.2%
1	FY09EM21-12	SO4	0.0749	0.0749	0.0000	0.0749	0.0749		
1	FY09EM21-12	TiO2	1.9933	2.1050	2.0000	-0.0067	0.1050	-0.3%	5.2%
1	FY09EM21-12	ZnO	0.0062	0.0062	0.0000	0.0062	0.0062		
1	FY09EM21-12	ZrO2	0.0068	0.0068	0.0000	0.0068	0.0068		
1	FY09EM21-12	Sum	96.3660	98.7208	100.0000	-3.6340	-1.2792	-3.6%	-1.3%
1	FY09EM21-13	Al2O3	10.3119	10.8786	10.3780	-0.0661	0.5006	-0.6%	4.8%
1	FY09EM21-13	B2O3	5.8844	5.8367	5.8833	0.0011	-0.0466	0.0%	-0.8%
1	FY09EM21-13	BaO	0.0745	0.0803	0.0801	-0.0056	0.0002	-7.0%	0.2%
1	FY09EM21-13	CaO	4.0262	4.2203	4.0000	0.0262	0.2203	0.7%	5.5%
1	FY09EM21-13	CdO	0.2547	0.2547	0.2965	-0.0417	-0.0417	-14.1%	-14.1%
1	FY09EM21-13	Ce2O3	0.3367	0.3367	0.3606	-0.0238	-0.0238	-6.6%	-6.6%
1	FY09EM21-13	Cr2O3	0.1739	0.1622	0.2000	-0.0261	-0.0378	-13.0%	-18.9%
1	FY09EM21-13	CuO	0.1227	0.1285	0.1282	-0.0055	0.0003	-4.3%	0.2%
1	FY09EM21-13	Fe2O3	13.3641	13.7796	14.0780	-0.7139	-0.2985	-5.1%	-2.1%
1	FY09EM21-13	La2O3	0.0856	0.0856	0.0978	-0.0121	-0.0121	-12.4%	-12.4%
1	FY09EM21-13	Li2O	6.9108	6.9921	7.0000	-0.0892	-0.0079	-1.3%	-0.1%
1	FY09EM21-13	MgO	0.0083	0.0089	0.0000	0.0083	0.0089		
1	FY09EM21-13	MnO	0.2902	0.2935	0.3000	-0.0098	-0.0065	-3.3%	-2.2%
1	FY09EM21-13	Na2O	10.4571	10.6652	10.5159	-0.0588	0.1493	-0.6%	1.4%

Table A4. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by Glass ID for the Non-Rad Matrix 2 Study

Set	Glass #	Oxide	Measured (wt%)	Measured Bias-Corrected (BC) (wt%)	Targeted (wt%)	Difference of Measured	Difference of Meas BC	% Difference Measured	% Difference Meas BC
1	FY09EM21-13	NiO	2.2301	2.5037	2.5000	-0.2699	0.0037	-10.8%	0.1%
1	FY09EM21-13	PbO	0.1842	0.1842	0.2163	-0.0321	-0.0321	-14.9%	-14.9%
1	FY09EM21-13	SiO2	36.6890	37.5568	37.1447	-0.4557	0.4121	-1.2%	1.1%
1	FY09EM21-13	SO4	0.4434	0.4434	0.4808	-0.0374	-0.0374	-7.8%	-7.8%
1	FY09EM21-13	TiO2	5.9673	6.3017	6.0000	-0.0327	0.3017	-0.5%	5.0%
1	FY09EM21-13	ZnO	0.1354	0.1354	0.1346	0.0008	0.0008	0.6%	0.6%
1	FY09EM21-13	ZrO2	0.1938	0.1938	0.2051	-0.0113	-0.0113	-5.5%	-5.5%
1	FY09EM21-13	Sum	98.1444	101.0419	100.0000	-1.8556	1.0419	-1.9%	1.0%
1	FY09EM21-14	Al2O3	3.2169	3.3937	3.2500	-0.0331	0.1437	-1.0%	4.4%
1	FY09EM21-14	B2O3	14.9725	14.8513	13.6465	1.3260	1.2048	9.7%	8.8%
1	FY09EM21-14	BaO	0.0782	0.0842	0.0801	-0.0020	0.0041	-2.5%	5.1%
1	FY09EM21-14	CaO	0.0350	0.0367	0.0000	0.0350	0.0367		
1	FY09EM21-14	CdO	0.2499	0.2499	0.2965	-0.0466	-0.0466	-15.7%	-15.7%
1	FY09EM21-14	Ce2O3	0.3426	0.3426	0.3606	-0.0180	-0.0180	-5.0%	-5.0%
1	FY09EM21-14	Cr2O3	0.1432	0.1336	0.2000	-0.0568	-0.0664	-28.4%	-33.2%
1	FY09EM21-14	CuO	0.1289	0.1350	0.1282	0.0007	0.0068	0.6%	5.3%
1	FY09EM21-14	Fe2O3	19.6226	20.2324	20.5438	-0.9212	-0.3114	-4.5%	-1.5%
1	FY09EM21-14	La2O3	0.0862	0.0862	0.0978	-0.0116	-0.0116	-11.8%	-11.8%
1	FY09EM21-14	Li2O	4.3435	4.3945	4.0000	0.3435	0.3945	8.6%	9.9%
1	FY09EM21-14	MgO	0.0062	0.0066	0.0000	0.0062	0.0066		
1	FY09EM21-14	MnO	0.2992	0.3027	0.3000	-0.0008	0.0027	-0.3%	0.9%
1	FY09EM21-14	Na2O	9.7730	9.9679	10.0000	-0.2270	-0.0321	-2.3%	-0.3%
1	FY09EM21-14	NiO	0.0064	0.0071	0.0000	0.0064	0.0071		
1	FY09EM21-14	PbO	0.1861	0.1861	0.2163	-0.0303	-0.0303	-14.0%	-14.0%
1	FY09EM21-14	SiO2	39.4166	40.3486	40.3535	-0.9369	-0.0049	-2.3%	0.0%
1	FY09EM21-14	SO4	0.4292	0.4292	0.4808	-0.0516	-0.0516	-10.7%	-10.7%
1	FY09EM21-14	TiO2	5.5961	5.9098	5.7062	-0.1101	0.2036	-1.9%	3.6%
1	FY09EM21-14	ZnO	0.1279	0.1279	0.1346	-0.0067	-0.0067	-5.0%	-5.0%
1	FY09EM21-14	ZrO2	0.1942	0.1942	0.2051	-0.0110	-0.0110	-5.3%	-5.3%
1	FY09EM21-14	Sum	99.2544	101.4202	100.0000	-0.7456	1.4202	-0.7%	1.4%
2	Batch 1	Al2O3	4.7647	4.8770	4.8770	-0.1123	0.0000	-2.3%	0.0%
2	Batch 1	B2O3	7.8566	7.7770	7.7770	0.0796	0.0000	1.0%	0.0%
2	Batch 1	BaO	0.1385	0.1510	0.1510	-0.0125	0.0000	-8.3%	0.0%
2	Batch 1	CaO	1.1627	1.2200	1.2200	-0.0573	0.0000	-4.7%	0.0%
2	Batch 1	CdO	0.0057	0.0057	0.0000	0.0057	0.0057		
2	Batch 1	Ce2O3	0.0059	0.0059	0.0000	0.0059	0.0059		
2	Batch 1	Cr2O3	0.1124	0.1079	0.1070	0.0054	0.0009	5.1%	0.9%
2	Batch 1	CuO	0.3759	0.3990	0.3990	-0.0231	0.0000	-5.8%	0.0%
2	Batch 1	Fe2O3	12.5802	12.8390	12.8390	-0.2588	0.0000	-2.0%	0.0%
2	Batch 1	La2O3	0.0059	0.0059	0.0000	0.0059	0.0059		
2	Batch 1	Li2O	4.4278	4.4290	4.4290	-0.0012	0.0000	0.0%	0.0%
2	Batch 1	MgO	1.3228	1.4190	1.4190	-0.0962	0.0000	-6.8%	0.0%
2	Batch 1	MnO	1.7216	1.7260	1.7260	-0.0044	0.0000	-0.3%	0.0%
2	Batch 1	Na2O	8.9867	9.0030	9.0030	-0.0163	0.0000	-0.2%	0.0%
2	Batch 1	NiO	0.6648	0.7510	0.7510	-0.0862	0.0000	-11.5%	0.0%
2	Batch 1	PbO	0.0054	0.0054	0.0000	0.0054	0.0054		
2	Batch 1	SiO2	50.5588	50.2200	50.2200	0.3388	0.0000	0.7%	0.0%
2	Batch 1	SO4	0.0749	0.0749	0.0000	0.0749	0.0749		
2	Batch 1	TiO2	0.6375	0.6770	0.6770	-0.0395	0.0000	-5.8%	0.0%
2	Batch 1	ZnO	0.0062	0.0062	0.0000	0.0062	0.0062		
2	Batch 1	ZrO2	0.0842	0.0842	0.0980	-0.0138	-0.0138	-14.1%	-14.1%
2	Batch 1	Sum	95.4990	95.7840	95.6930	-0.1940	0.0910	-0.2%	0.1%
2	FY09EM21-15	Al2O3	5.3662	5.5075	5.3229	0.0433	0.1846	0.8%	3.5%
2	FY09EM21-15	B2O3	4.6045	4.6042	4.5000	0.1045	0.1042	2.3%	2.3%
2	FY09EM21-15	BaO	0.0879	0.0962	0.0801	0.0078	0.0160	9.7%	20.0%
2	FY09EM21-15	CaO	3.1342	3.3325	3.1904	-0.0562	0.1421	-1.8%	4.5%
2	FY09EM21-15	CdO	0.2136	0.2136	0.2965	-0.0829	-0.0829	-27.9%	-27.9%
2	FY09EM21-15	Ce2O3	0.3455	0.3455	0.3606	-0.0150	-0.0150	-4.2%	-4.2%
2	FY09EM21-15	Cr2O3	0.1407	0.1343	0.2000	-0.0593	-0.0657	-29.7%	-32.8%
2	FY09EM21-15	CuO	0.1264	0.1334	0.1282	-0.0018	0.0052	-1.4%	4.1%

Table A4. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by Glass ID for the Non-Rad Matrix 2 Study

Set	Glass #	Oxide	Measured (wt%)	Measured Bias-Corrected (BC) (wt%)	Targeted (wt%)	Difference of Measured	Difference of Meas BC	% Difference Measured	% Difference Meas BC
2	FY09EM21-15	Fe2O3	7.8669	7.9202	8.2902	-0.4232	-0.3699	-5.1%	-4.5%
2	FY09EM21-15	La2O3	0.0906	0.0906	0.0978	-0.0072	-0.0072	-7.3%	-7.3%
2	FY09EM21-15	Li2O	5.8074	5.8854	6.0020	-0.1946	-0.1166	-3.2%	-1.9%
2	FY09EM21-15	MgO	1.3358	1.4500	1.5000	-0.1642	-0.0500	-10.9%	-3.3%
2	FY09EM21-15	MnO	5.3294	5.2971	5.3591	-0.0296	-0.0619	-0.6%	-1.2%
2	FY09EM21-15	Na2O	9.9078	9.9415	10.0000	-0.0922	-0.0585	-0.9%	-0.6%
2	FY09EM21-15	NiO	2.2714	2.5926	2.5000	-0.2286	0.0926	-9.1%	3.7%
2	FY09EM21-15	PbO	0.1810	0.1810	0.2163	-0.0354	-0.0354	-16.4%	-16.4%
2	FY09EM21-15	SiO2	49.4713	49.3478	49.1354	0.3359	0.2124	0.7%	0.4%
2	FY09EM21-15	SO4	0.4359	0.4359	0.4808	-0.0449	-0.0449	-9.3%	-9.3%
2	FY09EM21-15	TiO2	1.8640	1.9736	2.0000	-0.1360	-0.0264	-6.8%	-1.3%
2	FY09EM21-15	ZnO	0.1323	0.1323	0.1346	-0.0024	-0.0024	-1.8%	-1.8%
2	FY09EM21-15	ZrO2	0.1871	0.1871	0.2051	-0.0180	-0.0180	-8.8%	-8.8%
2	FY09EM21-15	Sum	98.8999	99.8023	100.0000	-1.1001	-0.1977	-1.1%	-0.2%
2	FY09EM21-16	Al2O3	3.7365	3.8145	3.6772	0.0593	0.1373	1.6%	3.7%
2	FY09EM21-16	B2O3	6.6169	6.4837	6.4270	0.1899	0.0567	3.0%	0.9%
2	FY09EM21-16	BaO	0.0756	0.0822	0.0801	-0.0045	0.0020	-5.6%	2.5%
2	FY09EM21-16	CaO	3.8443	3.9842	3.8213	0.0230	0.1629	0.6%	4.3%
2	FY09EM21-16	CdO	0.2267	0.2267	0.2965	-0.0697	-0.0697	-23.5%	-23.5%
2	FY09EM21-16	Ce2O3	0.3479	0.3479	0.3606	-0.0127	-0.0127	-3.5%	-3.5%
2	FY09EM21-16	Cr2O3	0.1524	0.1471	0.2000	-0.0476	-0.0529	-23.8%	-26.4%
2	FY09EM21-16	CuO	0.1258	0.1343	0.1282	-0.0024	0.0061	-1.9%	4.8%
2	FY09EM21-16	Fe2O3	8.7390	9.0428	9.0461	-0.3070	-0.0033	-3.4%	0.0%
2	FY09EM21-16	La2O3	0.0862	0.0862	0.0978	-0.0116	-0.0116	-11.8%	-11.8%
2	FY09EM21-16	Li2O	3.9882	3.9383	4.0000	-0.0118	-0.0617	-0.3%	-1.5%
2	FY09EM21-16	MgO	1.4091	1.4942	1.5000	-0.0909	-0.0058	-6.1%	-0.4%
2	FY09EM21-16	MnO	0.3076	0.3112	0.3000	0.0076	0.0112	2.5%	3.7%
2	FY09EM21-16	Na2O	15.2661	15.2698	15.8200	-0.5539	-0.5502	-3.5%	-3.5%
2	FY09EM21-16	NiO	2.3414	2.6190	2.5000	-0.1586	0.1190	-6.3%	4.8%
2	FY09EM21-16	PbO	0.1855	0.1855	0.2163	-0.0308	-0.0308	-14.2%	-14.2%
2	FY09EM21-16	SiO2	48.0808	47.5571	48.7083	-0.6275	-1.1512	-1.3%	-2.4%
2	FY09EM21-16	SO4	0.4314	0.4314	0.4808	-0.0494	-0.0494	-10.3%	-10.3%
2	FY09EM21-16	TiO2	1.9682	2.0972	2.0000	-0.0318	0.0972	-1.6%	4.9%
2	FY09EM21-16	ZnO	0.1385	0.1385	0.1346	0.0039	0.0039	2.9%	2.9%
2	FY09EM21-16	ZrO2	0.1945	0.1945	0.2051	-0.0106	-0.0106	-5.2%	-5.2%
2	FY09EM21-16	Sum	98.2628	98.5862	99.9999	-1.7371	-1.4137	-1.7%	-1.4%
2	FY09EM21-17	Al2O3	7.6666	7.8267	7.1927	0.4739	0.6340	6.6%	8.8%
2	FY09EM21-17	B2O3	4.7977	4.6990	4.5000	0.2977	0.1990	6.6%	4.4%
2	FY09EM21-17	BaO	0.0879	0.0955	0.0801	0.0078	0.0154	9.7%	19.2%
2	FY09EM21-17	CaO	0.1140	0.1181	0.1041	0.0100	0.0140	9.6%	13.5%
2	FY09EM21-17	CdO	0.2736	0.2736	0.2965	-0.0229	-0.0229	-7.7%	-7.7%
2	FY09EM21-17	Ce2O3	0.3736	0.3736	0.3606	0.0131	0.0131	3.6%	3.6%
2	FY09EM21-17	Cr2O3	0.0117	0.0113	0.0000	0.0117	0.0113		
2	FY09EM21-17	CuO	0.1380	0.1473	0.1282	0.0098	0.0191	7.6%	14.9%
2	FY09EM21-17	Fe2O3	13.8145	14.2951	13.9129	-0.0985	0.3821	-0.7%	2.7%
2	FY09EM21-17	La2O3	0.0985	0.0985	0.0978	0.0008	0.0008	0.8%	0.8%
2	FY09EM21-17	Li2O	6.9969	6.9096	6.7401	0.2568	0.1695	3.8%	2.5%
2	FY09EM21-17	MgO	0.0083	0.0088	0.0000	0.0083	0.0088		
2	FY09EM21-17	MnO	0.5901	0.5969	5.5000	-4.9099	-4.9031	-89.3%	-89.1%
2	FY09EM21-17	Na2O	15.0302	15.0343	14.8547	0.1755	0.1796	1.2%	1.2%
2	FY09EM21-17	NiO	0.0064	0.0071	0.0000	0.0064	0.0071		
2	FY09EM21-17	PbO	0.2052	0.2052	0.2163	-0.0111	-0.0111	-5.1%	-5.1%
2	FY09EM21-17	SiO2	41.2885	40.8388	39.1955	2.0930	1.6433	5.3%	4.2%
2	FY09EM21-17	SO4	0.4906	0.4906	0.4808	0.0098	0.0098	2.0%	2.0%
2	FY09EM21-17	TiO2	6.1257	6.5265	6.0000	0.1257	0.5265	2.1%	8.8%
2	FY09EM21-17	ZnO	0.1388	0.1388	0.1346	0.0042	0.0042	3.1%	3.1%
2	FY09EM21-17	ZrO2	0.2063	0.2063	0.2051	0.0012	0.0012	0.6%	0.6%
2	FY09EM21-17	Sum	98.4632	98.9016	100.0000	-1.5369	-1.0985	-1.5%	-1.1%
2	FY09EM21-18	Al2O3	11.0677	11.3587	10.9157	0.1521	0.4430	1.4%	4.1%
2	FY09EM21-18	B2O3	4.8620	4.8619	4.8441	0.0179	0.0178	0.4%	0.4%

Table A4. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by Glass ID for the Non-Rad Matrix 2 Study

Set	Glass #	Oxide	Measured (wt%)	Measured Bias-Corrected (BC) (wt%)	Targeted (wt%)	Difference of Measured	Difference of Meas BC	% Difference Measured	% Difference Meas BC
2	FY09EM21-18	BaO	0.0829	0.0907	0.0801	0.0028	0.0105	3.5%	13.2%
2	FY09EM21-18	CaO	0.4030	0.4285	0.4385	-0.0355	-0.0100	-8.1%	-2.3%
2	FY09EM21-18	CdO	0.2042	0.2042	0.2965	-0.0923	-0.0923	-31.1%	-31.1%
2	FY09EM21-18	Ce2O3	0.3452	0.3452	0.3606	-0.0153	-0.0153	-4.3%	-4.3%
2	FY09EM21-18	Cr2O3	0.0186	0.0178	0.0000	0.0186	0.0178		
2	FY09EM21-18	CuO	0.1242	0.1311	0.1282	-0.0040	0.0029	-3.1%	2.3%
2	FY09EM21-18	Fe2O3	6.6696	6.7145	6.7914	-0.1218	-0.0769	-1.8%	-1.1%
2	FY09EM21-18	La2O3	0.0850	0.0850	0.0978	-0.0127	-0.0127	-13.0%	-13.0%
2	FY09EM21-18	Li2O	5.3284	5.3999	5.4934	-0.1650	-0.0935	-3.0%	-1.7%
2	FY09EM21-18	MgO	0.0083	0.0090	0.0000	0.0083	0.0090		
2	FY09EM21-18	MnO	0.8015	0.7967	0.8350	-0.0335	-0.0383	-4.0%	-4.6%
2	FY09EM21-18	Na2O	16.1086	16.1622	17.0195	-0.9109	-0.8572	-5.4%	-5.0%
2	FY09EM21-18	NiO	0.0064	0.0073	0.0000	0.0064	0.0073		
2	FY09EM21-18	PbO	0.1899	0.1899	0.2163	-0.0265	-0.0265	-12.2%	-12.2%
2	FY09EM21-18	SiO2	49.7387	49.6111	49.6625	0.0762	-0.0514	0.2%	-0.1%
2	FY09EM21-18	SO4	0.4322	0.4322	0.4808	-0.0486	-0.0486	-10.1%	-10.1%
2	FY09EM21-18	TiO2	1.9599	2.0752	2.0000	-0.0401	0.0752	-2.0%	3.8%
2	FY09EM21-18	ZnO	0.1242	0.1242	0.1346	-0.0104	-0.0104	-7.8%	-7.8%
2	FY09EM21-18	ZrO2	0.1999	0.1999	0.2051	-0.0052	-0.0052	-2.5%	-2.5%
2	FY09EM21-18	Sum	98.7605	99.2452	100.0000	-1.2395	-0.7548	-1.2%	-0.8%
2	FY09EM21-19	Al2O3	5.8386	5.9921	5.7191	0.1194	0.2730	2.1%	4.8%
2	FY09EM21-19	B2O3	4.5803	4.5817	4.5009	0.0794	0.0808	1.8%	1.8%
2	FY09EM21-19	BaO	0.0056	0.0061	0.0000	0.0056	0.0061		
2	FY09EM21-19	CaO	4.0647	4.3222	4.0000	0.0647	0.3222	1.6%	8.1%
2	FY09EM21-19	CdO	0.0057	0.0057	0.0000	0.0057	0.0057		
2	FY09EM21-19	Ce2O3	0.0059	0.0059	0.0000	0.0059	0.0059		
2	FY09EM21-19	Cr2O3	0.0183	0.0174	0.0000	0.0183	0.0174		
2	FY09EM21-19	CuO	0.0063	0.0066	0.0000	0.0063	0.0066		
2	FY09EM21-19	Fe2O3	4.9825	5.0161	5.0000	-0.0175	0.0161	-0.3%	0.3%
2	FY09EM21-19	La2O3	0.0059	0.0059	0.0000	0.0059	0.0059		
2	FY09EM21-19	Li2O	3.9667	4.0199	4.0021	-0.0354	0.0178	-0.9%	0.4%
2	FY09EM21-19	MgO	0.0083	0.0090	0.0000	0.0083	0.0090		
2	FY09EM21-19	MnO	0.3034	0.3016	0.3000	0.0034	0.0016	1.1%	0.5%
2	FY09EM21-19	Na2O	16.7152	16.7709	18.0000	-1.2848	-1.2291	-7.1%	-6.8%
2	FY09EM21-19	NiO	0.8958	1.0223	0.9809	-0.0850	0.0415	-8.7%	4.2%
2	FY09EM21-19	PbO	0.0054	0.0054	0.0000	0.0054	0.0054		
2	FY09EM21-19	SiO2	51.4502	51.3132	51.4970	-0.0468	-0.1838	-0.1%	-0.4%
2	FY09EM21-19	SO4	0.0749	0.0749	0.0000	0.0749	0.0749		
2	FY09EM21-19	TiO2	5.8505	6.1946	6.0000	-0.1495	0.1946	-2.5%	3.2%
2	FY09EM21-19	ZnO	0.0062	0.0062	0.0000	0.0062	0.0062		
2	FY09EM21-19	ZrO2	0.0068	0.0068	0.0000	0.0068	0.0068		
2	FY09EM21-19	Sum	98.7970	99.6845	100.0000	-1.2030	-0.3155	-1.2%	-0.3%
2	FY09EM21-20	Al2O3	6.1598	6.3215	6.0242	0.1356	0.2973	2.3%	4.9%
2	FY09EM21-20	B2O3	5.4094	5.3005	5.3114	0.0980	-0.0109	1.8%	-0.2%
2	FY09EM21-20	BaO	0.0056	0.0061	0.0000	0.0056	0.0061		
2	FY09EM21-20	CaO	0.0070	0.0074	0.0000	0.0070	0.0074		
2	FY09EM21-20	CdO	0.0057	0.0057	0.0000	0.0057	0.0057		
2	FY09EM21-20	Ce2O3	0.0059	0.0059	0.0000	0.0059	0.0059		
2	FY09EM21-20	Cr2O3	0.1593	0.1521	0.2000	-0.0407	-0.0479	-20.3%	-23.9%
2	FY09EM21-20	CuO	0.0063	0.0066	0.0000	0.0063	0.0066		
2	FY09EM21-20	Fe2O3	11.3876	11.4649	11.8301	-0.4426	-0.3652	-3.7%	-3.1%
2	FY09EM21-20	La2O3	0.0059	0.0059	0.0000	0.0059	0.0059		
2	FY09EM21-20	Li2O	4.0152	3.9650	4.0000	0.0152	-0.0350	0.4%	-0.9%
2	FY09EM21-20	MgO	1.1782	1.2790	1.2691	-0.0908	0.0099	-7.2%	0.8%
2	FY09EM21-20	MnO	0.3002	0.2984	0.3000	0.0002	-0.0016	0.1%	-0.5%
2	FY09EM21-20	Na2O	16.9511	17.0066	18.0000	-1.0489	-0.9934	-5.8%	-5.5%
2	FY09EM21-20	NiO	2.3128	2.6398	2.5000	-0.1872	0.1398	-7.5%	5.6%
2	FY09EM21-20	PbO	0.0054	0.0054	0.0000	0.0054	0.0054		
2	FY09EM21-20	SiO2	47.8668	47.3455	48.5652	-0.6984	-1.2197	-1.4%	-2.5%
2	FY09EM21-20	SO4	0.0749	0.0749	0.0000	0.0749	0.0749		

Table A4. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by Glass ID for the Non-Rad Matrix 2 Study

Set	Glass #	Oxide	Measured (wt%)	Measured Bias-Corrected (BC) (wt%)	Targeted (wt%)	Difference of Measured	Difference of Meas BC	% Difference Measured	% Difference Meas BC
2	FY09EM21-20	TiO2	1.9766	2.0929	2.0000	-0.0234	0.0929	-1.2%	4.6%
2	FY09EM21-20	ZnO	0.0062	0.0062	0.0000	0.0062	0.0062		
2	FY09EM21-20	ZrO2	0.0068	0.0068	0.0000	0.0068	0.0068		
2	FY09EM21-20	Sum	97.8465	97.9970	99.9999	-2.1534	-2.0029	-2.2%	-2.0%
2	FY09EM21-21	Al2O3	4.8607	4.9622	4.8572	0.0035	0.1050	0.1%	2.2%
2	FY09EM21-21	B2O3	8.9513	8.9519	9.0097	-0.0584	-0.0578	-0.6%	-0.6%
2	FY09EM21-21	BaO	0.0801	0.0870	0.0801	0.0000	0.0069	0.0%	8.6%
2	FY09EM21-21	CaO	0.0070	0.0072	0.0000	0.0070	0.0072		
2	FY09EM21-21	CdO	0.2839	0.2839	0.2965	-0.0126	-0.0126	-4.3%	-4.3%
2	FY09EM21-21	Ce2O3	0.3581	0.3581	0.3606	-0.0025	-0.0025	-0.7%	-0.7%
2	FY09EM21-21	Cr2O3	0.1904	0.1838	0.2000	-0.0096	-0.0162	-4.8%	-8.1%
2	FY09EM21-21	CuO	0.1274	0.1360	0.1282	-0.0008	0.0078	-0.7%	6.1%
2	FY09EM21-21	Fe2O3	18.8363	19.4914	19.9511	-1.1148	-0.4597	-5.6%	-2.3%
2	FY09EM21-21	La2O3	0.0865	0.0865	0.0978	-0.0113	-0.0113	-11.5%	-11.5%
2	FY09EM21-21	Li2O	6.8839	6.9762	7.0000	-0.1161	-0.0238	-1.7%	-0.3%
2	FY09EM21-21	MgO	0.0083	0.0088	0.0000	0.0083	0.0088		
2	FY09EM21-21	MnO	1.0097	1.0213	0.9970	0.0127	0.0243	1.3%	2.4%
2	FY09EM21-21	Na2O	14.4236	14.4264	14.6666	-0.2430	-0.2403	-1.7%	-1.6%
2	FY09EM21-21	NiO	0.0064	0.0071	0.0000	0.0064	0.0071		
2	FY09EM21-21	PbO	0.2109	0.2109	0.2163	-0.0055	-0.0055	-2.5%	-2.5%
2	FY09EM21-21	SiO2	39.1492	39.0489	39.3055	-0.1563	-0.2566	-0.4%	-0.7%
2	FY09EM21-21	SO4	0.4741	0.4741	0.4808	-0.0067	-0.0067	-1.4%	-1.4%
2	FY09EM21-21	TiO2	1.9766	2.1059	2.0129	-0.0363	0.0930	-1.8%	4.6%
2	FY09EM21-21	ZnO	0.1316	0.1316	0.1346	-0.0030	-0.0030	-2.2%	-2.2%
2	FY09EM21-21	ZrO2	0.1976	0.1976	0.2051	-0.0076	-0.0076	-3.7%	-3.7%
2	FY09EM21-21	Sum	98.2535	99.1567	100.0000	-1.7465	-0.8433	-1.7%	-0.8%
2	FY09EM21-22	Al2O3	14.2610	14.5587	14.0414	0.2196	0.5172	1.6%	3.7%
2	FY09EM21-22	B2O3	13.2901	13.0236	13.1992	0.0909	-0.1756	0.7%	-1.3%
2	FY09EM21-22	BaO	0.0754	0.0818	0.0801	-0.0048	0.0017	-5.9%	2.1%
2	FY09EM21-22	CaO	0.0070	0.0072	0.0000	0.0070	0.0072		
2	FY09EM21-22	CdO	0.2659	0.2659	0.2965	-0.0306	-0.0306	-10.3%	-10.3%
2	FY09EM21-22	Ce2O3	0.3482	0.3482	0.3606	-0.0124	-0.0124	-3.4%	-3.4%
2	FY09EM21-22	Cr2O3	0.0132	0.0127	0.0000	0.0132	0.0127		
2	FY09EM21-22	CuO	0.1252	0.1336	0.1282	-0.0030	0.0054	-2.4%	4.2%
2	FY09EM21-22	Fe2O3	8.6211	8.9209	9.1773	-0.5563	-0.2564	-6.1%	-2.8%
2	FY09EM21-22	La2O3	0.0850	0.0850	0.0978	-0.0127	-0.0127	-13.0%	-13.0%
2	FY09EM21-22	Li2O	4.0582	4.0073	4.0000	0.0582	0.0073	1.5%	0.2%
2	FY09EM21-22	MgO	0.0083	0.0088	0.0000	0.0083	0.0088		
2	FY09EM21-22	MnO	0.3086	0.3122	0.3000	0.0086	0.0122	2.9%	4.1%
2	FY09EM21-22	Na2O	10.0561	10.0586	10.0000	0.0561	0.0586	0.6%	0.6%
2	FY09EM21-22	NiO	2.2301	2.4944	2.5000	-0.2699	-0.0056	-10.8%	-0.2%
2	FY09EM21-22	PbO	0.1944	0.1944	0.2163	-0.0219	-0.0219	-10.1%	-10.1%
2	FY09EM21-22	SiO2	43.6417	43.1665	42.7403	0.9014	0.4262	2.1%	1.0%
2	FY09EM21-22	SO4	0.4059	0.4059	0.4808	-0.0748	-0.0748	-15.6%	-15.6%
2	FY09EM21-22	TiO2	2.0016	2.1326	2.0417	-0.0401	0.0908	-2.0%	4.4%
2	FY09EM21-22	ZnO	0.1391	0.1391	0.1346	0.0045	0.0045	3.3%	3.3%
2	FY09EM21-22	ZrO2	0.1965	0.1965	0.2051	-0.0086	-0.0086	-4.2%	-4.2%
2	FY09EM21-22	Sum	100.3326	100.5540	100.0000	0.3326	0.5540	0.3%	0.6%
2	FY09EM21-23	Al2O3	13.9823	14.2742	13.9588	0.0235	0.3154	0.2%	2.3%
2	FY09EM21-23	B2O3	5.8119	5.8107	5.7805	0.0314	0.0302	0.5%	0.5%
2	FY09EM21-23	BaO	0.0762	0.0828	0.0801	-0.0039	0.0027	-4.9%	3.3%
2	FY09EM21-23	CaO	0.0070	0.0072	0.0000	0.0070	0.0072		
2	FY09EM21-23	CdO	0.2664	0.2664	0.2965	-0.0300	-0.0300	-10.1%	-10.1%
2	FY09EM21-23	Ce2O3	0.3490	0.3490	0.3606	-0.0115	-0.0115	-3.2%	-3.2%
2	FY09EM21-23	Cr2O3	0.0121	0.0116	0.0000	0.0121	0.0116		
2	FY09EM21-23	CuO	0.1221	0.1303	0.1282	-0.0062	0.0021	-4.8%	1.6%
2	FY09EM21-23	Fe2O3	11.3590	11.7541	12.1089	-0.7500	-0.3549	-6.2%	-2.9%
2	FY09EM21-23	La2O3	0.0859	0.0859	0.0978	-0.0118	-0.0118	-12.1%	-12.1%
2	FY09EM21-23	Li2O	3.8806	3.9326	4.0000	-0.1194	-0.0674	-3.0%	-1.7%
2	FY09EM21-23	MgO	1.4324	1.5189	1.5000	-0.0676	0.0189	-4.5%	1.3%

Table A4. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by Glass ID for the Non-Rad Matrix 2 Study

Set	Glass #	Oxide	Measured (wt%)	Measured Bias-Corrected (BC) (wt%)	Targeted (wt%)	Difference of Measured	Difference of Meas BC	% Difference Measured	% Difference Meas BC
2	FY09EM21-23	MnO	0.3034	0.3069	0.3000	0.0034	0.0069	1.1%	2.3%
2	FY09EM21-23	Na2O	9.8438	9.8456	10.0000	-0.1562	-0.1544	-1.6%	-1.5%
2	FY09EM21-23	NiO	0.0064	0.0071	0.0000	0.0064	0.0071		
2	FY09EM21-23	PbO	0.1931	0.1931	0.2163	-0.0233	-0.0233	-10.8%	-10.8%
2	FY09EM21-23	SiO2	44.0696	43.9483	44.3518	-0.2822	-0.4035	-0.6%	-0.9%
2	FY09EM21-23	SO4	0.3767	0.3767	0.4808	-0.1040	-0.1040	-21.6%	-21.6%
2	FY09EM21-23	TiO2	5.7046	6.0779	6.0000	-0.2954	0.0779	-4.9%	1.3%
2	FY09EM21-23	ZnO	0.1285	0.1285	0.1346	-0.0061	-0.0061	-4.5%	-4.5%
2	FY09EM21-23	ZrO2	0.1928	0.1928	0.2051	-0.0123	-0.0123	-6.0%	-6.0%
2	FY09EM21-23	Sum	98.2037	99.3008	100.0000	-1.7963	-0.6992	-1.8%	-0.7%
2	FY09EM21-24	Al2O3	10.5245	10.8009	10.5061	0.0184	0.2948	0.2%	2.8%
2	FY09EM21-24	B2O3	4.6206	4.6197	4.5000	0.1206	0.1197	2.7%	2.7%
2	FY09EM21-24	BaO	0.0765	0.0836	0.0801	-0.0036	0.0035	-4.6%	4.4%
2	FY09EM21-24	CaO	4.0297	4.2853	4.0000	0.0297	0.2853	0.7%	7.1%
2	FY09EM21-24	CdO	0.2530	0.2530	0.2965	-0.0435	-0.0435	-14.7%	-14.7%
2	FY09EM21-24	Ce2O3	0.3414	0.3414	0.3606	-0.0191	-0.0191	-5.3%	-5.3%
2	FY09EM21-24	Cr2O3	0.1743	0.1664	0.2000	-0.0257	-0.0336	-12.9%	-16.8%
2	FY09EM21-24	CuO	0.1214	0.1282	0.1282	-0.0068	-0.0001	-5.3%	0.0%
2	FY09EM21-24	Fe2O3	19.0865	19.2155	20.5597	-1.4732	-1.3442	-7.2%	-6.5%
2	FY09EM21-24	La2O3	0.0856	0.0856	0.0978	-0.0121	-0.0121	-12.4%	-12.4%
2	FY09EM21-24	Li2O	3.9129	3.9653	4.0000	-0.0871	-0.0347	-2.2%	-0.9%
2	FY09EM21-24	MgO	1.3660	1.4828	1.5000	-0.1340	-0.0172	-8.9%	-1.1%
2	FY09EM21-24	MnO	0.8464	0.8413	0.9172	-0.0708	-0.0759	-7.7%	-8.3%
2	FY09EM21-24	Na2O	9.9752	10.0082	10.0010	-0.0258	0.0072	-0.3%	0.1%
2	FY09EM21-24	NiO	0.0064	0.0073	0.0000	0.0064	0.0073		
2	FY09EM21-24	PbO	0.1893	0.1893	0.2163	-0.0270	-0.0270	-12.5%	-12.5%
2	FY09EM21-24	SiO2	38.4004	38.2992	37.8796	0.5208	0.4196	1.4%	1.1%
2	FY09EM21-24	SO4	0.3962	0.3962	0.4808	-0.0846	-0.0846	-17.6%	-17.6%
2	FY09EM21-24	TiO2	3.5403	3.7486	3.9364	-0.3961	-0.1878	-10.1%	-4.8%
2	FY09EM21-24	ZnO	0.1263	0.1263	0.1346	-0.0083	-0.0083	-6.1%	-6.1%
2	FY09EM21-24	ZrO2	0.1911	0.1911	0.2051	-0.0140	-0.0140	-6.8%	-6.8%
2	FY09EM21-24	Sum	98.2642	99.2353	100.0000	-1.7358	-0.7647	-1.7%	-0.8%
2	FY09EM21-25	Al2O3	6.4101	6.5440	6.2430	0.1671	0.3009	2.7%	4.8%
2	FY09EM21-25	B2O3	4.9828	4.8814	4.7295	0.2533	0.1519	5.4%	3.2%
2	FY09EM21-25	BaO	0.0056	0.0061	0.0000	0.0056	0.0061		
2	FY09EM21-25	CaO	4.1346	4.2857	4.0000	0.1346	0.2857	3.4%	7.1%
2	FY09EM21-25	CdO	0.0057	0.0057	0.0000	0.0057	0.0057		
2	FY09EM21-25	Ce2O3	0.0059	0.0059	0.0000	0.0059	0.0059		
2	FY09EM21-25	Cr2O3	0.1644	0.1587	0.2000	-0.0356	-0.0413	-17.8%	-20.6%
2	FY09EM21-25	CuO	0.0125	0.0133	0.0000	0.0125	0.0133		
2	FY09EM21-25	Fe2O3	7.5274	7.7892	7.8302	-0.3028	-0.0410	-3.9%	-0.5%
2	FY09EM21-25	La2O3	0.0059	0.0059	0.0000	0.0059	0.0059		
2	FY09EM21-25	Li2O	4.0098	3.9596	4.0000	0.0098	-0.0404	0.2%	-1.0%
2	FY09EM21-25	MgO	0.0083	0.0088	0.0000	0.0083	0.0088		
2	FY09EM21-25	MnO	5.6458	5.7102	5.5000	0.1458	0.2102	2.7%	3.8%
2	FY09EM21-25	Na2O	15.4009	15.4037	15.4638	-0.0629	-0.0601	-0.4%	-0.4%
2	FY09EM21-25	NiO	0.0064	0.0071	0.0000	0.0064	0.0071		
2	FY09EM21-25	PbO	0.0054	0.0054	0.0000	0.0054	0.0054		
2	FY09EM21-25	SiO2	48.8295	48.2955	50.0335	-1.2040	-1.7380	-2.4%	-3.5%
2	FY09EM21-25	SO4	0.0749	0.0749	0.0000	0.0749	0.0749		
2	FY09EM21-25	TiO2	2.0058	2.1370	2.0000	0.0058	0.1370	0.3%	6.9%
2	FY09EM21-25	ZnO	0.0062	0.0062	0.0000	0.0062	0.0062		
2	FY09EM21-25	ZrO2	0.0128	0.0128	0.0000	0.0128	0.0128		
2	FY09EM21-25	Sum	99.2606	99.3172	100.0000	-0.7394	-0.6828	-0.7%	-0.7%
2	FY09EM21-26	Al2O3	13.7319	14.0186	13.6557	0.0762	0.3628	0.6%	2.7%
2	FY09EM21-26	B2O3	7.5346	7.3826	7.5763	-0.0417	-0.1937	-0.6%	-2.6%
2	FY09EM21-26	BaO	0.0056	0.0061	0.0000	0.0056	0.0061		
2	FY09EM21-26	CaO	0.0073	0.0076	0.0000	0.0073	0.0076		
2	FY09EM21-26	CdO	0.0057	0.0057	0.0000	0.0057	0.0057		
2	FY09EM21-26	Ce2O3	0.0059	0.0059	0.0000	0.0059	0.0059		

Table A4. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by Glass ID for the Non-Rad Matrix 2 Study

Set	Glass #	Oxide	Measured (wt%)	Measured Bias-Corrected (BC) (wt%)	Targeted (wt%)	Difference of Measured	Difference of Meas BC	% Difference Measured	% Difference Meas BC
2	FY09EM21-26	Cr2O3	0.1352	0.1305	0.2000	-0.0648	-0.0695	-32.4%	-34.7%
2	FY09EM21-26	CuO	0.0063	0.0067	0.0000	0.0063	0.0067		
2	FY09EM21-26	Fe2O3	4.7895	4.9561	5.0000	-0.2105	-0.0439	-4.2%	-0.9%
2	FY09EM21-26	La2O3	0.0059	0.0059	0.0000	0.0059	0.0059		
2	FY09EM21-26	Li2O	4.0905	4.0393	4.0010	0.0895	0.0383	2.2%	1.0%
2	FY09EM21-26	MgO	1.4593	1.5474	1.5000	-0.0407	0.0474	-2.7%	3.2%
2	FY09EM21-26	MnO	5.1842	5.2433	5.0509	0.1333	0.1924	2.6%	3.8%
2	FY09EM21-26	Na2O	11.9264	11.9294	11.9564	-0.0299	-0.0270	-0.3%	-0.2%
2	FY09EM21-26	NiO	0.0064	0.0071	0.0000	0.0064	0.0071		
2	FY09EM21-26	PbO	0.0054	0.0054	0.0000	0.0054	0.0054		
2	FY09EM21-26	SiO2	45.4066	44.9119	45.7031	-0.2965	-0.7912	-0.6%	-1.7%
2	FY09EM21-26	SO4	0.0749	0.0749	0.0000	0.0749	0.0749		
2	FY09EM21-26	TiO2	4.8581	5.1759	5.3566	-0.4985	-0.1806	-9.3%	-3.4%
2	FY09EM21-26	ZnO	0.0062	0.0062	0.0000	0.0062	0.0062		
2	FY09EM21-26	ZrO2	0.0068	0.0068	0.0000	0.0068	0.0068		
2	FY09EM21-26	Sum	99.2525	99.4732	100.0000	-0.7474	-0.5268	-0.7%	-0.5%
2	FY09EM21-27	Al2O3	7.2887	7.4801	7.1923	0.0965	0.2878	1.3%	4.0%
2	FY09EM21-27	B2O3	6.8664	6.8674	6.9784	-0.1120	-0.1110	-1.6%	-1.6%
2	FY09EM21-27	BaO	0.0399	0.0437	0.0431	-0.0032	0.0005	-7.5%	1.2%
2	FY09EM21-27	CaO	1.7945	1.9083	1.8080	-0.0135	0.1003	-0.7%	5.5%
2	FY09EM21-27	CdO	0.1351	0.1351	0.1596	-0.0246	-0.0246	-15.4%	-15.4%
2	FY09EM21-27	Ce2O3	0.1845	0.1845	0.1942	-0.0097	-0.0097	-5.0%	-5.0%
2	FY09EM21-27	Cr2O3	0.0917	0.0876	0.1000	-0.0083	-0.0124	-8.3%	-12.4%
2	FY09EM21-27	CuO	0.0660	0.0697	0.0690	-0.0030	0.0007	-4.3%	1.0%
2	FY09EM21-27	Fe2O3	12.6850	12.7713	13.1246	-0.4395	-0.3533	-3.3%	-2.7%
2	FY09EM21-27	La2O3	0.0469	0.0469	0.0526	-0.0057	-0.0057	-10.9%	-10.9%
2	FY09EM21-27	Li2O	4.9463	5.0126	5.1023	-0.1560	-0.0897	-3.1%	-1.8%
2	FY09EM21-27	MgO	0.6716	0.7291	0.6834	-0.0118	0.0457	-1.7%	6.7%
2	FY09EM21-27	MnO	2.6986	2.6822	2.6230	0.0757	0.0593	2.9%	2.3%
2	FY09EM21-27	Na2O	12.6308	12.6721	12.7162	-0.0855	-0.0441	-0.7%	-0.3%
2	FY09EM21-27	NiO	1.1252	1.2844	1.2913	-0.1661	-0.0069	-12.9%	-0.5%
2	FY09EM21-27	PbO	0.1039	0.1039	0.1165	-0.0125	-0.0125	-10.8%	-10.8%
2	FY09EM21-27	SiO2	43.0534	42.9461	43.3778	-0.3244	-0.4317	-0.7%	-1.0%
2	FY09EM21-27	SO4	0.2472	0.2472	0.2589	-0.0117	-0.0117	-4.5%	-4.5%
2	FY09EM21-27	TiO2	3.8906	4.1195	3.9259	-0.0353	0.1935	-0.9%	4.9%
2	FY09EM21-27	ZnO	0.0678	0.0678	0.0725	-0.0046	-0.0046	-6.4%	-6.4%
2	FY09EM21-27	ZrO2	0.1087	0.1087	0.1105	-0.0017	-0.0017	-1.6%	-1.6%
2	FY09EM21-27	Sum	98.7430	99.5681	100.0000	-1.2570	-0.4319	-1.3%	-0.4%

Table A5. Measured, Measured Bias-Corrected (BC), and Targeted Chemical Compositions for the Samples of the Rad Glasses of the Matrix 2 Study

Set	Prep Method	Glass ID	Lab ID	Analyte	Measured	Measured bc	Targeted
2	LM	FY09EM21-28	b04LM11	BaO (wt%)	0.0391	0.0401	0.0423
2	LM	FY09EM21-28	b04LM12	BaO (wt%)	0.0391	0.0399	0.0423
2	LM	FY09EM21-28	b04LM21	BaO (wt%)	0.0435	0.0447	0.0423
2	LM	FY09EM21-28	b04LM22	BaO (wt%)	0.0424	0.0434	0.0423
2	LM	FY09EM21-28	b04LM11	CaO (wt%)	1.6231	1.6348	1.7718
2	LM	FY09EM21-28	b04LM12	CaO (wt%)	1.6231	1.6380	1.7718
2	LM	FY09EM21-28	b04LM21	CaO (wt%)	1.8050	1.8180	1.7718
2	LM	FY09EM21-28	b04LM22	CaO (wt%)	1.8050	1.8215	1.7718
2	LM	FY09EM21-28	b04LM11	CdO (wt%)	0.1257	0.1257	0.1564
2	LM	FY09EM21-28	b04LM12	CdO (wt%)	0.1211	0.1211	0.1564
2	LM	FY09EM21-28	b04LM21	CdO (wt%)	0.1382	0.1382	0.1564
2	LM	FY09EM21-28	b04LM22	CdO (wt%)	0.1348	0.1348	0.1564
2	LM	FY09EM21-28	b04LM11	Ce2O3 (wt%)	0.1722	0.1722	0.1903
2	LM	FY09EM21-28	b04LM12	Ce2O3 (wt%)	0.1652	0.1652	0.1903
2	LM	FY09EM21-28	b04LM21	Ce2O3 (wt%)	0.1839	0.1839	0.1903
2	LM	FY09EM21-28	b04LM22	Ce2O3 (wt%)	0.1816	0.1816	0.1903
2	LM	FY09EM21-28	b04LM11	Cr2O3 (wt%)	0.0935	0.0942	0.0980
2	LM	FY09EM21-28	b04LM12	Cr2O3 (wt%)	0.0950	0.0927	0.0980
2	LM	FY09EM21-28	b04LM21	Cr2O3 (wt%)	0.0994	0.1001	0.0980
2	LM	FY09EM21-28	b04LM22	Cr2O3 (wt%)	0.1038	0.1013	0.0980
2	LM	FY09EM21-28	b04LM11	CuO (wt%)	0.0688	0.0693	0.0677
2	LM	FY09EM21-28	b04LM12	CuO (wt%)	0.0776	0.0793	0.0677
2	LM	FY09EM21-28	b04LM21	CuO (wt%)	0.0814	0.0819	0.0677
2	LM	FY09EM21-28	b04LM22	CuO (wt%)	0.0876	0.0895	0.0677
2	LM	FY09EM21-28	b04LM11	K2O (wt%)	0.0301	0.0309	0.0000
2	LM	FY09EM21-28	b04LM12	K2O (wt%)	0.0687	0.0712	0.0000
2	LM	FY09EM21-28	b04LM21	K2O (wt%)	0.0301	0.0309	0.0000
2	LM	FY09EM21-28	b04LM22	K2O (wt%)	0.0301	0.0312	0.0000
2	LM	FY09EM21-28	b04LM11	La2O3 (wt%)	0.0387	0.0387	0.0516
2	LM	FY09EM21-28	b04LM12	La2O3 (wt%)	0.0387	0.0387	0.0516
2	LM	FY09EM21-28	b04LM21	La2O3 (wt%)	0.0410	0.0410	0.0516
2	LM	FY09EM21-28	b04LM22	La2O3 (wt%)	0.0422	0.0422	0.0516
2	LM	FY09EM21-28	b04LM11	MgO (wt%)	0.6202	0.6222	0.6698
2	LM	FY09EM21-28	b04LM12	MgO (wt%)	0.6119	0.6172	0.6698
2	LM	FY09EM21-28	b04LM21	MgO (wt%)	0.6832	0.6854	0.6698
2	LM	FY09EM21-28	b04LM22	MgO (wt%)	0.6816	0.6875	0.6698
2	LM	FY09EM21-28	b04LM11	MnO (wt%)	2.2209	2.3133	2.5705
2	LM	FY09EM21-28	b04LM12	MnO (wt%)	2.2338	2.2969	2.5705
2	LM	FY09EM21-28	b04LM21	MnO (wt%)	2.4662	2.5688	2.5705
2	LM	FY09EM21-28	b04LM22	MnO (wt%)	2.4920	2.5624	2.5705
2	LM	FY09EM21-28	b04LM11	Na2O (wt%)	11.8759	11.5622	12.4619
2	LM	FY09EM21-28	b04LM12	Na2O (wt%)	11.2154	11.4592	12.4619
2	LM	FY09EM21-28	b04LM21	Na2O (wt%)	12.9947	12.6514	12.4619
2	LM	FY09EM21-28	b04LM22	Na2O (wt%)	12.3612	12.6299	12.4619
2	LM	FY09EM21-28	b04LM11	NiO (wt%)	1.0651	1.0471	1.2654
2	LM	FY09EM21-28	b04LM12	NiO (wt%)	1.0320	1.0101	1.2654
2	LM	FY09EM21-28	b04LM21	NiO (wt%)	1.1592	1.1396	1.2654
2	LM	FY09EM21-28	b04LM22	NiO (wt%)	1.1567	1.1321	1.2654
2	LM	FY09EM21-28	b04LM11	PbO (wt%)	0.1002	0.1002	0.1142
2	LM	FY09EM21-28	b04LM12	PbO (wt%)	0.0969	0.0969	0.1142
2	LM	FY09EM21-28	b04LM21	PbO (wt%)	0.1056	0.1056	0.1142
2	LM	FY09EM21-28	b04LM22	PbO (wt%)	0.1088	0.1088	0.1142
2	LM	FY09EM21-28	b04LM11	SiO2 (wt%)	38.7213	39.1803	42.5103
2	LM	FY09EM21-28	b04LM12	SiO2 (wt%)	37.8656	38.5359	42.5103
2	LM	FY09EM21-28	b04LM21	SiO2 (wt%)	42.7860	43.2931	42.5103
2	LM	FY09EM21-28	b04LM22	SiO2 (wt%)	42.1442	42.8902	42.5103
2	LM	FY09EM21-28	b04LM11	SO4 (wt%)	0.2247	0.2247	0.2537
2	LM	FY09EM21-28	b04LM12	SO4 (wt%)	0.2247	0.2247	0.2537
2	LM	FY09EM21-28	b04LM21	SO4 (wt%)	0.2247	0.2247	0.2537
2	LM	FY09EM21-28	b04LM22	SO4 (wt%)	0.2247	0.2247	0.2537
2	LM	FY09EM21-28	b04LM11	TiO2 (wt%)	3.2192	3.4115	3.8474
2	LM	FY09EM21-28	b04LM12	TiO2 (wt%)	3.2359	3.4143	3.8474
2	LM	FY09EM21-28	b04LM21	TiO2 (wt%)	3.5695	3.7827	3.8474
2	LM	FY09EM21-28	b04LM22	TiO2 (wt%)	3.5862	3.7839	3.8474
2	LM	FY09EM21-28	b04LM11	U3O8 (wt%)	1.8631	1.8727	2.0000
2	LM	FY09EM21-28	b04LM12	U3O8 (wt%)	1.9811	1.9248	2.0000
2	LM	FY09EM21-28	b04LM21	U3O8 (wt%)	2.2051	2.2164	2.0000
2	LM	FY09EM21-28	b04LM22	U3O8 (wt%)	2.2051	2.1425	2.0000
2	LM	FY09EM21-28	b04LM11	ZnO (wt%)	0.0747	0.0747	0.0710
2	LM	FY09EM21-28	b04LM12	ZnO (wt%)	0.0759	0.0759	0.0710
2	LM	FY09EM21-28	b04LM21	ZnO (wt%)	0.0809	0.0809	0.0710

Table A5. Measured, Measured Bias-Corrected (BC), and Targeted Chemical Compositions for the Samples of the Rad Glasses of the Matrix 2 Study

Set	Prep Method	Glass ID	Lab ID	Analyte	Measured	Measured bc	Targeted
2	LM	FY09EM21-28	b04LM22	ZnO (wt%)	0.0846	0.0846	0.0710
2	LM	FY09EM21-28	b04LM11	ZrO2 (wt%)	0.0946	0.0946	0.1082
2	LM	FY09EM21-28	b04LM12	ZrO2 (wt%)	0.0905	0.0905	0.1082
2	LM	FY09EM21-28	b04LM21	ZrO2 (wt%)	0.1040	0.1040	0.1082
2	LM	FY09EM21-28	b04LM22	ZrO2 (wt%)	0.1054	0.1054	0.1082
2	PF	FY09EM21-28	b04PF11	Al2O3 (wt%)	7.2179	7.5732	7.0484
2	PF	FY09EM21-28	b04PF12	Al2O3 (wt%)	7.1423	7.2962	7.0484
2	PF	FY09EM21-28	b04PF21	Al2O3 (wt%)	7.0856	7.4345	7.0484
2	PF	FY09EM21-28	b04PF22	Al2O3 (wt%)	7.2368	7.3927	7.0484
2	PF	FY09EM21-28	b04PF11	B2O3 (wt%)	6.7940	7.2501	6.8388
2	PF	FY09EM21-28	b04PF12	B2O3 (wt%)	6.7296	7.1185	6.8388
2	PF	FY09EM21-28	b04PF21	B2O3 (wt%)	6.6652	7.1127	6.8388
2	PF	FY09EM21-28	b04PF22	B2O3 (wt%)	6.7940	7.1866	6.8388
2	PF	FY09EM21-28	b04PF11	Fe2O3 (wt%)	12.6243	13.0159	12.8621
2	PF	FY09EM21-28	b04PF12	Fe2O3 (wt%)	12.3526	12.6343	12.8621
2	PF	FY09EM21-28	b04PF21	Fe2O3 (wt%)	12.4098	12.7948	12.8621
2	PF	FY09EM21-28	b04PF22	Fe2O3 (wt%)	12.4813	12.7659	12.8621
2	PF	FY09EM21-28	b04PF11	Li2O (wt%)	4.7149	5.0961	5.0003
2	PF	FY09EM21-28	b04PF12	Li2O (wt%)	4.7579	4.9518	5.0003
2	PF	FY09EM21-28	b04PF21	Li2O (wt%)	4.7579	5.1426	5.0003
2	PF	FY09EM21-28	b04PF22	Li2O (wt%)	4.8225	5.0190	5.0003
2	LM	FY09EM21-29	b15LM11	BaO (wt%)	0.0447	0.0459	0.0414
2	LM	FY09EM21-29	b15LM12	BaO (wt%)	0.0447	0.0456	0.0414
2	LM	FY09EM21-29	b15LM21	BaO (wt%)	0.0435	0.0447	0.0414
2	LM	FY09EM21-29	b15LM22	BaO (wt%)	0.0447	0.0456	0.0414
2	LM	FY09EM21-29	b15LM11	CaO (wt%)	1.7490	1.7616	1.7357
2	LM	FY09EM21-29	b15LM12	CaO (wt%)	1.7630	1.7792	1.7357
2	LM	FY09EM21-29	b15LM21	CaO (wt%)	1.7350	1.7476	1.7357
2	LM	FY09EM21-29	b15LM22	CaO (wt%)	1.7490	1.7650	1.7357
2	LM	FY09EM21-29	b15LM11	CdO (wt%)	0.1496	0.1496	0.1533
2	LM	FY09EM21-29	b15LM12	CdO (wt%)	0.1462	0.1462	0.1533
2	LM	FY09EM21-29	b15LM21	CdO (wt%)	0.1474	0.1474	0.1533
2	LM	FY09EM21-29	b15LM22	CdO (wt%)	0.1451	0.1451	0.1533
2	LM	FY09EM21-29	b15LM11	Ce2O3 (wt%)	0.1898	0.1898	0.1864
2	LM	FY09EM21-29	b15LM12	Ce2O3 (wt%)	0.1816	0.1816	0.1864
2	LM	FY09EM21-29	b15LM21	Ce2O3 (wt%)	0.1862	0.1862	0.1864
2	LM	FY09EM21-29	b15LM22	Ce2O3 (wt%)	0.1804	0.1804	0.1864
2	LM	FY09EM21-29	b15LM11	Cr2O3 (wt%)	0.0935	0.0942	0.0960
2	LM	FY09EM21-29	b15LM12	Cr2O3 (wt%)	0.0979	0.0956	0.0960
2	LM	FY09EM21-29	b15LM21	Cr2O3 (wt%)	0.0906	0.0913	0.0960
2	LM	FY09EM21-29	b15LM22	Cr2O3 (wt%)	0.0950	0.0927	0.0960
2	LM	FY09EM21-29	b15LM11	CuO (wt%)	0.0864	0.0869	0.0663
2	LM	FY09EM21-29	b15LM12	CuO (wt%)	0.0839	0.0857	0.0663
2	LM	FY09EM21-29	b15LM21	CuO (wt%)	0.0776	0.0781	0.0663
2	LM	FY09EM21-29	b15LM22	CuO (wt%)	0.0864	0.0882	0.0663
2	LM	FY09EM21-29	b15LM11	K2O (wt%)	0.0301	0.0309	0.0000
2	LM	FY09EM21-29	b15LM12	K2O (wt%)	0.0301	0.0312	0.0000
2	LM	FY09EM21-29	b15LM21	K2O (wt%)	0.0301	0.0309	0.0000
2	LM	FY09EM21-29	b15LM22	K2O (wt%)	0.0301	0.0312	0.0000
2	LM	FY09EM21-29	b15LM11	La2O3 (wt%)	0.0446	0.0446	0.0505
2	LM	FY09EM21-29	b15LM12	La2O3 (wt%)	0.0446	0.0446	0.0505
2	LM	FY09EM21-29	b15LM21	La2O3 (wt%)	0.0434	0.0434	0.0505
2	LM	FY09EM21-29	b15LM22	La2O3 (wt%)	0.0446	0.0446	0.0505
2	LM	FY09EM21-29	b15LM11	MgO (wt%)	0.6633	0.6654	0.6561
2	LM	FY09EM21-29	b15LM12	MgO (wt%)	0.6583	0.6641	0.6561
2	LM	FY09EM21-29	b15LM21	MgO (wt%)	0.6583	0.6604	0.6561
2	LM	FY09EM21-29	b15LM22	MgO (wt%)	0.6534	0.6590	0.6561
2	LM	FY09EM21-29	b15LM11	MnO (wt%)	2.3758	2.4747	2.5180
2	LM	FY09EM21-29	b15LM12	MnO (wt%)	2.4145	2.4828	2.5180
2	LM	FY09EM21-29	b15LM21	MnO (wt%)	2.3629	2.4612	2.5180
2	LM	FY09EM21-29	b15LM22	MnO (wt%)	2.4016	2.4695	2.5180
2	LM	FY09EM21-29	b15LM11	Na2O (wt%)	12.8869	12.5465	12.2076
2	LM	FY09EM21-29	b15LM12	Na2O (wt%)	11.9298	12.1892	12.2076
2	LM	FY09EM21-29	b15LM21	Na2O (wt%)	12.6847	12.3496	12.2076
2	LM	FY09EM21-29	b15LM22	Na2O (wt%)	11.9028	12.1616	12.2076
2	LM	FY09EM21-29	b15LM11	NiO (wt%)	1.0753	1.0571	1.2396
2	LM	FY09EM21-29	b15LM12	NiO (wt%)	1.0676	1.0449	1.2396
2	LM	FY09EM21-29	b15LM21	NiO (wt%)	1.0816	1.0633	1.2396
2	LM	FY09EM21-29	b15LM22	NiO (wt%)	1.0880	1.0649	1.2396
2	LM	FY09EM21-29	b15LM11	PbO (wt%)	0.1282	0.1282	0.1118
2	LM	FY09EM21-29	b15LM12	PbO (wt%)	0.1325	0.1325	0.1118

Table A5. Measured, Measured Bias-Corrected (BC), and Targeted Chemical Compositions for the Samples of the Rad Glasses of the Matrix 2 Study

Set	Prep Method	Glass ID	Lab ID	Analyte	Measured	Measured bc	Targeted
2	LM	FY09EM21-29	b15LM21	PbO (wt%)	0.1260	0.1260	0.1118
2	LM	FY09EM21-29	b15LM22	PbO (wt%)	0.1325	0.1325	0.1118
2	LM	FY09EM21-29	b15LM11	SiO2 (wt%)	41.7164	42.2108	41.6427
2	LM	FY09EM21-29	b15LM12	SiO2 (wt%)	41.5024	42.2371	41.6427
2	LM	FY09EM21-29	b15LM21	SiO2 (wt%)	40.6467	41.1284	41.6427
2	LM	FY09EM21-29	b15LM22	SiO2 (wt%)	40.6467	41.3662	41.6427
2	LM	FY09EM21-29	b15LM11	SO4 (wt%)	0.2247	0.2247	0.2485
2	LM	FY09EM21-29	b15LM12	SO4 (wt%)	0.2247	0.2247	0.2485
2	LM	FY09EM21-29	b15LM21	SO4 (wt%)	0.2247	0.2247	0.2485
2	LM	FY09EM21-29	b15LM22	SO4 (wt%)	0.2247	0.2247	0.2485
2	LM	FY09EM21-29	b15LM11	TiO2 (wt%)	3.5528	3.7650	3.7689
2	LM	FY09EM21-29	b15LM12	TiO2 (wt%)	3.6029	3.8015	3.7689
2	LM	FY09EM21-29	b15LM21	TiO2 (wt%)	3.5362	3.7474	3.7689
2	LM	FY09EM21-29	b15LM22	TiO2 (wt%)	3.5862	3.7839	3.7689
2	LM	FY09EM21-29	b15LM11	U3O8 (wt%)	3.9975	4.0179	4.0000
2	LM	FY09EM21-29	b15LM12	U3O8 (wt%)	4.0564	3.9413	4.0000
2	LM	FY09EM21-29	b15LM21	U3O8 (wt%)	3.9739	3.9942	4.0000
2	LM	FY09EM21-29	b15LM22	U3O8 (wt%)	4.0329	3.9183	4.0000
2	LM	FY09EM21-29	b15LM11	ZnO (wt%)	0.0747	0.0747	0.0696
2	LM	FY09EM21-29	b15LM12	ZnO (wt%)	0.0772	0.0772	0.0696
2	LM	FY09EM21-29	b15LM21	ZnO (wt%)	0.0734	0.0734	0.0696
2	LM	FY09EM21-29	b15LM22	ZnO (wt%)	0.0772	0.0772	0.0696
2	LM	FY09EM21-29	b15LM11	ZrO2 (wt%)	0.1040	0.1040	0.1060
2	LM	FY09EM21-29	b15LM12	ZrO2 (wt%)	0.1000	0.1000	0.1060
2	LM	FY09EM21-29	b15LM21	ZrO2 (wt%)	0.0837	0.0837	0.1060
2	LM	FY09EM21-29	b15LM22	ZrO2 (wt%)	0.0878	0.0878	0.1060
2	PF	FY09EM21-29	b15PF11	Al2O3 (wt%)	7.2179	7.2491	6.9046
2	PF	FY09EM21-29	b15PF12	Al2O3 (wt%)	7.2557	7.2588	6.9046
2	PF	FY09EM21-29	b15PF21	Al2O3 (wt%)	7.2935	7.3250	6.9046
2	PF	FY09EM21-29	b15PF22	Al2O3 (wt%)	7.1990	7.2021	6.9046
2	PF	FY09EM21-29	b15PF11	B2O3 (wt%)	6.3754	6.8948	6.6992
2	PF	FY09EM21-29	b15PF12	B2O3 (wt%)	6.6652	6.9290	6.6992
2	PF	FY09EM21-29	b15PF21	B2O3 (wt%)	6.5042	7.0341	6.6992
2	PF	FY09EM21-29	b15PF22	B2O3 (wt%)	6.6008	6.8621	6.6992
2	PF	FY09EM21-29	b15PF11	Fe2O3 (wt%)	12.2239	12.2789	12.5996
2	PF	FY09EM21-29	b15PF12	Fe2O3 (wt%)	12.3669	12.1907	12.5996
2	PF	FY09EM21-29	b15PF21	Fe2O3 (wt%)	12.4670	12.5231	12.5996
2	PF	FY09EM21-29	b15PF22	Fe2O3 (wt%)	12.8101	12.6276	12.5996
2	PF	FY09EM21-29	b15PF11	Li2O (wt%)	4.8656	4.9881	4.8982
2	PF	FY09EM21-29	b15PF12	Li2O (wt%)	4.8440	4.9496	4.8982
2	PF	FY09EM21-29	b15PF21	Li2O (wt%)	4.9301	5.0544	4.8982
2	PF	FY09EM21-29	b15PF22	Li2O (wt%)	4.9086	5.0156	4.8982
2	LM	FY09EM21-30	b18LM11	BaO (wt%)	0.0424	0.0430	0.0406
2	LM	FY09EM21-30	b18LM12	BaO (wt%)	0.0424	0.0431	0.0406
2	LM	FY09EM21-30	b18LM21	BaO (wt%)	0.0435	0.0442	0.0406
2	LM	FY09EM21-30	b18LM22	BaO (wt%)	0.0424	0.0431	0.0406
2	LM	FY09EM21-30	b18LM11	CaO (wt%)	1.6371	1.6376	1.6995
2	LM	FY09EM21-30	b18LM12	CaO (wt%)	1.6091	1.6610	1.6995
2	LM	FY09EM21-30	b18LM21	CaO (wt%)	1.6790	1.6795	1.6995
2	LM	FY09EM21-30	b18LM22	CaO (wt%)	1.6511	1.7043	1.6995
2	LM	FY09EM21-30	b18LM11	CdO (wt%)	0.1371	0.1371	0.1501
2	LM	FY09EM21-30	b18LM12	CdO (wt%)	0.1359	0.1359	0.1501
2	LM	FY09EM21-30	b18LM21	CdO (wt%)	0.1451	0.1451	0.1501
2	LM	FY09EM21-30	b18LM22	CdO (wt%)	0.1416	0.1416	0.1501
2	LM	FY09EM21-30	b18LM11	Ce2O3 (wt%)	0.1722	0.1722	0.1825
2	LM	FY09EM21-30	b18LM12	Ce2O3 (wt%)	0.1734	0.1734	0.1825
2	LM	FY09EM21-30	b18LM21	Ce2O3 (wt%)	0.1745	0.1745	0.1825
2	LM	FY09EM21-30	b18LM22	Ce2O3 (wt%)	0.1839	0.1839	0.1825
2	LM	FY09EM21-30	b18LM11	Cr2O3 (wt%)	0.0848	0.0846	0.0940
2	LM	FY09EM21-30	b18LM12	Cr2O3 (wt%)	0.0837	0.0849	0.0940
2	LM	FY09EM21-30	b18LM21	Cr2O3 (wt%)	0.0892	0.0890	0.0940
2	LM	FY09EM21-30	b18LM22	Cr2O3 (wt%)	0.0862	0.0874	0.0940
2	LM	FY09EM21-30	b18LM11	CuO (wt%)	0.0851	0.0872	0.0649
2	LM	FY09EM21-30	b18LM12	CuO (wt%)	0.0739	0.0773	0.0649
2	LM	FY09EM21-30	b18LM21	CuO (wt%)	0.0839	0.0860	0.0649
2	LM	FY09EM21-30	b18LM22	CuO (wt%)	0.0789	0.0825	0.0649
2	LM	FY09EM21-30	b18LM11	K2O (wt%)	0.0301	0.0304	0.0000
2	LM	FY09EM21-30	b18LM12	K2O (wt%)	0.0301	0.0304	0.0000
2	LM	FY09EM21-30	b18LM21	K2O (wt%)	0.0301	0.0304	0.0000
2	LM	FY09EM21-30	b18LM22	K2O (wt%)	0.0301	0.0304	0.0000
2	LM	FY09EM21-30	b18LM11	La2O3 (wt%)	0.0273	0.0273	0.0495

Table A5. Measured, Measured Bias-Corrected (BC), and Targeted Chemical Compositions for the Samples of the Rad Glasses of the Matrix 2 Study

Set	Prep Method	Glass ID	Lab ID	Analyte	Measured	Measured bc	Targeted
2	LM	FY09EM21-30	b18LM12	La2O3 (wt%)	0.0276	0.0276	0.0495
2	LM	FY09EM21-30	b18LM21	La2O3 (wt%)	0.0359	0.0359	0.0495
2	LM	FY09EM21-30	b18LM22	La2O3 (wt%)	0.0367	0.0367	0.0495
2	LM	FY09EM21-30	b18LM11	MgO (wt%)	0.6318	0.6358	0.6424
2	LM	FY09EM21-30	b18LM12	MgO (wt%)	0.6384	0.6340	0.6424
2	LM	FY09EM21-30	b18LM21	MgO (wt%)	0.6517	0.6558	0.6424
2	LM	FY09EM21-30	b18LM22	MgO (wt%)	0.6550	0.6505	0.6424
2	LM	FY09EM21-30	b18LM11	MnO (wt%)	2.2983	2.3694	2.4656
2	LM	FY09EM21-30	b18LM12	MnO (wt%)	2.3242	2.3656	2.4656
2	LM	FY09EM21-30	b18LM21	MnO (wt%)	2.3758	2.4492	2.4656
2	LM	FY09EM21-30	b18LM22	MnO (wt%)	2.4016	2.4444	2.4656
2	LM	FY09EM21-30	b18LM11	Na2O (wt%)	11.5254	11.5348	11.9532
2	LM	FY09EM21-30	b18LM12	Na2O (wt%)	11.5658	11.5695	11.9532
2	LM	FY09EM21-30	b18LM21	Na2O (wt%)	11.8894	11.8991	11.9532
2	LM	FY09EM21-30	b18LM22	Na2O (wt%)	11.7276	11.7313	11.9532
2	LM	FY09EM21-30	b18LM11	NiO (wt%)	1.0256	1.0055	1.2138
2	LM	FY09EM21-30	b18LM12	NiO (wt%)	1.0218	1.0233	1.2138
2	LM	FY09EM21-30	b18LM21	NiO (wt%)	1.0765	1.0554	1.2138
2	LM	FY09EM21-30	b18LM22	NiO (wt%)	1.0562	1.0577	1.2138
2	LM	FY09EM21-30	b18LM11	PbO (wt%)	0.0840	0.0840	0.1095
2	LM	FY09EM21-30	b18LM12	PbO (wt%)	0.0808	0.0808	0.1095
2	LM	FY09EM21-30	b18LM21	PbO (wt%)	0.0894	0.0894	0.1095
2	LM	FY09EM21-30	b18LM22	PbO (wt%)	0.0829	0.0829	0.1095
2	LM	FY09EM21-30	b18LM11	SiO2 (wt%)	38.2935	39.3122	40.7751
2	LM	FY09EM21-30	b18LM12	SiO2 (wt%)	38.2935	39.1410	40.7751
2	LM	FY09EM21-30	b18LM21	SiO2 (wt%)	39.7910	40.8495	40.7751
2	LM	FY09EM21-30	b18LM22	SiO2 (wt%)	39.5771	40.4530	40.7751
2	LM	FY09EM21-30	b18LM11	SO4 (wt%)	0.2247	0.2247	0.2433
2	LM	FY09EM21-30	b18LM12	SO4 (wt%)	0.2247	0.2247	0.2433
2	LM	FY09EM21-30	b18LM21	SO4 (wt%)	0.2247	0.2247	0.2433
2	LM	FY09EM21-30	b18LM22	SO4 (wt%)	0.2247	0.2247	0.2433
2	LM	FY09EM21-30	b18LM11	TiO2 (wt%)	3.5695	3.6740	3.6904
2	LM	FY09EM21-30	b18LM12	TiO2 (wt%)	3.5528	3.6568	3.6904
2	LM	FY09EM21-30	b18LM21	TiO2 (wt%)	3.6529	3.7598	3.6904
2	LM	FY09EM21-30	b18LM22	TiO2 (wt%)	3.6696	3.7770	3.6904
2	LM	FY09EM21-30	b18LM11	U3O8 (wt%)	5.5069	5.5808	6.0000
2	LM	FY09EM21-30	b18LM12	U3O8 (wt%)	5.5422	5.5432	6.0000
2	LM	FY09EM21-30	b18LM21	U3O8 (wt%)	5.6602	5.7362	6.0000
2	LM	FY09EM21-30	b18LM22	U3O8 (wt%)	5.7899	5.7909	6.0000
2	LM	FY09EM21-30	b18LM11	ZnO (wt%)	0.0622	0.0622	0.0681
2	LM	FY09EM21-30	b18LM12	ZnO (wt%)	0.0589	0.0589	0.0681
2	LM	FY09EM21-30	b18LM21	ZnO (wt%)	0.0647	0.0647	0.0681
2	LM	FY09EM21-30	b18LM22	ZnO (wt%)	0.0598	0.0598	0.0681
2	LM	FY09EM21-30	b18LM11	ZrO2 (wt%)	0.0959	0.0959	0.1038
2	LM	FY09EM21-30	b18LM12	ZrO2 (wt%)	0.0959	0.0959	0.1038
2	LM	FY09EM21-30	b18LM21	ZrO2 (wt%)	0.0973	0.0973	0.1038
2	LM	FY09EM21-30	b18LM22	ZrO2 (wt%)	0.0973	0.0973	0.1038
2	PF	FY09EM21-30	b18PF11	Al2O3 (wt%)	6.8022	7.1371	6.7607
2	PF	FY09EM21-30	b18PF12	Al2O3 (wt%)	6.9723	7.1225	6.7607
2	PF	FY09EM21-30	b18PF21	Al2O3 (wt%)	6.9534	7.2957	6.7607
2	PF	FY09EM21-30	b18PF22	Al2O3 (wt%)	7.0100	7.1611	6.7607
2	PF	FY09EM21-30	b18PF11	B2O3 (wt%)	6.3754	6.8034	6.5597
2	PF	FY09EM21-30	b18PF12	B2O3 (wt%)	6.5364	6.9142	6.5597
2	PF	FY09EM21-30	b18PF21	B2O3 (wt%)	6.5364	6.9752	6.5597
2	PF	FY09EM21-30	b18PF22	B2O3 (wt%)	6.5686	6.9482	6.5597
2	PF	FY09EM21-30	b18PF11	Fe2O3 (wt%)	12.2811	12.6621	12.3371
2	PF	FY09EM21-30	b18PF12	Fe2O3 (wt%)	12.6385	12.9267	12.3371
2	PF	FY09EM21-30	b18PF21	Fe2O3 (wt%)	12.5385	12.9274	12.3371
2	PF	FY09EM21-30	b18PF22	Fe2O3 (wt%)	12.4384	12.7220	12.3371
2	PF	FY09EM21-30	b18PF11	Li2O (wt%)	4.4996	4.8634	4.7962
2	PF	FY09EM21-30	b18PF12	Li2O (wt%)	4.8225	5.0190	4.7962
2	PF	FY09EM21-30	b18PF21	Li2O (wt%)	4.5426	4.9099	4.7962
2	PF	FY09EM21-30	b18PF22	Li2O (wt%)	4.6718	4.8622	4.7962

Table A6. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by Glass ID for Rad Glasses of the Matrix 2 Study

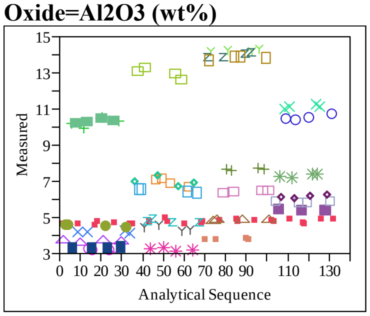
Glass #	Oxide	Measured (wt%)	Measured Bias-Corrected (wt%)	Targeted (wt%)	Diff of Measured	Diff of Meas BC	% Diff of Measured	% Diff of Meas BC
FY09EM21-28	Al2O3	7.1707	7.4241	7.0484	0.1223	0.3757	1.7%	5.3%
FY09EM21-28	B2O3	6.7457	7.1670	6.8388	-0.0931	0.3282	-1.4%	4.8%
FY09EM21-28	BaO	0.0410	0.0420	0.0423	-0.0013	-0.0003	-3.0%	-0.6%
FY09EM21-28	CaO	1.7140	1.7281	1.7718	-0.0578	-0.0437	-3.3%	-2.5%
FY09EM21-28	CdO	0.1299	0.1299	0.1564	-0.0265	-0.0265	-16.9%	-16.9%
FY09EM21-28	Ce2O3	0.1757	0.1757	0.1903	-0.0146	-0.0146	-7.7%	-7.7%
FY09EM21-28	Cr2O3	0.0979	0.0971	0.0980	-0.0001	-0.0009	-0.1%	-0.9%
FY09EM21-28	CuO	0.0789	0.0800	0.0677	0.0112	0.0123	16.5%	18.2%
FY09EM21-28	Fe2O3	12.4670	12.8027	12.8621	-0.3951	-0.0594	-3.1%	-0.5%
FY09EM21-28	K2O	0.0398	0.0410	0.0000	0.0398	0.0410		
FY09EM21-28	La2O3	0.0402	0.0402	0.0516	-0.0114	-0.0114	-22.2%	-22.2%
FY09EM21-28	Li2O	4.7633	5.0524	5.0003	-0.2370	0.0521	-4.7%	1.0%
FY09EM21-28	MgO	0.6492	0.6531	0.6698	-0.0206	-0.0167	-3.1%	-2.5%
FY09EM21-28	MnO	2.3532	2.4354	2.5705	-0.2173	-0.1351	-8.5%	-5.3%
FY09EM21-28	Na2O	12.1118	12.0757	12.4619	-0.3501	-0.3862	-2.8%	-3.1%
FY09EM21-28	NiO	1.1033	1.0822	1.2654	-0.1621	-0.1832	-12.8%	-14.5%
FY09EM21-28	PbO	0.1029	0.1029	0.1142	-0.0113	-0.0113	-9.9%	-9.9%
FY09EM21-28	SiO2	40.3793	40.9749	42.5103	-2.1310	-1.5354	-5.0%	-3.6%
FY09EM21-28	SO4	0.2247	0.2247	0.2537	-0.0290	-0.0290	-11.4%	-11.4%
FY09EM21-28	TiO2	3.4027	3.5981	3.8474	-0.4447	-0.2493	-11.6%	-6.5%
FY09EM21-28	U3O8	2.0636	2.0391	2.0000	0.0636	0.0391	3.2%	2.0%
FY09EM21-28	ZnO	0.0790	0.0790	0.0710	0.0080	0.0080	11.3%	11.3%
FY09EM21-28	ZrO2	0.0986	0.0986	0.1082	-0.0096	-0.0096	-8.9%	-8.9%
FY09EM21-28	Sum	96.0323	98.1439	100.0001	-3.9678	-1.8562	-4.0%	-1.9%
FY09EM21-29	Al2O3	7.2415	7.2587	6.9046	0.3369	0.3541	4.9%	5.1%
FY09EM21-29	B2O3	6.5364	6.9300	6.6992	-0.1628	0.2308	-2.4%	3.4%
FY09EM21-29	BaO	0.0444	0.0455	0.0414	0.0030	0.0041	7.2%	9.8%
FY09EM21-29	CaO	1.7490	1.7634	1.7357	0.0133	0.0277	0.8%	1.6%
FY09EM21-29	CdO	0.1471	0.1471	0.1533	-0.0062	-0.0062	-4.1%	-4.1%
FY09EM21-29	Ce2O3	0.1845	0.1845	0.1864	-0.0019	-0.0019	-1.0%	-1.0%
FY09EM21-29	Cr2O3	0.0943	0.0935	0.0960	-0.0017	-0.0025	-1.8%	-2.6%
FY09EM21-29	CuO	0.0836	0.0847	0.0663	0.0173	0.0184	26.0%	27.8%
FY09EM21-29	Fe2O3	12.4670	12.4051	12.5996	-0.1326	-0.1945	-1.1%	-1.5%
FY09EM21-29	K2O	0.0301	0.0311	0.0000	0.0301	0.0311		
FY09EM21-29	La2O3	0.0443	0.0443	0.0505	-0.0062	-0.0062	-12.3%	-12.3%
FY09EM21-29	Li2O	4.8871	5.0019	4.8982	-0.0111	0.1037	-0.2%	2.1%
FY09EM21-29	MgO	0.6583	0.6622	0.6561	0.0022	0.0061	0.3%	0.9%
FY09EM21-29	MnO	2.3887	2.4721	2.5180	-0.1293	-0.0459	-5.1%	-1.8%
FY09EM21-29	Na2O	12.3511	12.3117	12.2076	0.1435	0.1041	1.2%	0.9%
FY09EM21-29	NiO	1.0781	1.0575	1.2396	-0.1615	-0.1821	-13.0%	-14.7%
FY09EM21-29	PbO	0.1298	0.1298	0.1118	0.0180	0.0180	16.1%	16.1%
FY09EM21-29	SiO2	41.1280	41.7356	41.6427	-0.5147	0.0929	-1.2%	0.2%
FY09EM21-29	SO4	0.2247	0.2247	0.2485	-0.0238	-0.0238	-9.6%	-9.6%
FY09EM21-29	TiO2	3.5695	3.7745	3.7689	-0.1994	0.0056	-5.3%	0.1%
FY09EM21-29	U3O8	4.0152	3.9679	4.0000	0.0152	-0.0321	0.4%	-0.8%
FY09EM21-29	ZnO	0.0756	0.0756	0.0696	0.0060	0.0060	8.7%	8.7%
FY09EM21-29	ZrO2	0.0939	0.0939	0.1060	-0.0121	-0.0121	-11.4%	-11.4%
FY09EM21-29	Sum	99.2221	100.4952	100.0000	-0.7779	0.4952	-0.8%	0.5%
FY09EM21-30	Al2O3	6.9345	7.1791	6.7607	0.1738	0.4184	2.6%	6.2%
FY09EM21-30	B2O3	6.5042	6.9103	6.5597	-0.0555	0.3506	-0.8%	5.3%
FY09EM21-30	BaO	0.0427	0.0434	0.0406	0.0021	0.0028	5.2%	6.8%
FY09EM21-30	CaO	1.6441	1.6706	1.6995	-0.0554	-0.0289	-3.3%	-1.7%
FY09EM21-30	CdO	0.1399	0.1399	0.1501	-0.0102	-0.0102	-6.8%	-6.8%
FY09EM21-30	Ce2O3	0.1760	0.1760	0.1825	-0.0065	-0.0065	-3.6%	-3.6%
FY09EM21-30	Cr2O3	0.0860	0.0865	0.0940	-0.0080	-0.0075	-8.5%	-8.0%
FY09EM21-30	CuO	0.0804	0.0832	0.0649	0.0155	0.0183	23.9%	28.3%
FY09EM21-30	Fe2O3	12.4741	12.8096	12.3371	0.1370	0.4725	1.1%	3.8%
FY09EM21-30	K2O	0.0301	0.0304	0.0000	0.0301	0.0304		
FY09EM21-30	La2O3	0.0319	0.0319	0.0495	-0.0176	-0.0176	-35.6%	-35.6%

Table A6. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by Glass ID for Rad Glasses of the Matrix 2 Study

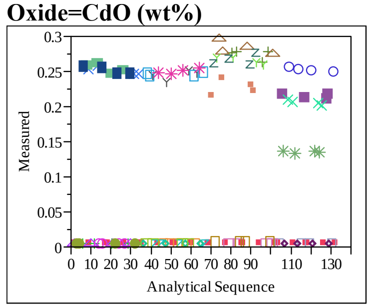
Glass #	Oxide	Measured (wt%)	Measured Bias-Corrected (wt%)	Targeted (wt%)	Diff of Measured	Diff of Meas BC	% Diff of Measured	% Diff of Meas BC
FY09EM21-30	Li_2O	4.6341	4.9136	4.7962	-0.1621	0.1174	-3.4%	2.4%
FY09EM21-30	MgO	0.6442	0.6440	0.6424	0.0018	0.0016	0.3%	0.3%
FY09EM21-30	MnO	2.3500	2.4072	2.4656	-0.1156	-0.0584	-4.7%	-2.4%
FY09EM21-30	Na_2O	11.6771	11.6837	11.9532	-0.2762	-0.2695	-2.3%	-2.3%
FY09EM21-30	NiO	1.0450	1.0355	1.2138	-0.1688	-0.1783	-13.9%	-14.7%
FY09EM21-30	PbO	0.0843	0.0843	0.1095	-0.0252	-0.0252	-23.0%	-23.0%
FY09EM21-30	SiO_2	38.9887	39.9389	40.7751	-1.7864	-0.8362	-4.4%	-2.1%
FY09EM21-30	SO_4	0.2247	0.2247	0.2433	-0.0186	-0.0186	-7.6%	-7.6%
FY09EM21-30	TiO_2	3.6112	3.7169	3.6904	-0.0792	0.0265	-2.1%	0.7%
FY09EM21-30	U_3O_8	5.6248	5.6628	6.0000	-0.3752	-0.3372	-6.3%	-5.6%
FY09EM21-30	ZnO	0.0614	0.0614	0.0681	-0.0067	-0.0067	-9.8%	-9.8%
FY09EM21-30	ZrO_2	0.0966	0.0966	0.1038	-0.0072	-0.0072	-7.0%	-7.0%
FY09EM21-30	Sum	97.1860	99.6303	100.0000	-2.8140	-0.3697	-2.8%	-0.4%

Exhibit A1. Non-Rad Sample Measurements in Analytical Sequence by Oxide for the Matrix 2 Study

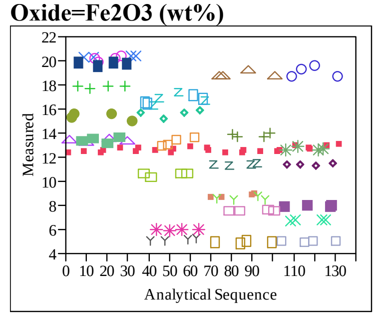
Measured By Analytical Sequence
Oxide=Al2O3 (wt%)



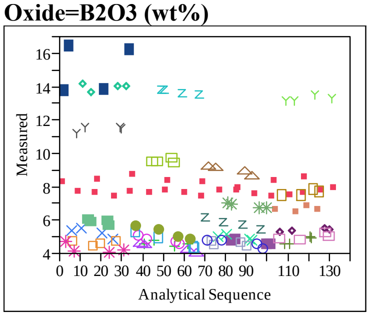
Measured By Analytical Sequence
Oxide=CdO (wt%)



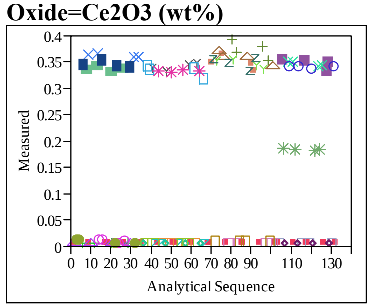
Measured By Analytical Sequence
Oxide=Fe2O3 (wt%)



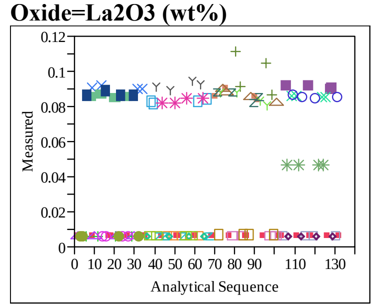
Measured By Analytical Sequence
Oxide=B2O3 (wt%)



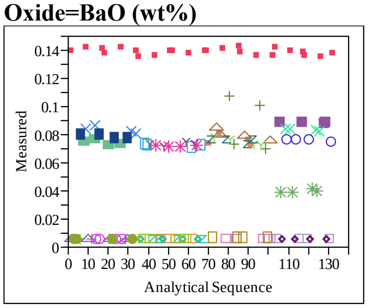
Measured By Analytical Sequence
Oxide=Ce2O3 (wt%)



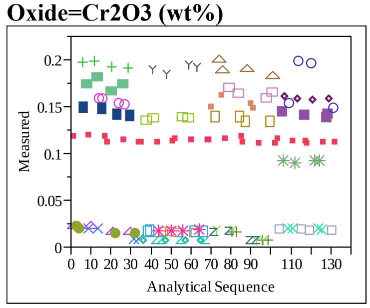
Measured By Analytical Sequence
Oxide=La2O3 (wt%)



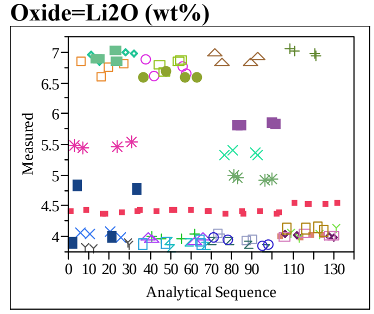
Measured By Analytical Sequence
Oxide=BaO (wt%)



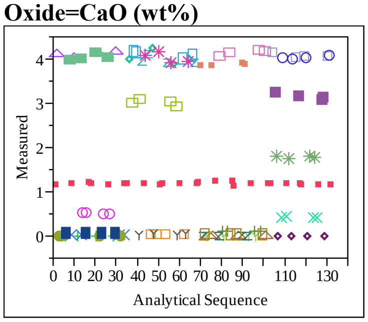
Measured By Analytical Sequence
Oxide=Cr2O3 (wt%)



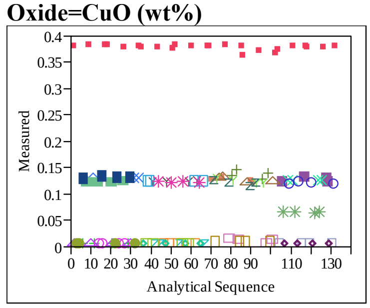
Measured By Analytical Sequence
Oxide=Li2O (wt%)



Measured By Analytical Sequence
Oxide=CaO (wt%)



Measured By Analytical Sequence
Oxide=CuO (wt%)



Measured By Analytical Sequence
Oxide=MgO (wt%)

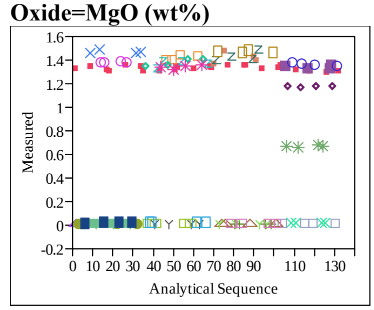
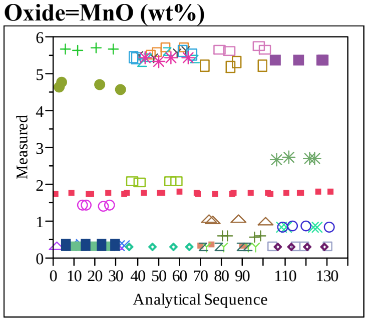
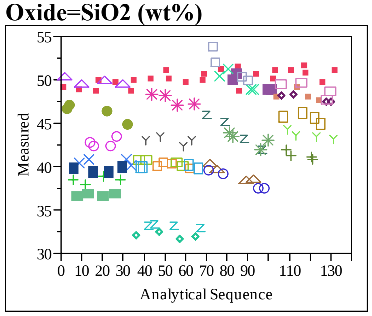


Exhibit A1. Non-Rad Sample Measurements in Analytical Sequence by Oxide for the Matrix 2 Study

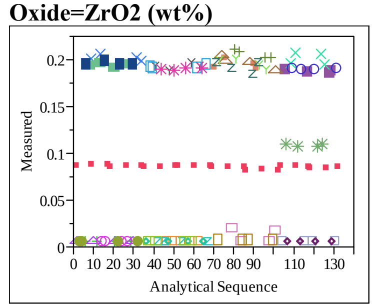
Measured By Analytical Sequence
Oxide=MnO (wt%)



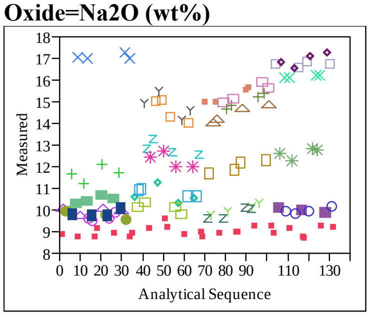
Measured By Analytical Sequence
Oxide=SiO2 (wt%)



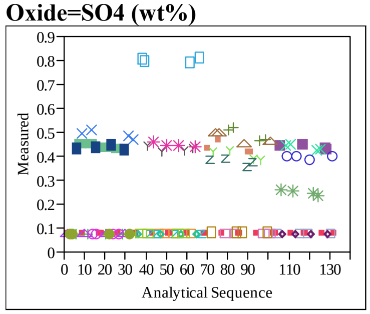
Measured By Analytical Sequence
Oxide=ZrO2 (wt%)



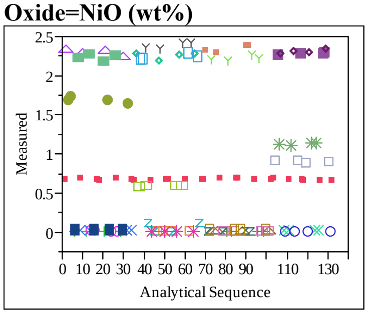
Measured By Analytical Sequence
Oxide=Na2O (wt%)



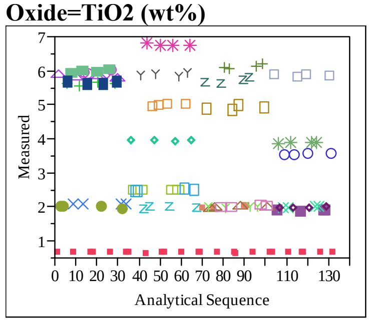
Measured By Analytical Sequence
Oxide=SO4 (wt%)



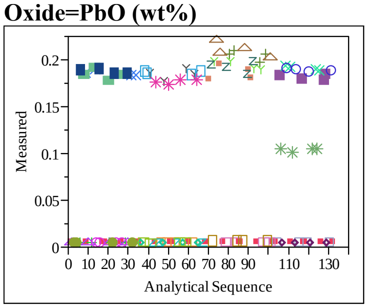
Measured By Analytical Sequence
Oxide=NiO (wt%)



Measured By Analytical Sequence
Oxide=TiO2 (wt%)



Measured By Analytical Sequence
Oxide=PbO (wt%)



Measured By Analytical Sequence
Oxide=ZnO (wt%)

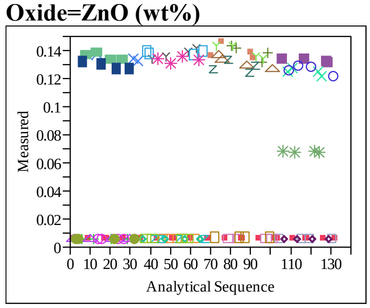
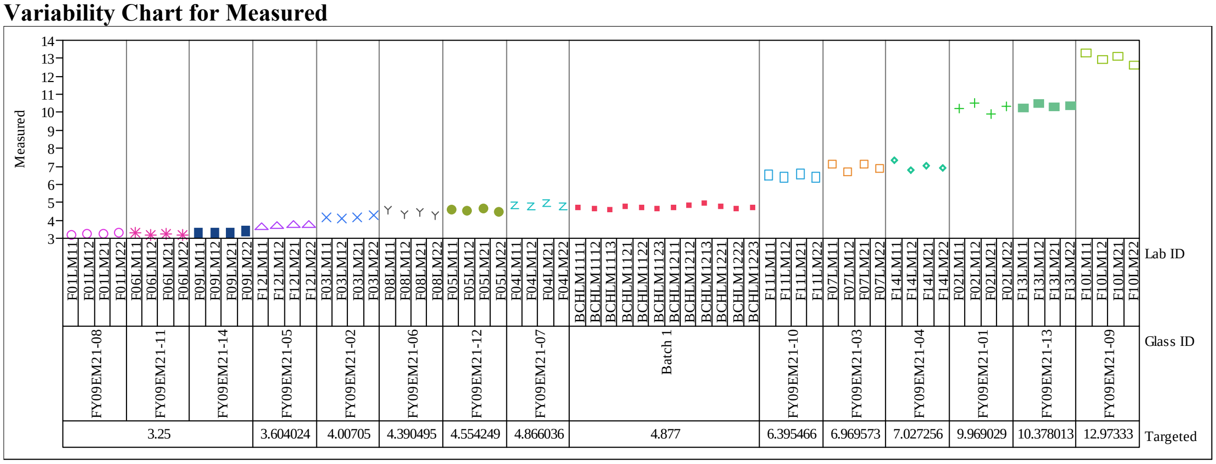
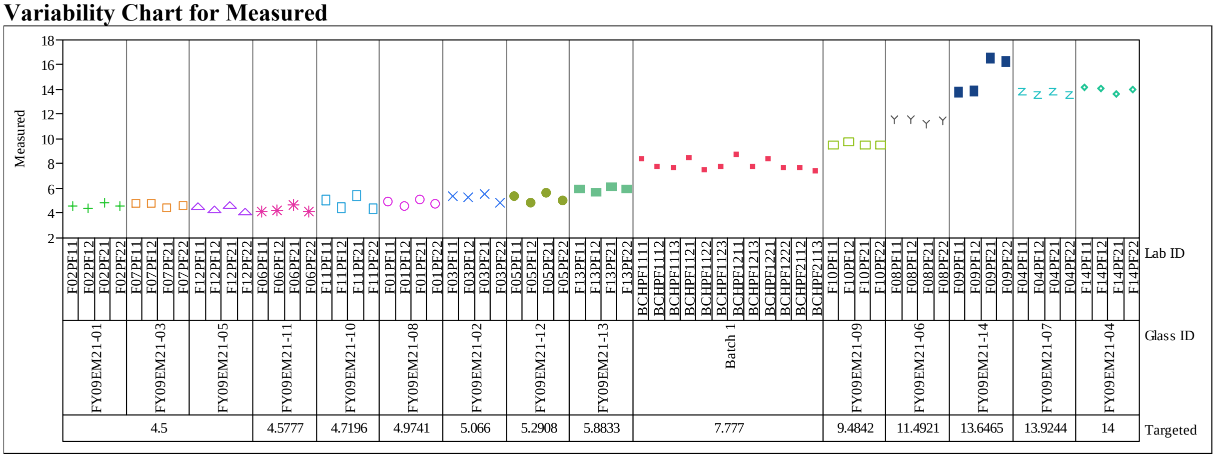


Exhibit A2. Non-Rad Sample Measurements by Lab ID within Glass ID for the Matrix 2 Study by Oxide by Analytical Block

Set=1, Oxide=Al2O3 (wt%)
Variability Chart for Measured



Set=1, Oxide=B2O3 (wt%)
Variability Chart for Measured



Set=1, Oxide=BaO (wt%)
Variability Chart for Measured

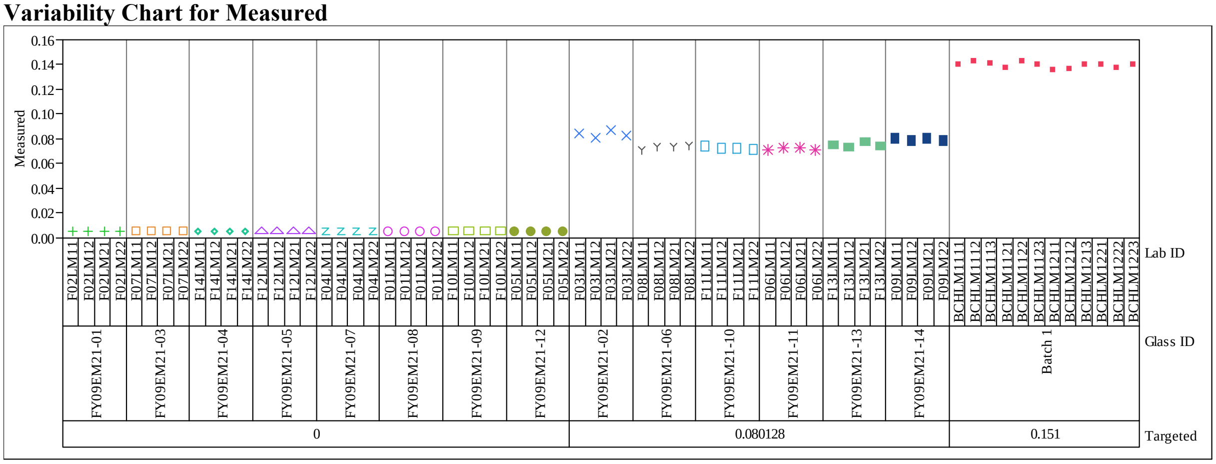
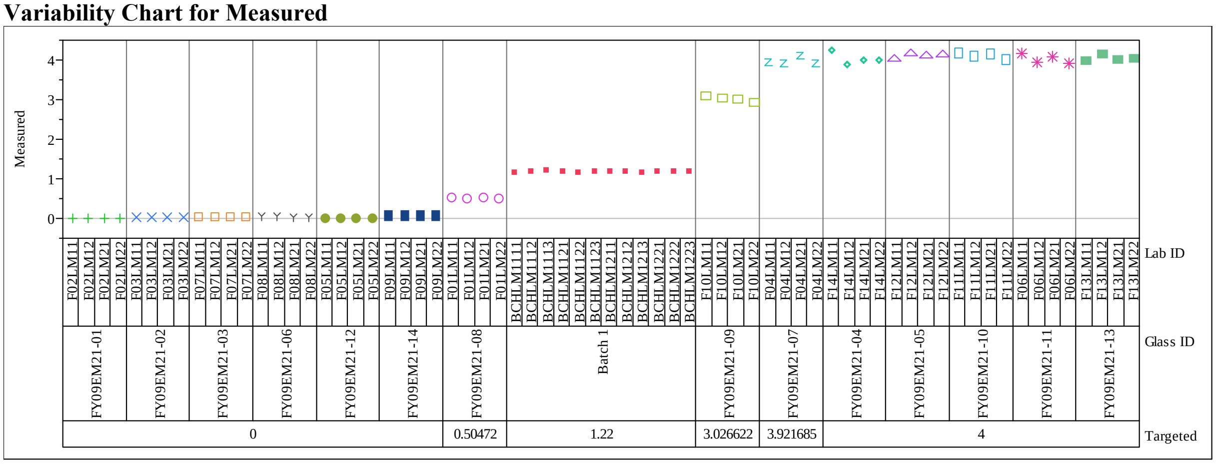
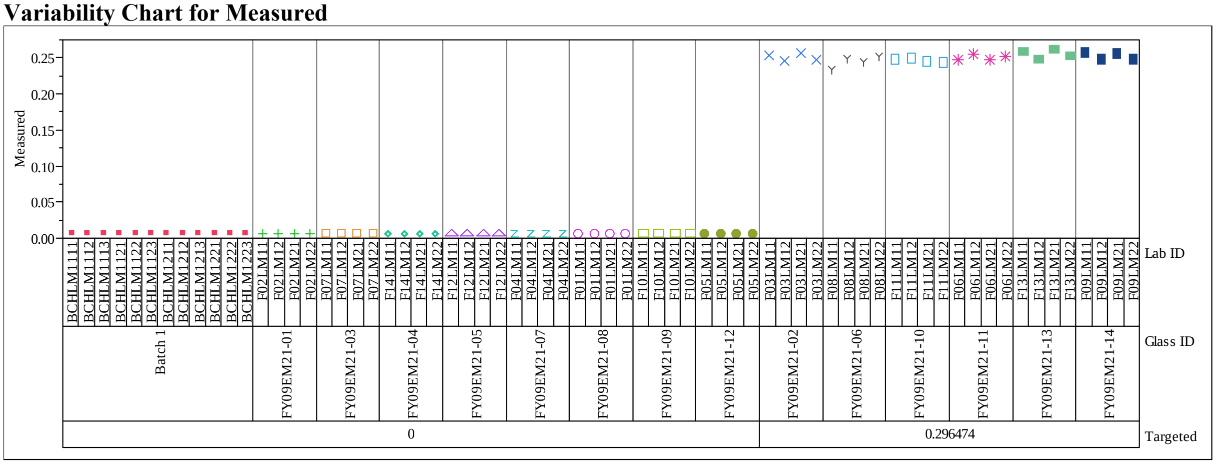


Exhibit A2. Non-Rad Sample Measurements by Lab ID within Glass ID for the Matrix 2 Study by Oxide by Analytical Block

Set=1, Oxide=CaO (wt%)
Variability Chart for Measured



Set=1, Oxide=CdO (wt%)
Variability Chart for Measured



Set=1, Oxide=Ce2O3 (wt%)
Variability Chart for Measured

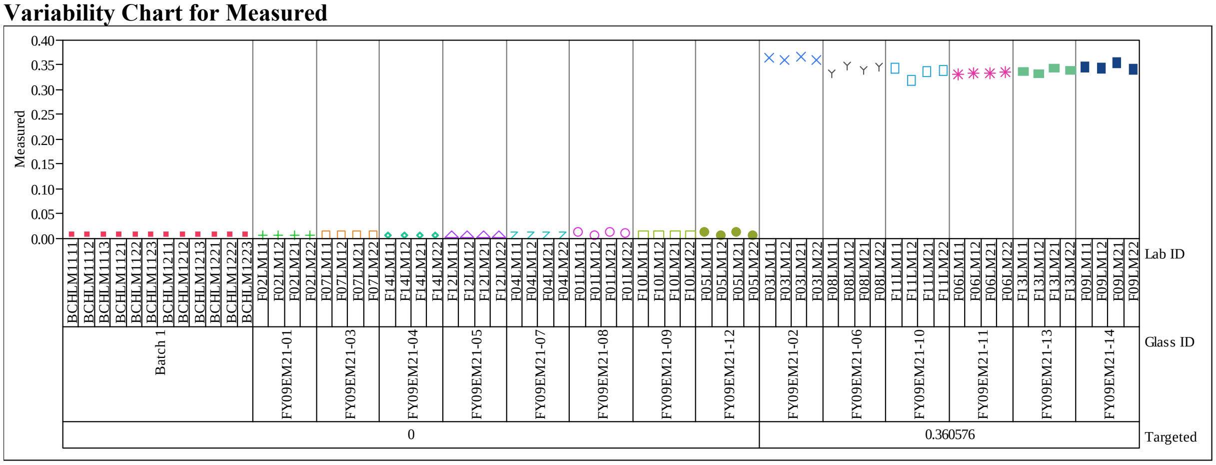
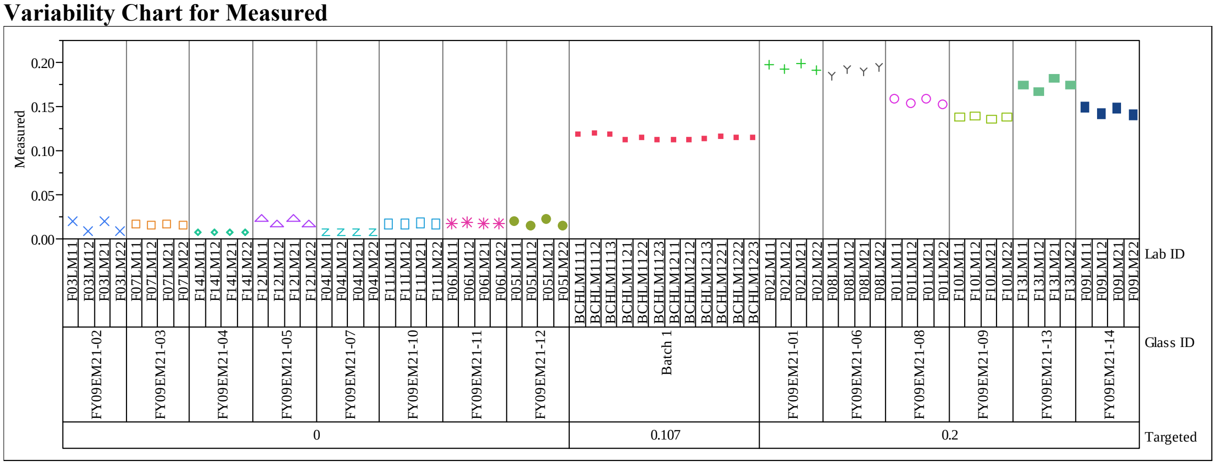
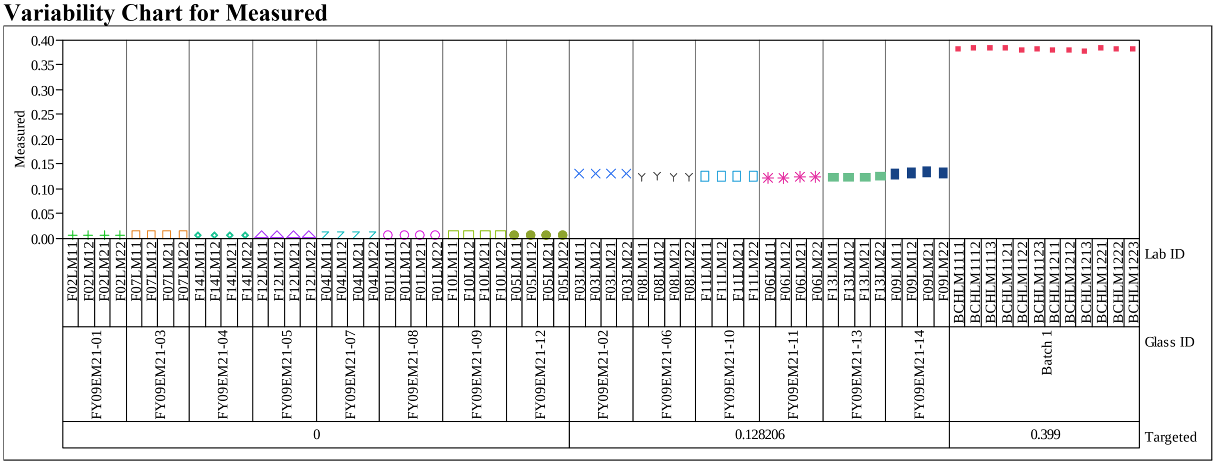


Exhibit A2. Non-Rad Sample Measurements by Lab ID within Glass ID for the Matrix 2 Study by Oxide by Analytical Block

Set=1, Oxide=Cr2O3 (wt%)
Variability Chart for Measured



Set=1, Oxide=CuO (wt%)
Variability Chart for Measured



Set=1, Oxide=Fe2O3 (wt%)
Variability Chart for Measured

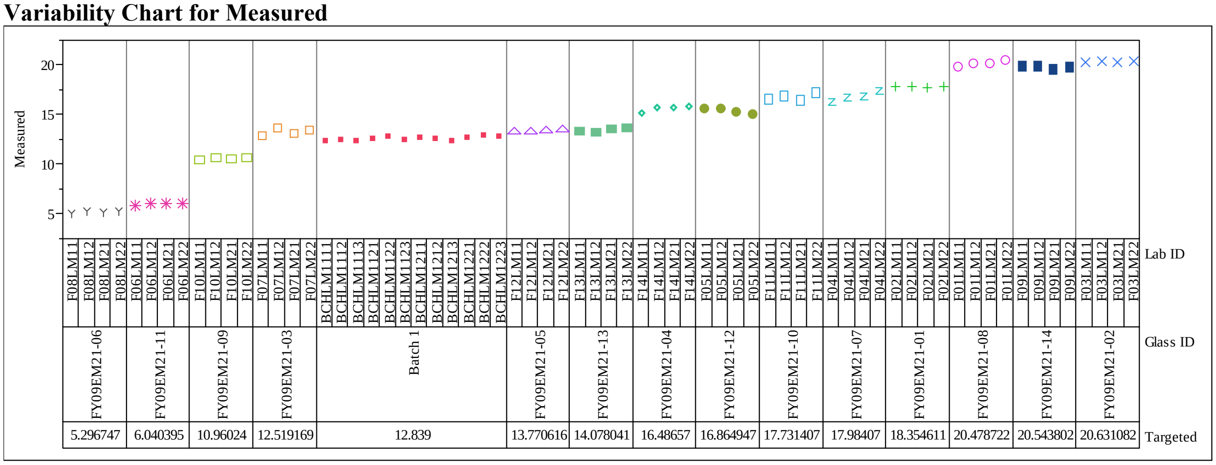
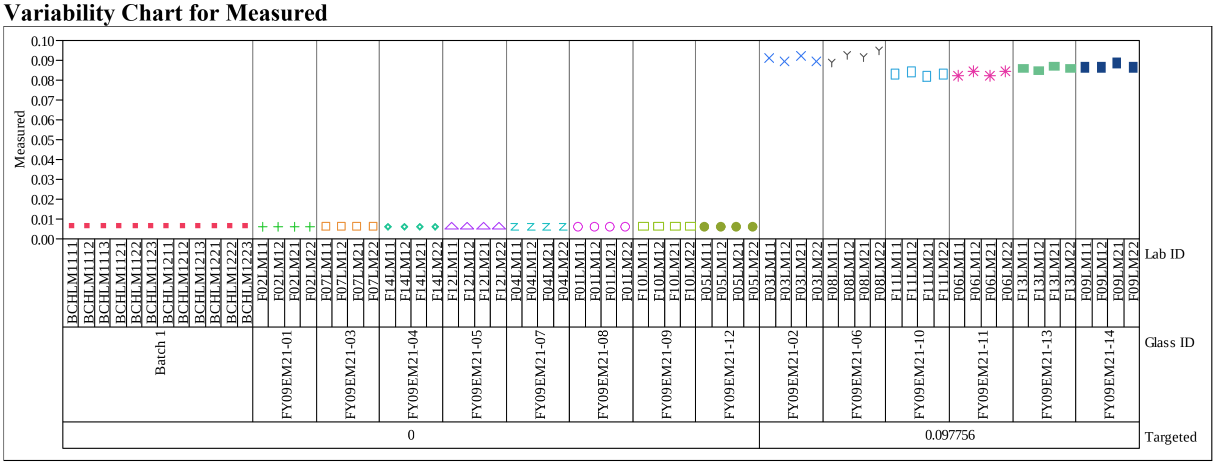
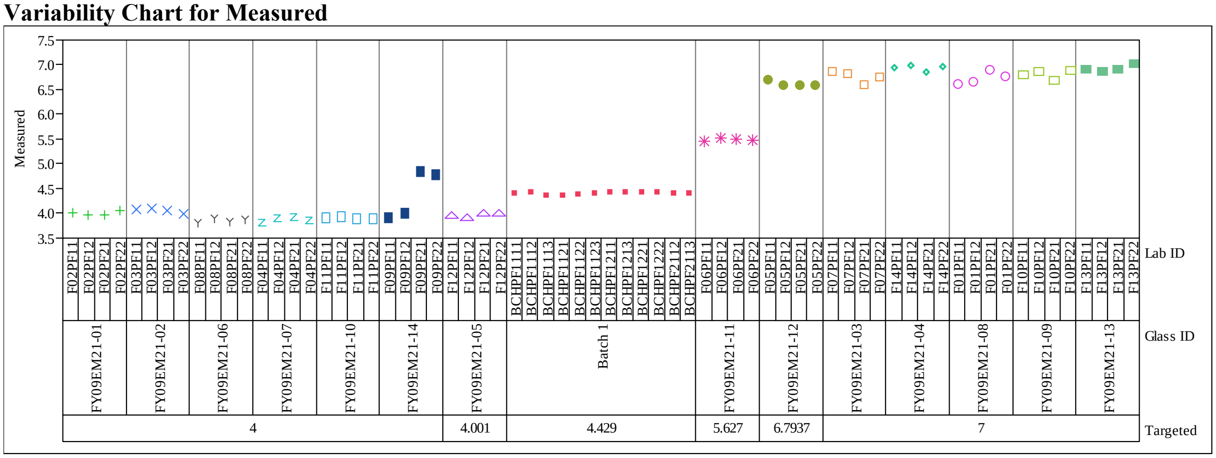


Exhibit A2. Non-Rad Sample Measurements by Lab ID within Glass ID for the Matrix 2 Study by Oxide by Analytical Block

Set=1, Oxide=La2O3 (wt%)
Variability Chart for Measured



Set=1, Oxide=Li2O (wt%)
Variability Chart for Measured



Set=1, Oxide=MgO (wt%)
Variability Chart for Measured

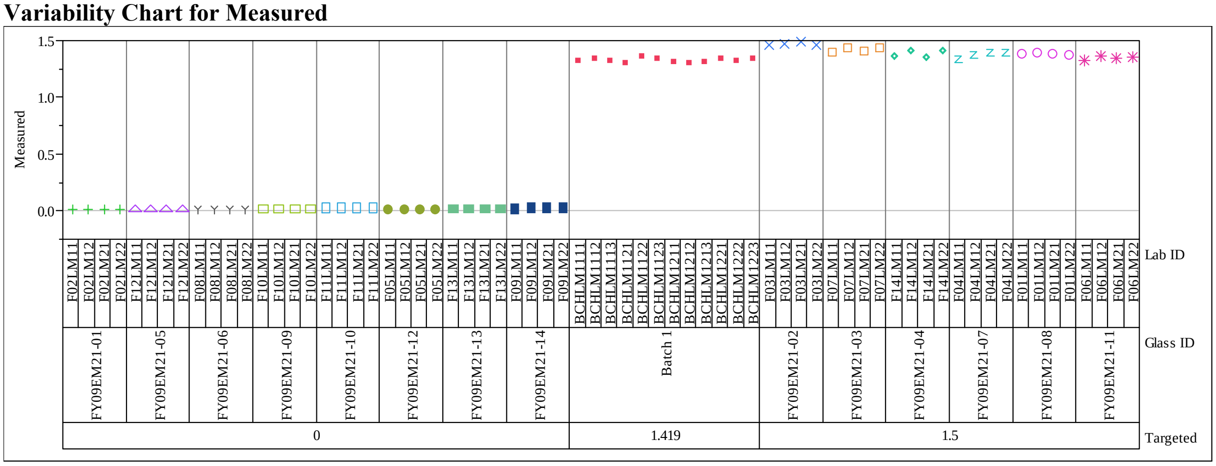
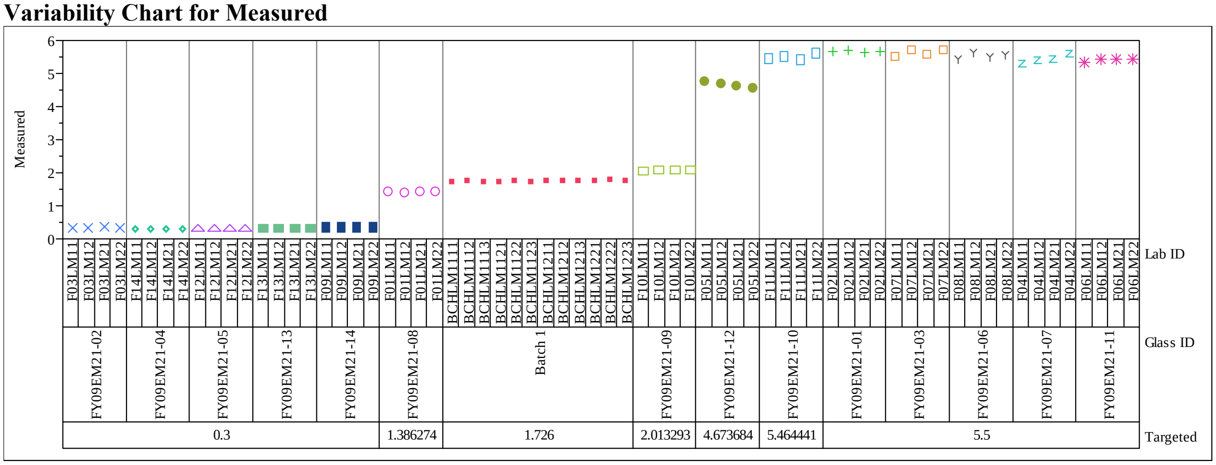
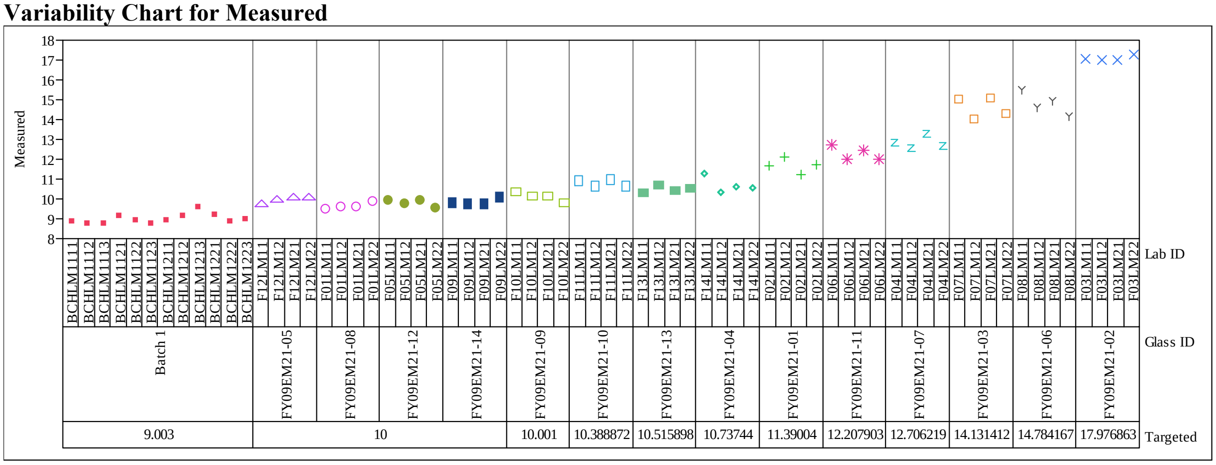


Exhibit A2. Non-Rad Sample Measurements by Lab ID within Glass ID for the Matrix 2 Study by Oxide by Analytical Block

Set=1, Oxide=MnO (wt%)
Variability Chart for Measured



Set=1, Oxide=Na2O (wt%)
Variability Chart for Measured



Set=1, Oxide=NiO (wt%)
Variability Chart for Measured

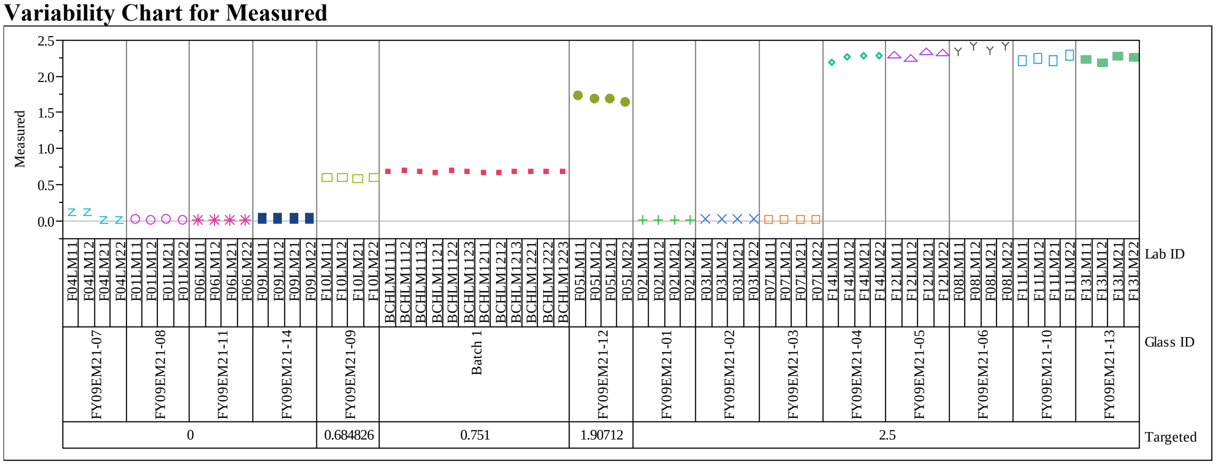
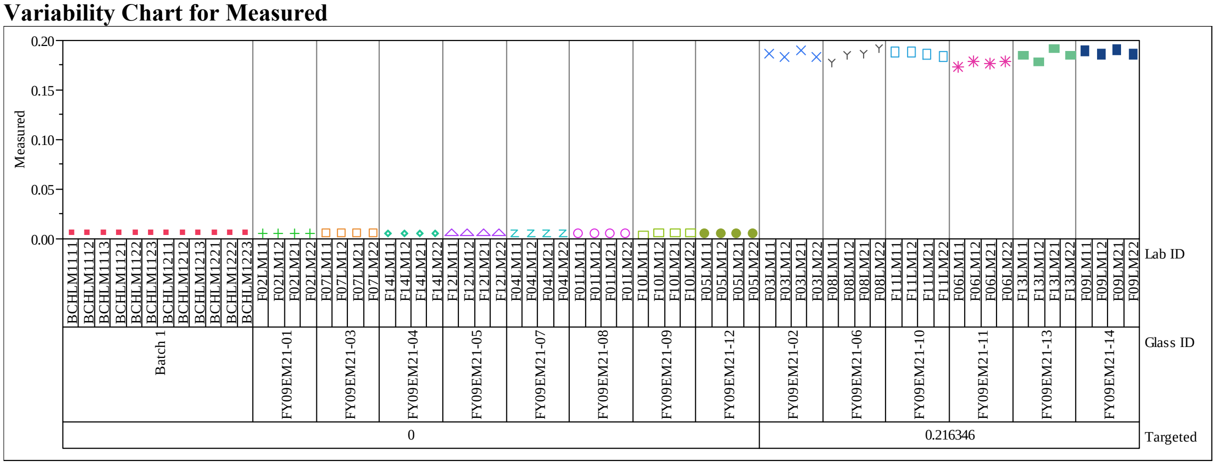
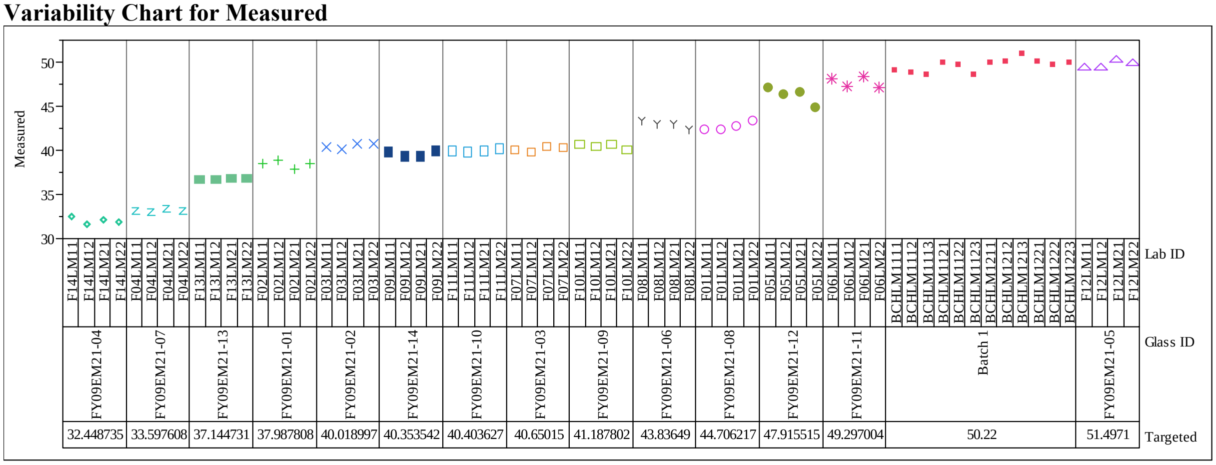


Exhibit A2. Non-Rad Sample Measurements by Lab ID within Glass ID for the Matrix 2 Study by Oxide by Analytical Block

Set=1, Oxide=PbO (wt%)
Variability Chart for Measured



Set=1, Oxide=SiO2 (wt%)
Variability Chart for Measured



Set=1, Oxide=SO4 (wt%)
Variability Chart for Measured

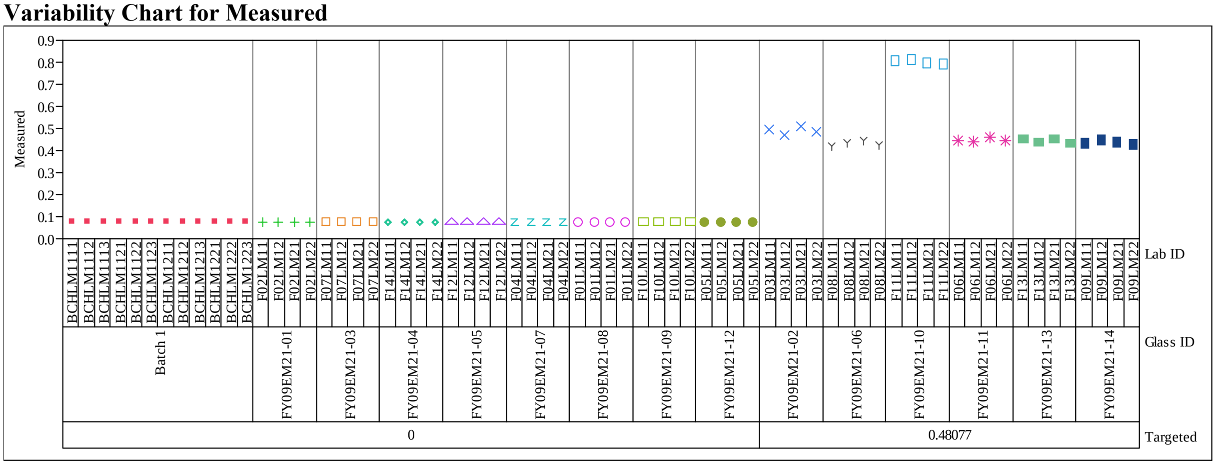
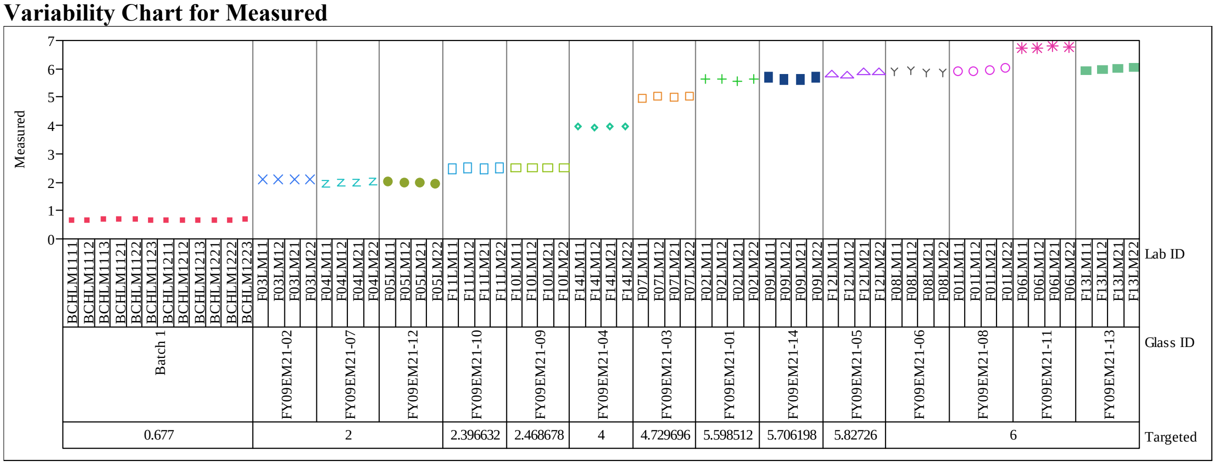
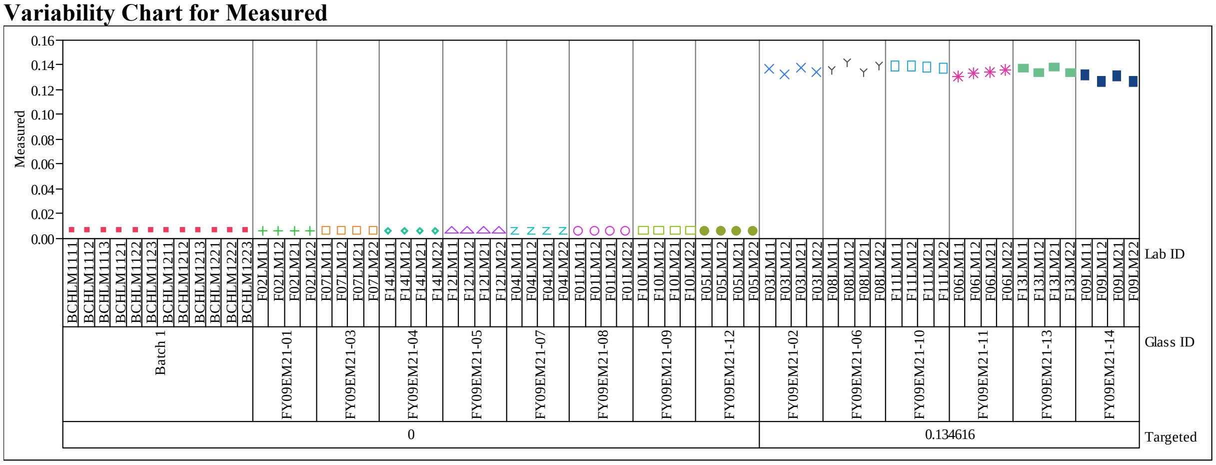


Exhibit A2. Non-Rad Sample Measurements by Lab ID within Glass ID for the Matrix 2 Study by Oxide by Analytical Block

Set=1, Oxide=TiO2 (wt%)
Variability Chart for Measured



Set=1, Oxide=ZnO (wt%)
Variability Chart for Measured



Set=1, Oxide=ZrO2 (wt%)
Variability Chart for Measured

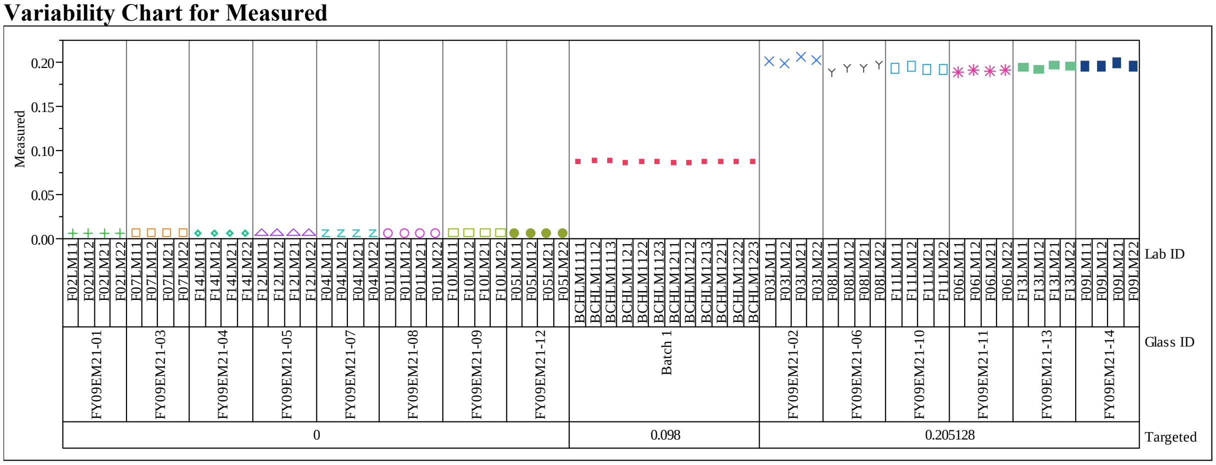
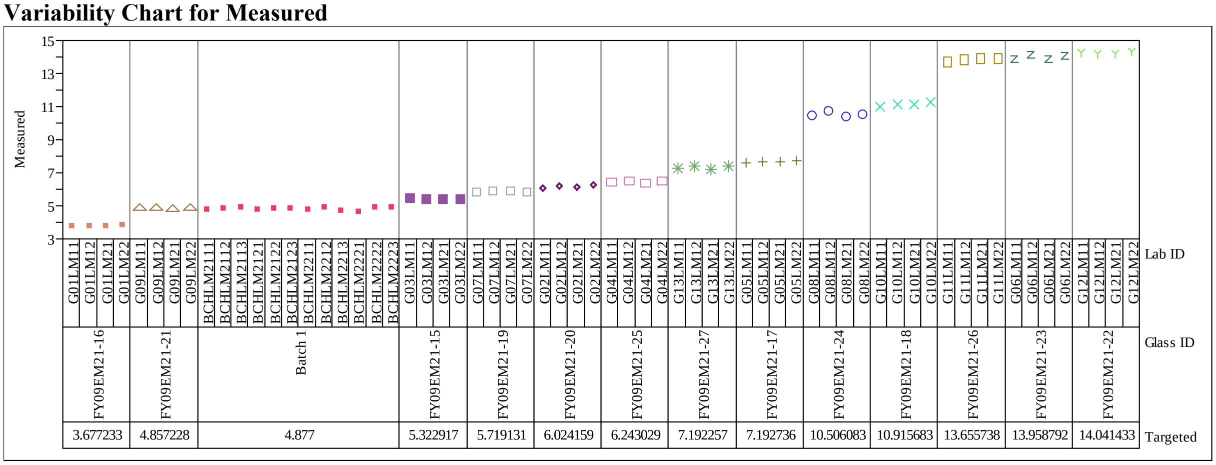
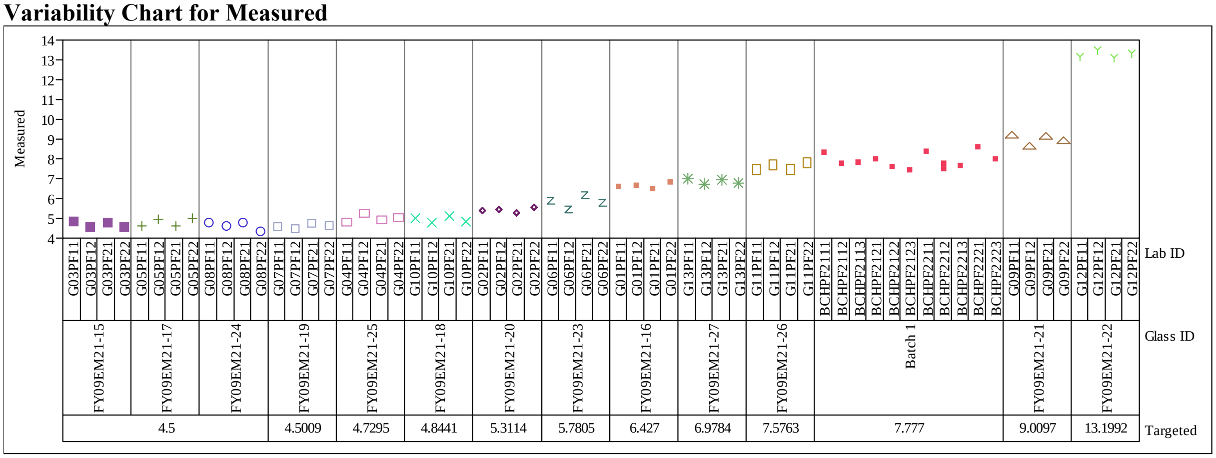


Exhibit A2. Non-Rad Sample Measurements by Lab ID within Glass ID for the Matrix 2 Study by Oxide by Analytical Block

Set=2, Oxide=Al2O3 (wt%)
Variability Chart for Measured



Set=2, Oxide=B2O3 (wt%)
Variability Chart for Measured



Set=2, Oxide=BaO (wt%)
Variability Chart for Measured

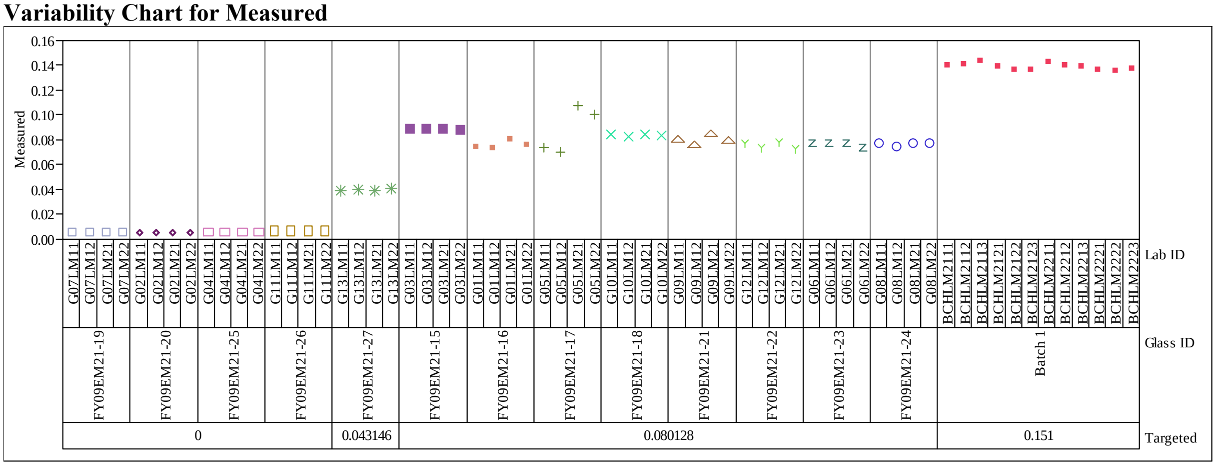
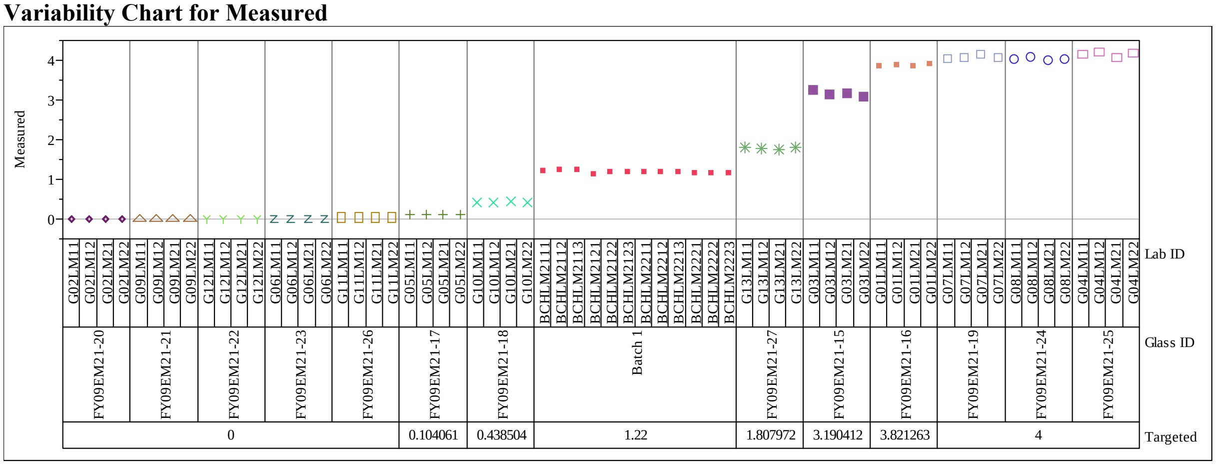
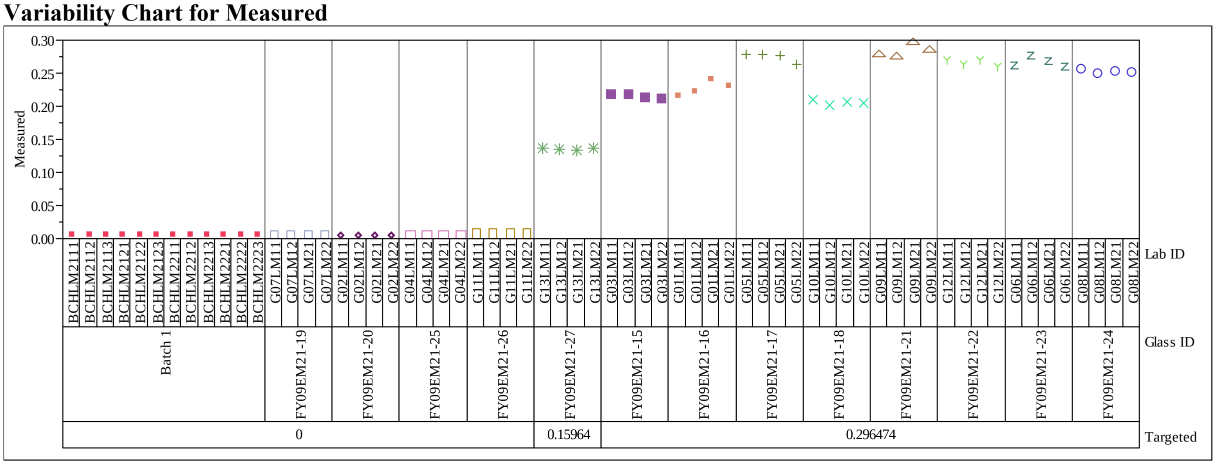


Exhibit A2. Non-Rad Sample Measurements by Lab ID within Glass ID for the Matrix 2 Study by Oxide by Analytical Block

Set=2, Oxide=CaO (wt%)
Variability Chart for Measured



Set=2, Oxide=CdO (wt%)
Variability Chart for Measured



Set=2, Oxide=Ce2O3 (wt%)
Variability Chart for Measured

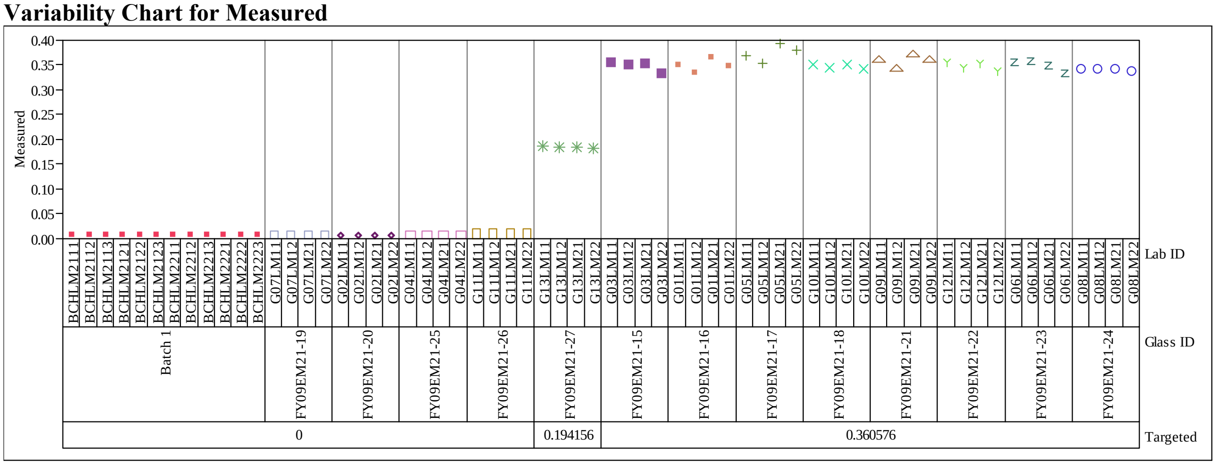
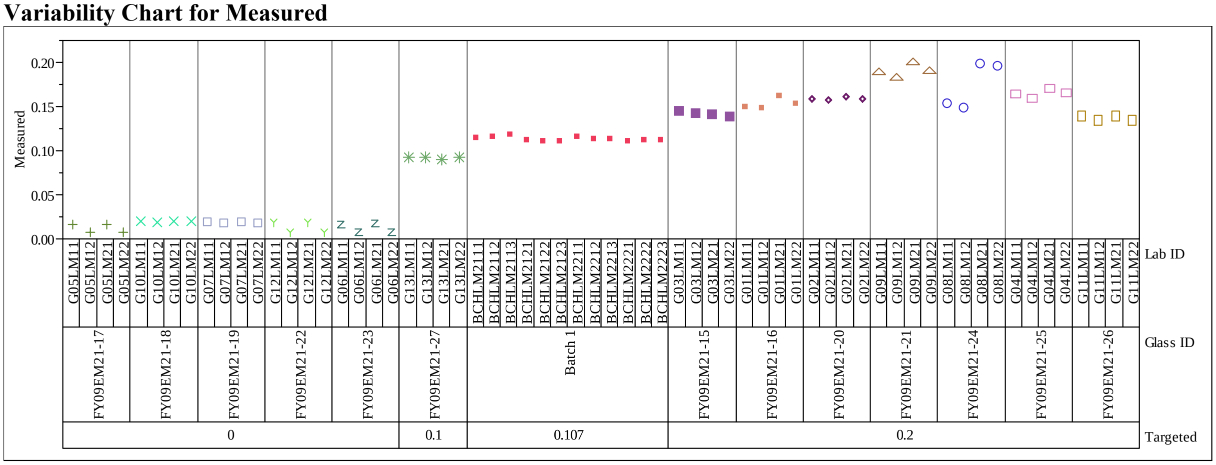
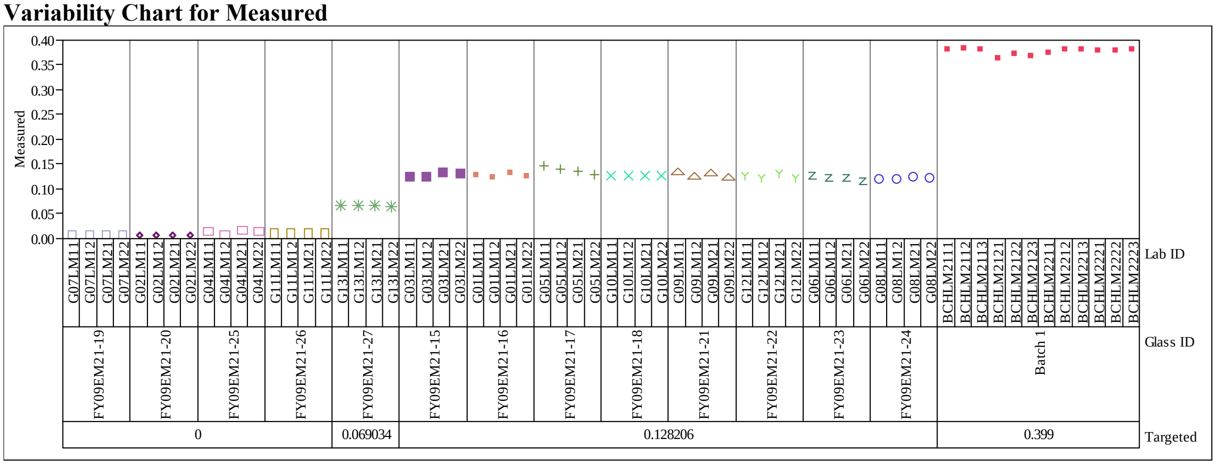


Exhibit A2. Non-Rad Sample Measurements by Lab ID within Glass ID for the Matrix 2 Study by Oxide by Analytical Block

Set=2, Oxide=Cr2O3 (wt%)
Variability Chart for Measured



Set=2, Oxide=CuO (wt%)
Variability Chart for Measured



Set=2, Oxide=Fe2O3 (wt%)
Variability Chart for Measured

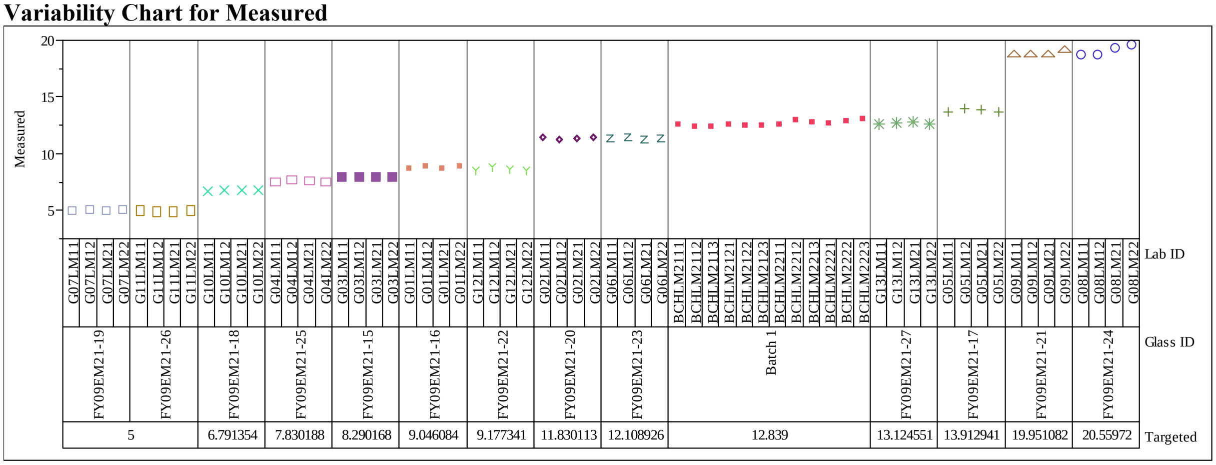
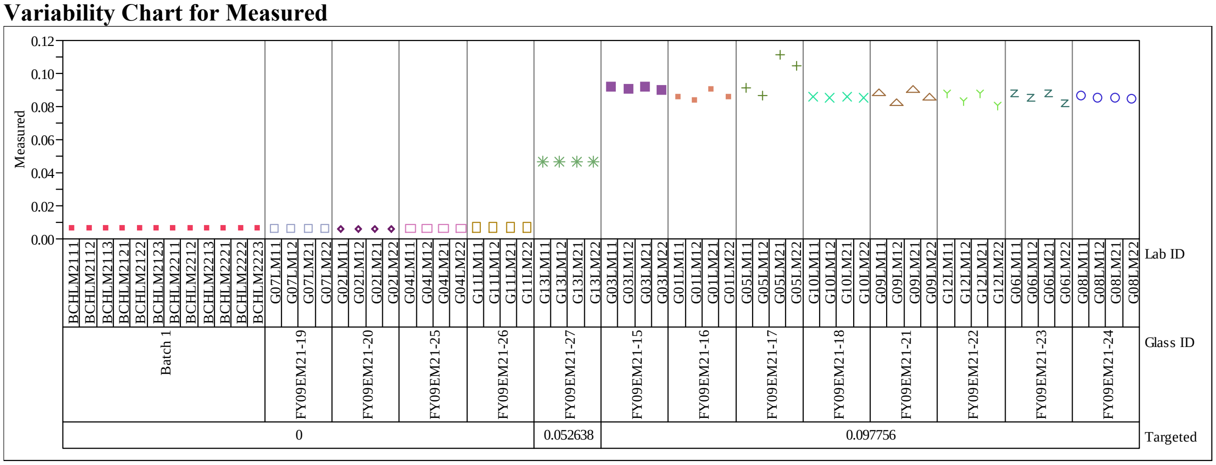
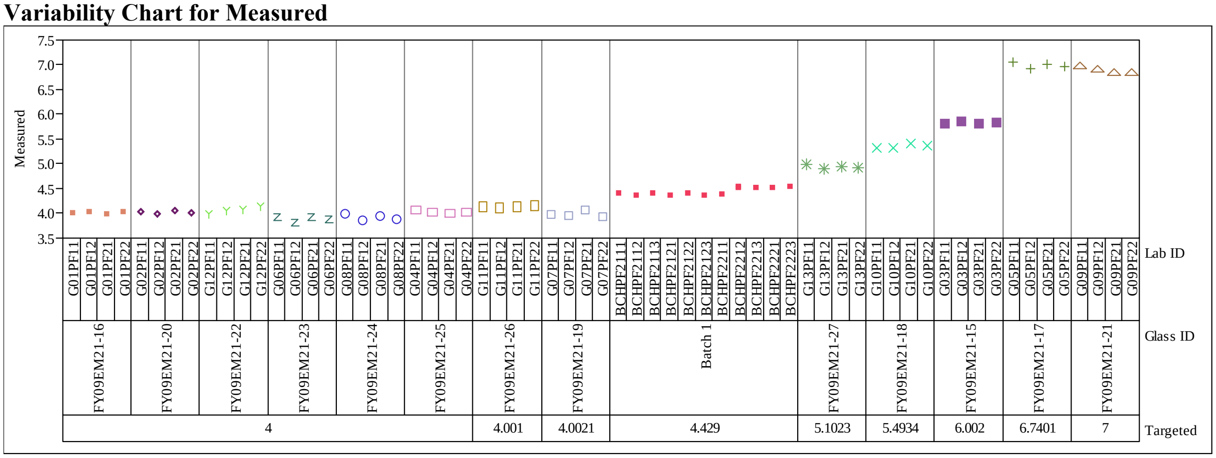


Exhibit A2. Non-Rad Sample Measurements by Lab ID within Glass ID for the Matrix 2 Study by Oxide by Analytical Block

Set=2, Oxide=La2O3 (wt%)
Variability Chart for Measured



Set=2, Oxide=Li2O (wt%)
Variability Chart for Measured



Set=2, Oxide=MgO (wt%)
Variability Chart for Measured

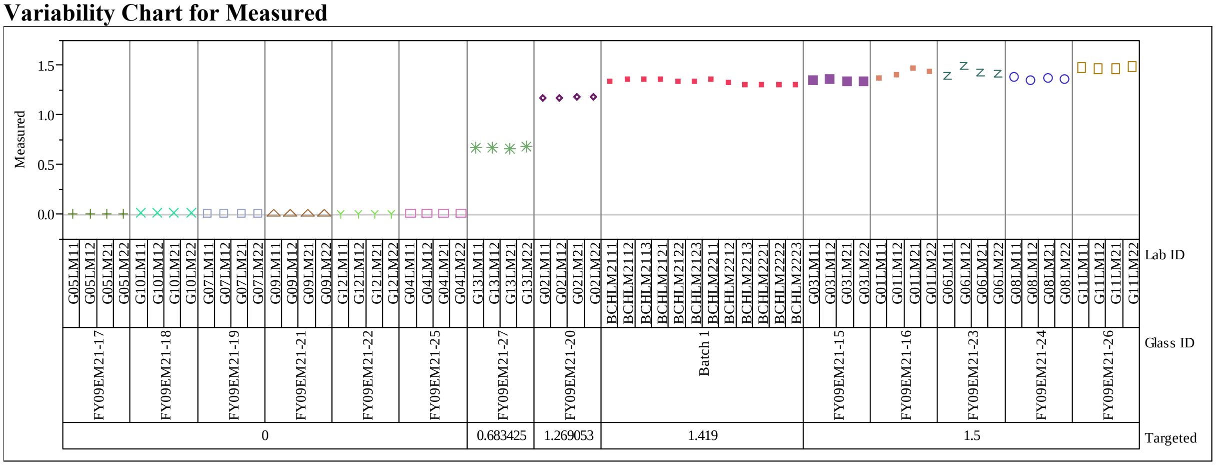
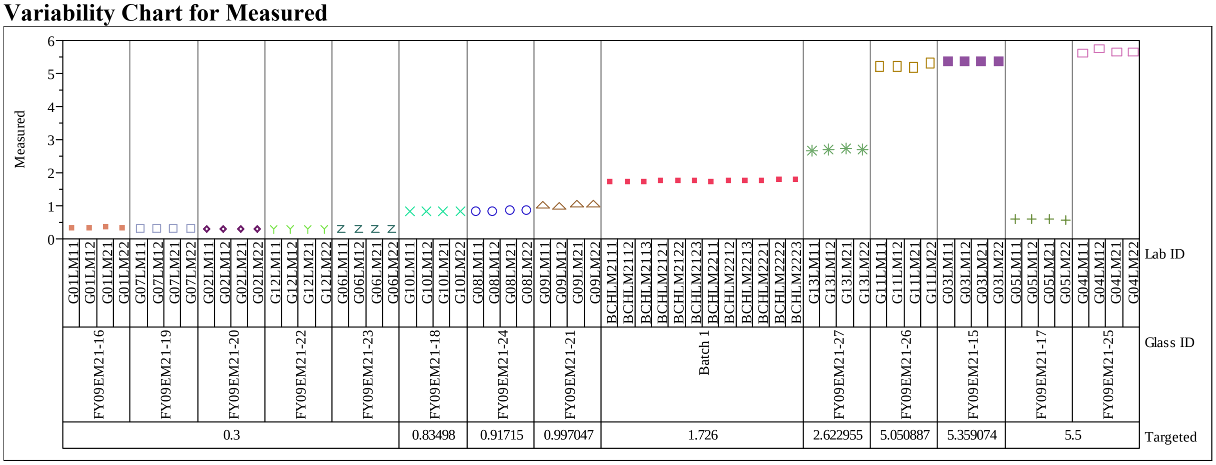
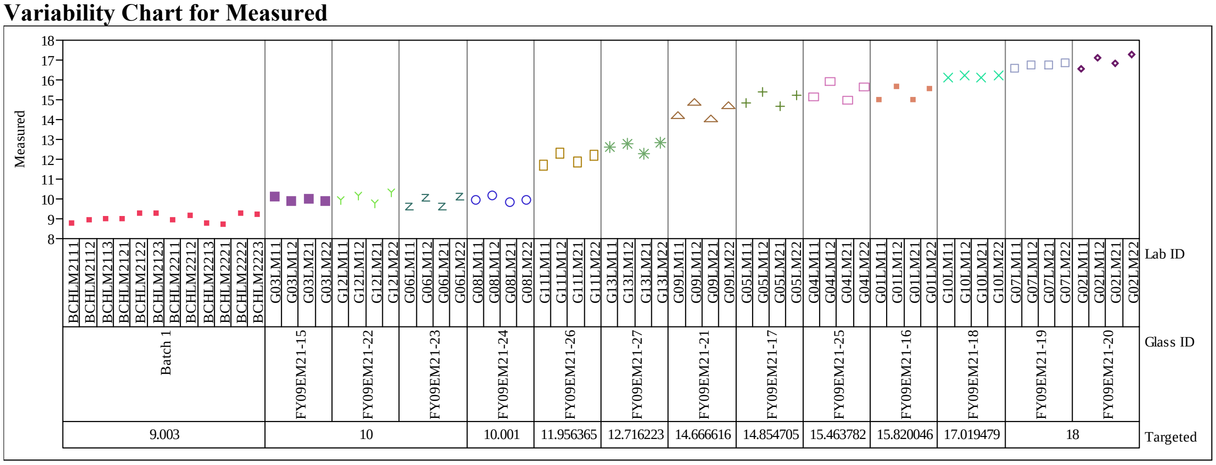


Exhibit A2. Non-Rad Sample Measurements by Lab ID within Glass ID for the Matrix 2 Study by Oxide by Analytical Block

Set=2, Oxide=MnO (wt%)
Variability Chart for Measured



Set=2, Oxide=Na2O (wt%)
Variability Chart for Measured



Set=2, Oxide=NiO (wt%)
Variability Chart for Measured

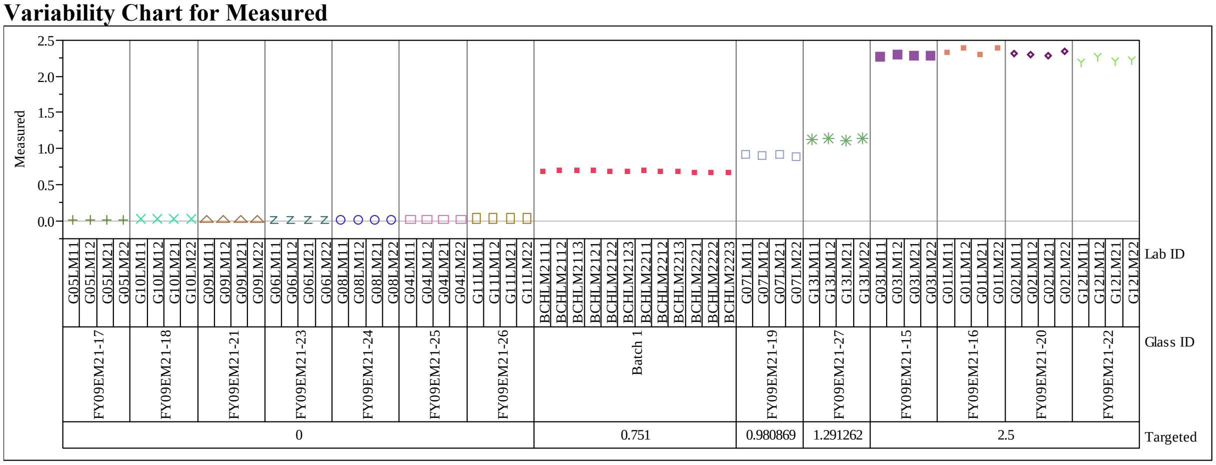
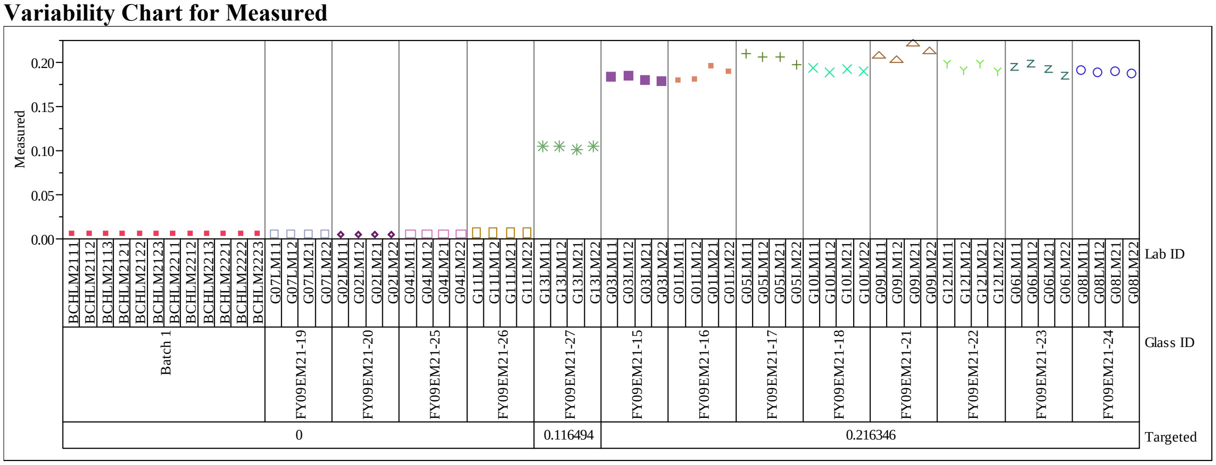
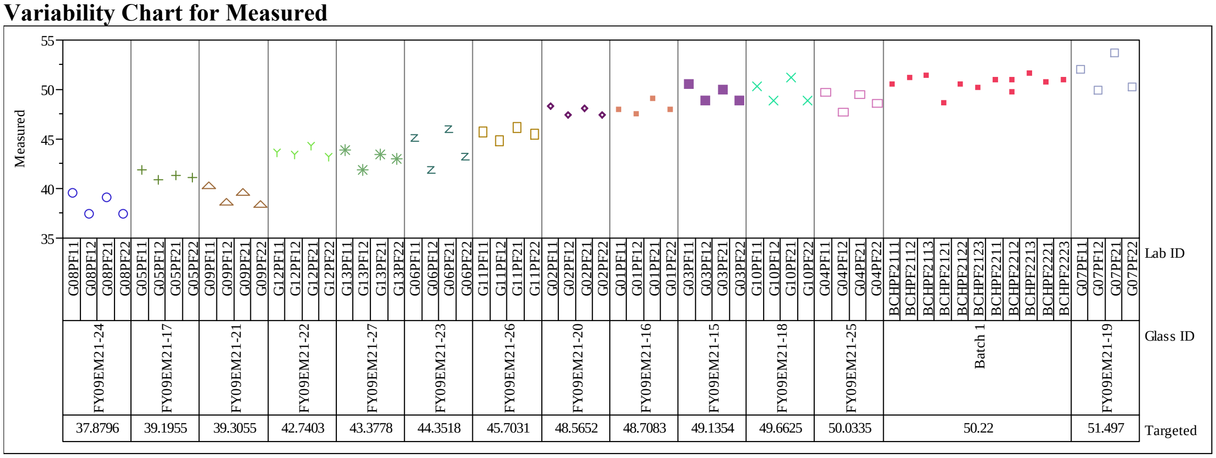


Exhibit A2. Non-Rad Sample Measurements by Lab ID within Glass ID for the Matrix 2 Study by Oxide by Analytical Block

Set=2, Oxide=PbO (wt%)
Variability Chart for Measured



Set=2, Oxide=SiO2 (wt%)
Variability Chart for Measured



Set=2, Oxide=SO4 (wt%)
Variability Chart for Measured

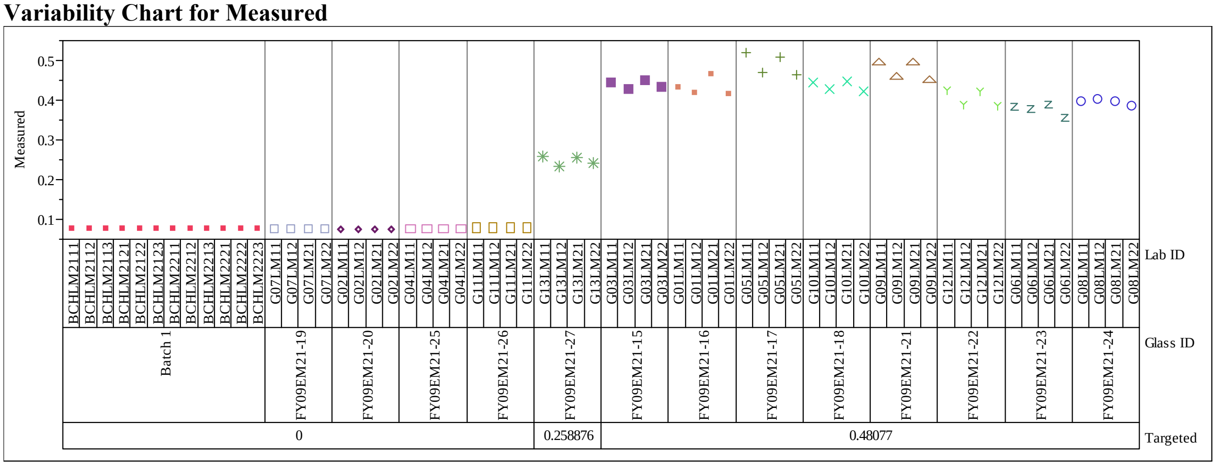
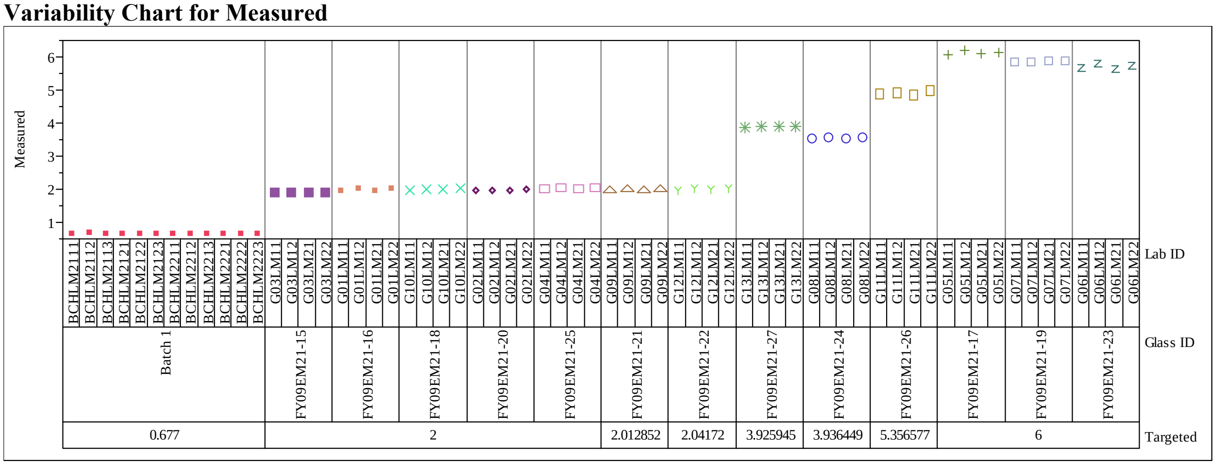
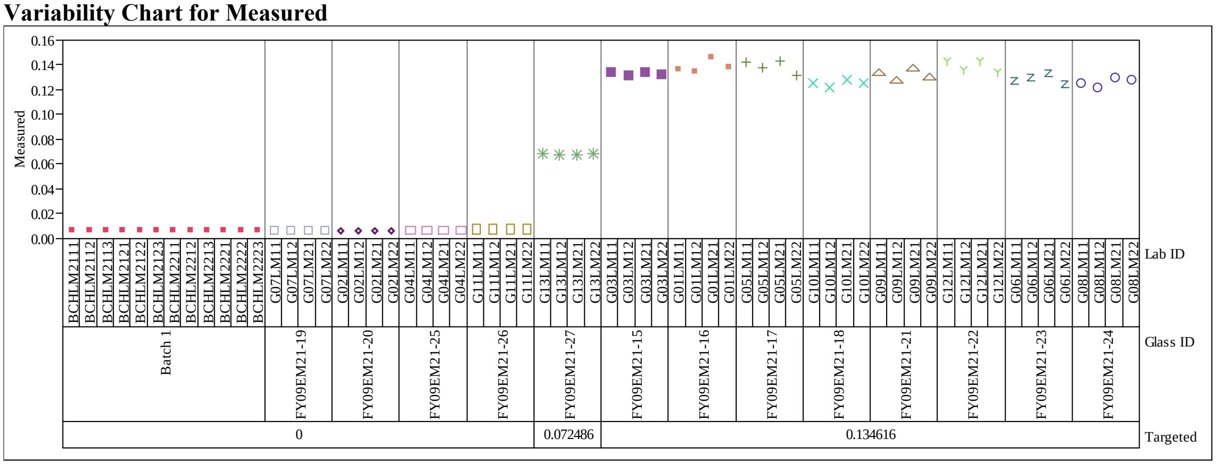


Exhibit A2. Non-Rad Sample Measurements by Lab ID within Glass ID for the Matrix 2 Study by Oxide by Analytical Block

Set=2, Oxide=TiO2 (wt%)
Variability Chart for Measured



Set=2, Oxide=ZnO (wt%)
Variability Chart for Measured



Set=2, Oxide=ZrO2 (wt%)
Variability Chart for Measured

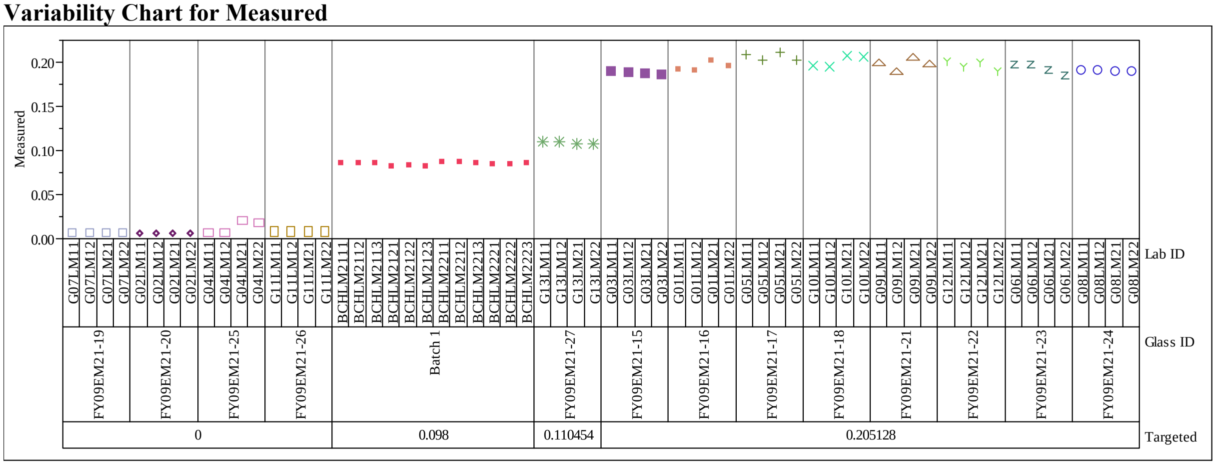
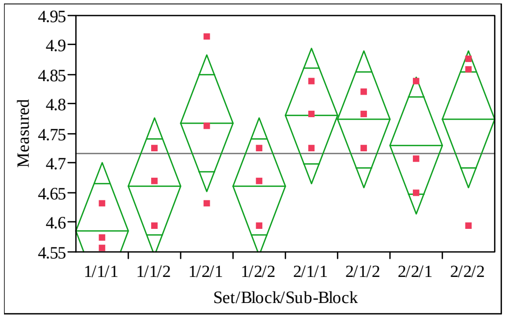


Exhibit A3. Batch 1 Sample Measurements by Block and Sub-Block by Oxide for Both Preparation Methods for the Non-Rad Matrix 2 Study

Oneway Analysis of Measured By Set/Block/Sub-Block
Oxide=Al2O3 (wt%)
Reference Value = 4.877 wt%



Oneway Anova
Summary of Fit

Rsquare	0.440685
Adj Rsquare	0.195985
Root Mean Square Error	0.093843
Mean of Response	4.716664
Observations (or Sum Wgts)	24

Analysis of Variance

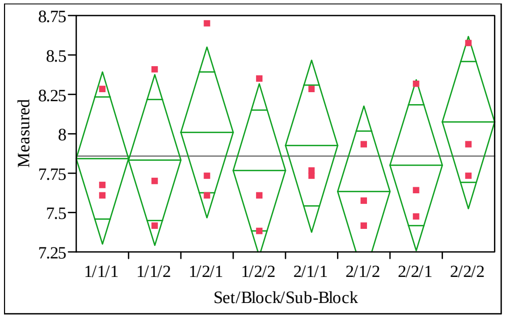
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	0.11101866	0.015860	1.8009	0.1561
Error	16	0.14090430	0.008807		
C. Total	23	0.25192296			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1/1	3	4.58519	0.05418	4.4703	4.7000
1/1/2	3	4.66077	0.05418	4.5459	4.7756
1/2/1	3	4.76784	0.05418	4.6530	4.8827
1/2/2	3	4.66077	0.05418	4.5459	4.7756
2/1/1	3	4.78044	0.05418	4.6656	4.8953
2/1/2	3	4.77414	0.05418	4.6593	4.8890
2/2/1	3	4.73005	0.05418	4.6152	4.8449
2/2/2	3	4.77414	0.05418	4.6593	4.8890

Std Error uses a pooled estimate of error variance

Oneway Analysis of Measured By Set/Block/Sub-Block
Oxide=B2O3 (wt%)
Reference Value = 7.777 wt%



Oneway Anova
Summary of Fit

Rsquare	0.113745
Adj Rsquare	-0.27399
Root Mean Square Error	0.442956
Mean of Response	7.860581
Observations (or Sum Wgts)	24

Analysis of Variance

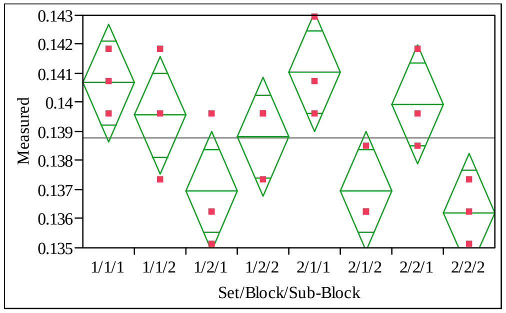
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	0.4029169	0.057560	0.2934	0.9468
Error	16	3.1393565	0.196210		
C. Total	23	3.5422734			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1/1	3	7.84582	0.25574	7.3037	8.3880
1/1/2	3	7.83509	0.25574	7.2929	8.3772
1/2/1	3	8.00682	0.25574	7.4647	8.5490
1/2/2	3	7.77069	0.25574	7.2285	8.3128
2/1/1	3	7.92095	0.25574	7.3788	8.4631
2/1/2	3	7.63116	0.25574	7.0890	8.1733
2/2/1	3	7.80289	0.25574	7.2607	8.3450
2/2/2	3	8.07122	0.25574	7.5291	8.6134

Std Error uses a pooled estimate of error variance

Oneway Analysis of Measured By Set/Block/Sub-Block
Oxide=BaO (wt%)
Reference Value = 0.151 wt%



Oneway Anova
Summary of Fit

Rsquare	0.619901
Adj Rsquare	0.453608
Root Mean Square Error	0.001659
Mean of Response	0.138772
Observations (or Sum Wgts)	24

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	0.00007183	0.000010	3.7278	0.0139
Error	16	0.00004405	2.753e-6		
C. Total	23	0.00011588			

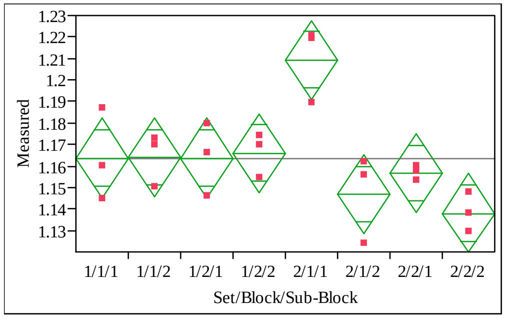
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1/1	3	0.140679	0.00096	0.13865	0.14271
1/1/2	3	0.139563	0.00096	0.13753	0.14159
1/2/1	3	0.136957	0.00096	0.13493	0.13899
1/2/2	3	0.138818	0.00096	0.13679	0.14085
2/1/1	3	0.141051	0.00096	0.13902	0.14308
2/1/2	3	0.136957	0.00096	0.13493	0.13899
2/2/1	3	0.139935	0.00096	0.13790	0.14197
2/2/2	3	0.136213	0.00096	0.13418	0.13824

Std Error uses a pooled estimate of error variance

Exhibit A3. Batch 1 Sample Measurements by Block and Sub-Block by Oxide for Both Preparation Methods for the Non-Rad Matrix 2 Study

Oneway Analysis of Measured By Set/Block/Sub-Block
Oxide=CaO (wt%)
Reference Value = 1.220 wt%



Oneway Anova
Summary of Fit

Rsquare	0.719441
Adj Rsquare	0.596696
Root Mean Square Error	0.015016
Mean of Response	1.163551
Observations (or Sum Wgts)	24

Analysis of Variance

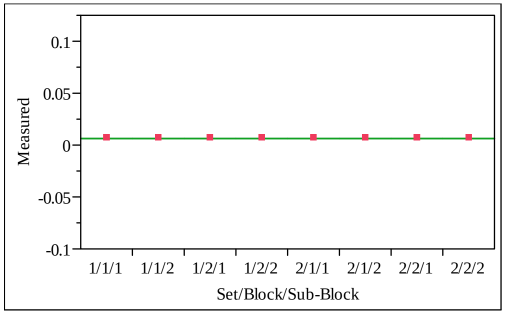
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	0.00925075	0.001322	5.8613	0.0017
Error	16	0.00360750	0.000225		
C. Total	23	0.01285825			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1/1	3	1.16367	0.00867	1.1453	1.1820
1/1/2	3	1.16413	0.00867	1.1458	1.1825
1/2/1	3	1.16367	0.00867	1.1453	1.1820
1/2/2	3	1.16600	0.00867	1.1476	1.1844
2/1/1	3	1.20938	0.00867	1.1910	1.2278
2/1/2	3	1.14688	0.00867	1.1285	1.1653
2/2/1	3	1.15667	0.00867	1.1383	1.1751
2/2/2	3	1.13802	0.00867	1.1196	1.1564

Std Error uses a pooled estimate of error variance

Oneway Analysis of Measured By Set/Block/Sub-Block
Oxide=CdO (wt%)
Reference Value = 0.0 wt%



Oneway Anova
Summary of Fit

Rsquare	.
Adj Rsquare	.
Root Mean Square Error	0
Mean of Response	0.005712
Observations (or Sum Wgts)	24

Analysis of Variance

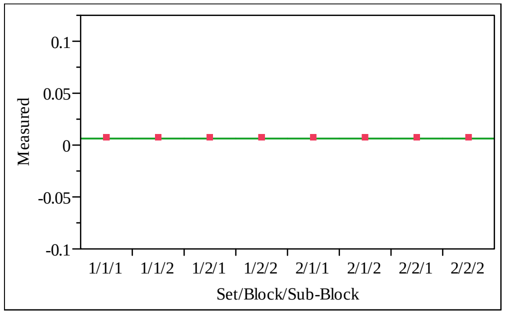
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	0	0	.	.
Error	16	0	0		
C. Total	23	0			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1/1	3	0.005712	0	0.00571	0.00571
1/1/2	3	0.005712	0	0.00571	0.00571
1/2/1	3	0.005712	0	0.00571	0.00571
1/2/2	3	0.005712	0	0.00571	0.00571
2/1/1	3	0.005712	0	0.00571	0.00571
2/1/2	3	0.005712	0	0.00571	0.00571
2/2/1	3	0.005712	0	0.00571	0.00571
2/2/2	3	0.005712	0	0.00571	0.00571

Std Error uses a pooled estimate of error variance

Oneway Analysis of Measured By Set/Block/Sub-Block
Oxide=Ce2O3 (wt%)
Reference Value = 0.0 wt%



Oneway Anova
Summary of Fit

Rsquare	.
Adj Rsquare	.
Root Mean Square Error	0
Mean of Response	0.005857
Observations (or Sum Wgts)	24

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	0	0	.	.
Error	16	0	0		
C. Total	23	0			

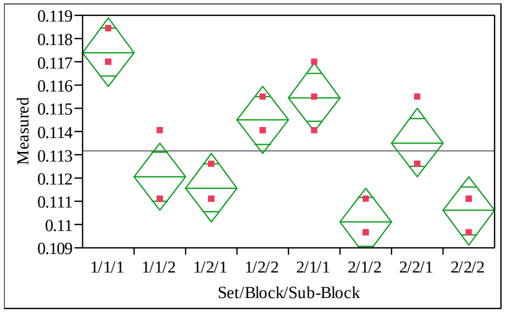
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1/1	3	0.005857	0	0.00586	0.00586
1/1/2	3	0.005857	0	0.00586	0.00586
1/2/1	3	0.005857	0	0.00586	0.00586
1/2/2	3	0.005857	0	0.00586	0.00586
2/1/1	3	0.005857	0	0.00586	0.00586
2/1/2	3	0.005857	0	0.00586	0.00586
2/2/1	3	0.005857	0	0.00586	0.00586
2/2/2	3	0.005857	0	0.00586	0.00586

Std Error uses a pooled estimate of error variance

Exhibit A3. Batch 1 Sample Measurements by Block and Sub-Block by Oxide for Both Preparation Methods for the Non-Rad Matrix 2 Study

Oneway Analysis of Measured By Set/Block/Sub-Block
Oxide=Cr2O3 (wt%)
Reference Value = 0.107 wt%



Oneway Anova
Summary of Fit

Rsquare	0.85553
Adj Rsquare	0.792325
Root Mean Square Error	0.001193
Mean of Response	0.113152
Observations (or Sum Wgts)	24

Analysis of Variance

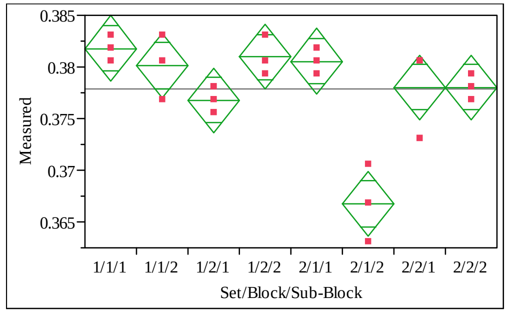
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	0.00013494	0.000019	13.5357	<.0001
Error	16	0.00002279	1.424e-6		
C. Total	23	0.00015773			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1/1	3	0.117415	0.00069	0.11595	0.11888
1/1/2	3	0.112056	0.00069	0.11060	0.11352
1/2/1	3	0.111569	0.00069	0.11011	0.11303
1/2/2	3	0.114492	0.00069	0.11303	0.11595
2/1/1	3	0.115466	0.00069	0.11401	0.11693
2/1/2	3	0.110107	0.00069	0.10865	0.11157
2/2/1	3	0.113518	0.00069	0.11206	0.11498
2/2/2	3	0.110594	0.00069	0.10913	0.11206

Std Error uses a pooled estimate of error variance

Oneway Analysis of Measured By Set/Block/Sub-Block
Oxide=CuO (wt%)
Reference Value = 0.399 wt%



Oneway Anova
Summary of Fit

Rsquare	0.821219
Adj Rsquare	0.743003
Root Mean Square Error	0.002568
Mean of Response	0.377887
Observations (or Sum Wgts)	24

Analysis of Variance

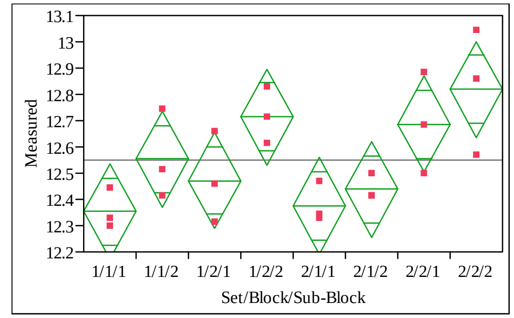
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	0.00048466	0.000069	10.4993	<.0001
Error	16	0.00010551	6.594e-6		
C. Total	23	0.00059017			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1/1	3	0.381799	0.00148	0.37866	0.38494
1/1/2	3	0.380130	0.00148	0.37699	0.38327
1/2/1	3	0.376792	0.00148	0.37365	0.37993
1/2/2	3	0.380964	0.00148	0.37782	0.38411
2/1/1	3	0.380547	0.00148	0.37740	0.38369
2/1/2	3	0.366777	0.00148	0.36363	0.36992
2/2/1	3	0.378044	0.00148	0.37490	0.38119
2/2/2	3	0.378044	0.00148	0.37490	0.38119

Std Error uses a pooled estimate of error variance

Oneway Analysis of Measured By Set/Block/Sub-Block
Oxide=Fe2O3 (wt%)
Reference Value = 12.839 wt%



Oneway Anova
Summary of Fit

Rsquare	0.634888
Adj Rsquare	0.475151
Root Mean Square Error	0.149065
Mean of Response	12.55157
Observations (or Sum Wgts)	24

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	0.61822053	0.088317	3.9746	0.0106
Error	16	0.35552705	0.022220		
C. Total	23	0.97374758			

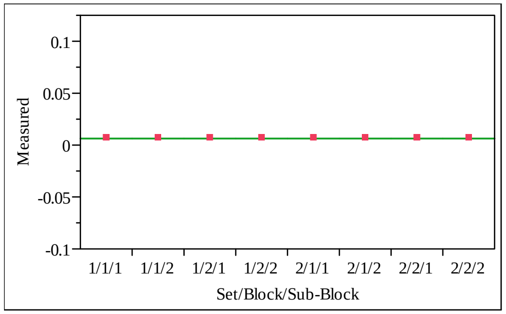
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1/1	3	12.3526	0.08606	12.170	12.535
1/1/2	3	12.5528	0.08606	12.370	12.735
1/2/1	3	12.4717	0.08606	12.289	12.654
1/2/2	3	12.7148	0.08606	12.532	12.897
2/1/1	3	12.3764	0.08606	12.194	12.559
2/1/2	3	12.4384	0.08606	12.256	12.621
2/2/1	3	12.6862	0.08606	12.504	12.869
2/2/2	3	12.8196	0.08606	12.637	13.002

Std Error uses a pooled estimate of error variance

Exhibit A3. Batch 1 Sample Measurements by Block and Sub-Block by Oxide for Both Preparation Methods for the Non-Rad Matrix 2 Study

Oneway Analysis of Measured By Set/Block/Sub-Block
Oxide=La2O3 (wt%)
Reference Value = 0.0 wt%



Oneway Anova
Summary of Fit

Rsquare	.
Adj Rsquare	.
Root Mean Square Error	0
Mean of Response	0.005864
Observations (or Sum Wgts)	24

Analysis of Variance

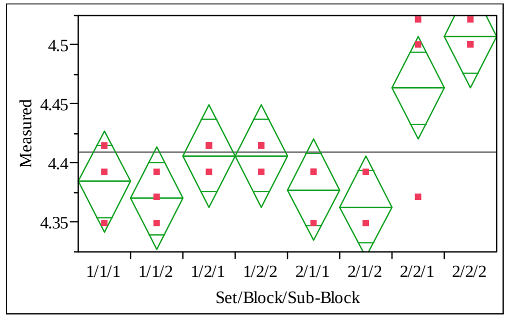
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	0	0	.	.
Error	16	0	0		
C. Total	23	0			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1/1	3	0.005864	0	0.00586	0.00586
1/1/2	3	0.005864	0	0.00586	0.00586
1/2/1	3	0.005864	0	0.00586	0.00586
1/2/2	3	0.005864	0	0.00586	0.00586
2/1/1	3	0.005864	0	0.00586	0.00586
2/1/2	3	0.005864	0	0.00586	0.00586
2/2/1	3	0.005864	0	0.00586	0.00586
2/2/2	3	0.005864	0	0.00586	0.00586

Std Error uses a pooled estimate of error variance

Oneway Analysis of Measured By Set/Block/Sub-Block
Oxide=Li2O (wt%)
Reference Value = 4.429 wt%



Oneway Anova
Summary of Fit

Rsquare	0.728814
Adj Rsquare	0.610169
Root Mean Square Error	0.035157
Mean of Response	4.409857
Observations (or Sum Wgts)	24

Analysis of Variance

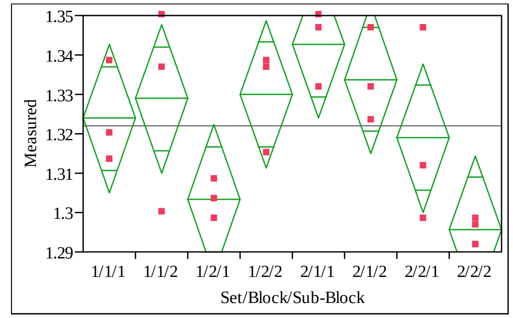
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	0.05314775	0.007593	6.1429	0.0013
Error	16	0.01977591	0.001236		
C. Total	23	0.07292366			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1/1	3	4.38474	0.02030	4.3417	4.4278
1/1/2	3	4.37039	0.02030	4.3274	4.4134
1/2/1	3	4.40627	0.02030	4.3632	4.4493
1/2/2	3	4.40627	0.02030	4.3632	4.4493
2/1/1	3	4.37756	0.02030	4.3345	4.4206
2/1/2	3	4.36321	0.02030	4.3202	4.4062
2/2/1	3	4.46368	0.02030	4.4207	4.5067
2/2/2	3	4.50674	0.02030	4.4637	4.5498

Std Error uses a pooled estimate of error variance

Oneway Analysis of Measured By Set/Block/Sub-Block
Oxide=MgO (wt%)
Reference Value = 1.419 wt%



Oneway Anova
Summary of Fit

Rsquare	0.579104
Adj Rsquare	0.394962
Root Mean Square Error	0.015345
Mean of Response	1.322149
Observations (or Sum Wgts)	24

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	0.00518356	0.000741	3.1449	0.0273
Error	16	0.00376744	0.000235		
C. Total	23	0.00895100			

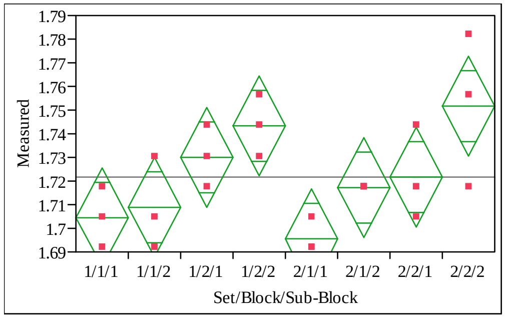
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1/1	3	1.32388	0.00886	1.3051	1.3427
1/1/2	3	1.32885	0.00886	1.3101	1.3476
1/2/1	3	1.30342	0.00886	1.2846	1.3222
1/2/2	3	1.32996	0.00886	1.3112	1.3487
2/1/1	3	1.34267	0.00886	1.3239	1.3615
2/1/2	3	1.33383	0.00886	1.3150	1.3526
2/2/1	3	1.31890	0.00886	1.3001	1.3377
2/2/2	3	1.29569	0.00886	1.2769	1.3145

Std Error uses a pooled estimate of error variance

Exhibit A3. Batch 1 Sample Measurements by Block and Sub-Block by Oxide for Both Preparation Methods for the Non-Rad Matrix 2 Study

Oneway Analysis of Measured By Set/Block/Sub-Block
Oxide=MnO (wt%)
Reference Value = 1.726 wt%



Oneway Anova
Summary of Fit

Rsquare	0.619469
Adj Rsquare	0.452987
Root Mean Square Error	0.017283
Mean of Response	1.7216
Observations (or Sum Wgts)	24

Analysis of Variance

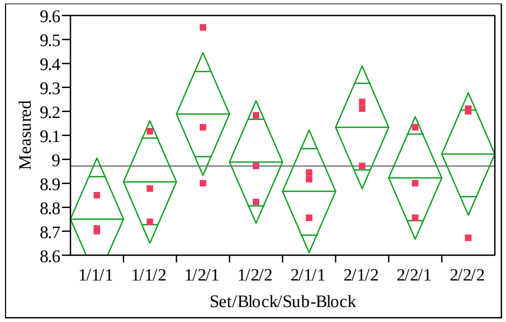
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	0.00778025	0.001111	3.7209	0.0140
Error	16	0.00477930	0.000299		
C. Total	23	0.01255955			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1/1	3	1.70438	0.00998	1.6832	1.7255
1/1/2	3	1.70869	0.00998	1.6875	1.7298
1/2/1	3	1.73021	0.00998	1.7091	1.7514
1/2/2	3	1.74312	0.00998	1.7220	1.7643
2/1/1	3	1.69578	0.00998	1.6746	1.7169
2/1/2	3	1.71730	0.00998	1.6961	1.7384
2/2/1	3	1.72160	0.00998	1.7004	1.7428
2/2/2	3	1.75173	0.00998	1.7306	1.7729

Std Error uses a pooled estimate of error variance

Oneway Analysis of Measured By Set/Block/Sub-Block
Oxide=Na2O (wt%)
Reference Value = 9.003 wt%



Oneway Anova
Summary of Fit

Rsquare	0.38388
Adj Rsquare	0.114328
Root Mean Square Error	0.20845
Mean of Response	8.972063
Observations (or Sum Wgts)	24

Analysis of Variance

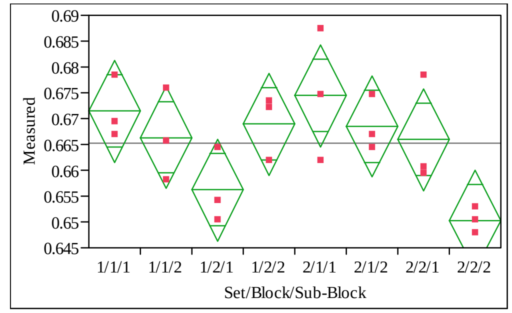
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	0.4331673	0.061881	1.4241	0.2627
Error	16	0.6952240	0.043451		
C. Total	23	1.1283913			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1/1	3	8.74852	0.12035	8.4934	9.0036
1/1/2	3	8.90579	0.12035	8.6507	9.1609
1/2/1	3	9.18887	0.12035	8.9337	9.4440
1/2/2	3	8.98667	0.12035	8.7315	9.2418
2/1/1	3	8.86535	0.12035	8.6102	9.1205
2/1/2	3	9.13495	0.12035	8.8798	9.3901
2/2/1	3	8.92376	0.12035	8.6686	9.1789
2/2/2	3	9.02261	0.12035	8.7675	9.2777

Std Error uses a pooled estimate of error variance

Oneway Analysis of Measured By Set/Block/Sub-Block
Oxide=NiO (wt%)
Reference Value = 0.751 wt%



Oneway Anova
Summary of Fit

Rsquare	0.568721
Adj Rsquare	0.380037
Root Mean Square Error	0.008048
Mean of Response	0.665252
Observations (or Sum Wgts)	24

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	0.00136658	0.000195	3.0141	0.0320
Error	16	0.00103632	0.000065		
C. Total	23	0.00240291			

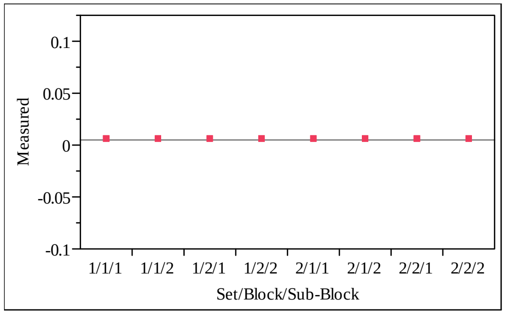
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1/1	3	0.671456	0.00465	0.66161	0.68131
1/1/2	3	0.666366	0.00465	0.65652	0.67622
1/2/1	3	0.656186	0.00465	0.64634	0.66604
1/2/2	3	0.668911	0.00465	0.65906	0.67876
2/1/1	3	0.674425	0.00465	0.66457	0.68428
2/1/2	3	0.668487	0.00465	0.65864	0.67834
2/2/1	3	0.665942	0.00465	0.65609	0.67579
2/2/2	3	0.650248	0.00465	0.64040	0.66010

Std Error uses a pooled estimate of error variance

Exhibit A3. Batch 1 Sample Measurements by Block and Sub-Block by Oxide for Both Preparation Methods for the Non-Rad Matrix 2 Study

Oneway Analysis of Measured By Set/Block/Sub-Block
Oxide=PbO (wt%)
Reference Value = 0.0 wt%



Oneway Anova
Summary of Fit

Rsquare	4
Adj Rsquare	5.3125
Root Mean Square Error	.
Mean of Response	0.005386
Observations (or Sum Wgts)	24

Analysis of Variance

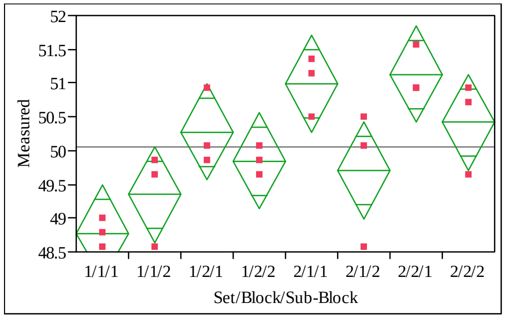
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	7.2222e-35	1.032e-35	-3.0476	0.0000
Error	16	-5.417e-35	-3.39e-36		
C. Total	23	1.8056e-35			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1/1	3	0.005386	.	.	.
1/1/2	3	0.005386	.	.	.
1/2/1	3	0.005386	.	.	.
1/2/2	3	0.005386	.	.	.
2/1/1	3	0.005386	.	.	.
2/1/2	3	0.005386	.	.	.
2/2/1	3	0.005386	.	.	.
2/2/2	3	0.005386	.	.	.

Std Error uses a pooled estimate of error variance

Oneway Analysis of Measured By Set/Block/Sub-Block
Oxide=SiO2 (wt%)
Reference Value = 50.22 wt%



Oneway Anova
Summary of Fit

Rsquare	0.713366
Adj Rsquare	0.587963
Root Mean Square Error	0.582608
Mean of Response	50.05962
Observations (or Sum Wgts)	24

Analysis of Variance

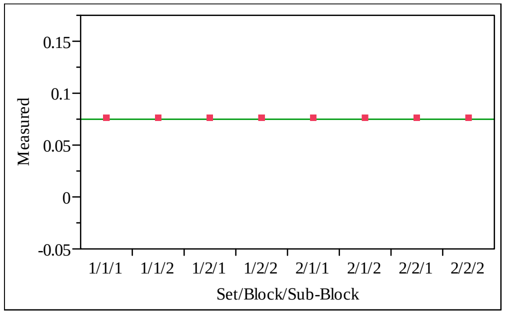
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	13.516239	1.93089	5.6886	0.0019
Error	16	5.430904	0.33943		
C. Total	23	18.947143			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1/1	3	48.7760	0.33637	48.063	49.489
1/1/2	3	49.3465	0.33637	48.633	50.060
1/2/1	3	50.2736	0.33637	49.560	50.987
1/2/2	3	49.8457	0.33637	49.133	50.559
2/1/1	3	50.9867	0.33637	50.274	51.700
2/1/2	3	49.7031	0.33637	48.990	50.416
2/2/1	3	51.1293	0.33637	50.416	51.842
2/2/2	3	50.4162	0.33637	49.703	51.129

Std Error uses a pooled estimate of error variance

Oneway Analysis of Measured By Set/Block/Sub-Block
Oxide=SO4 (wt%)
Reference Value = 0.0 wt%



Oneway Anova
Summary of Fit

Rsquare	.
Adj Rsquare	.
Root Mean Square Error	0
Mean of Response	0.074898
Observations (or Sum Wgts)	24

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	0	0	.	.
Error	16	0	0		
C. Total	23	0			

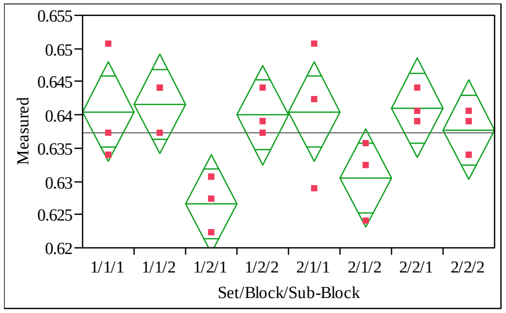
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1/1	3	0.074898	0	0.07490	0.07490
1/1/2	3	0.074898	0	0.07490	0.07490
1/2/1	3	0.074898	0	0.07490	0.07490
1/2/2	3	0.074898	0	0.07490	0.07490
2/1/1	3	0.074898	0	0.07490	0.07490
2/1/2	3	0.074898	0	0.07490	0.07490
2/2/1	3	0.074898	0	0.07490	0.07490
2/2/2	3	0.074898	0	0.07490	0.07490

Std Error uses a pooled estimate of error variance

Exhibit A3. Batch 1 Sample Measurements by Block and Sub-Block by Oxide for Both Preparation Methods for the Non-Rad Matrix 2 Study

Oneway Analysis of Measured By Set/Block/Sub-Block
Oxide=TiO2 (wt%)
Reference Value = 0.677 wt%



Oneway Anova
Summary of Fit

Rsquare	0.52785
Adj Rsquare	0.321284
Root Mean Square Error	0.006091
Mean of Response	0.637315
Observations (or Sum Wgts)	24

Analysis of Variance

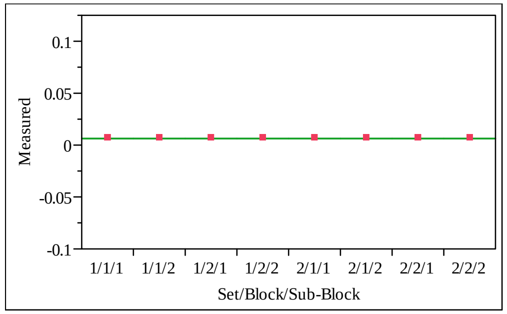
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	0.00066356	0.000095	2.5554	0.0570
Error	16	0.00059354	0.000037		
C. Total	23	0.00125710			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1/1	3	0.640512	0.00352	0.63306	0.64797
1/1/2	3	0.641624	0.00352	0.63417	0.64908
1/2/1	3	0.626612	0.00352	0.61916	0.63407
1/2/2	3	0.639956	0.00352	0.63250	0.64741
2/1/1	3	0.640512	0.00352	0.63306	0.64797
2/1/2	3	0.630504	0.00352	0.62305	0.63796
2/2/1	3	0.641068	0.00352	0.63361	0.64852
2/2/2	3	0.637732	0.00352	0.63028	0.64519

Std Error uses a pooled estimate of error variance

Oneway Analysis of Measured By Set/Block/Sub-Block
Oxide=ZnO (wt%)
Reference Value = 0.0 wt%



Oneway Anova
Summary of Fit

Rsquare	.
Adj Rsquare	.
Root Mean Square Error	0
Mean of Response	0.006224
Observations (or Sum Wgts)	24

Analysis of Variance

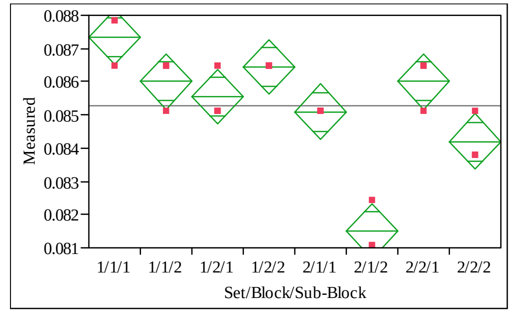
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	0	0	.	.
Error	16	0	0		
C. Total	23	0			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1/1	3	0.006224	0	0.00622	0.00622
1/1/2	3	0.006224	0	0.00622	0.00622
1/2/1	3	0.006224	0	0.00622	0.00622
1/2/2	3	0.006224	0	0.00622	0.00622
2/1/1	3	0.006224	0	0.00622	0.00622
2/1/2	3	0.006224	0	0.00622	0.00622
2/2/1	3	0.006224	0	0.00622	0.00622
2/2/2	3	0.006224	0	0.00622	0.00622

Std Error uses a pooled estimate of error variance

Oneway Analysis of Measured By Set/Block/Sub-Block
Oxide=ZrO2 (wt%)
Reference Value = 0.098 wt%



Oneway Anova
Summary of Fit

Rsquare	0.901538
Adj Rsquare	0.858462
Root Mean Square Error	0.000675
Mean of Response	0.085269
Observations (or Sum Wgts)	24

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	0.00006683	9.5469e-6	20.9286	<.0001
Error	16	0.00000730	4.5617e-7		
C. Total	23	0.00007413			

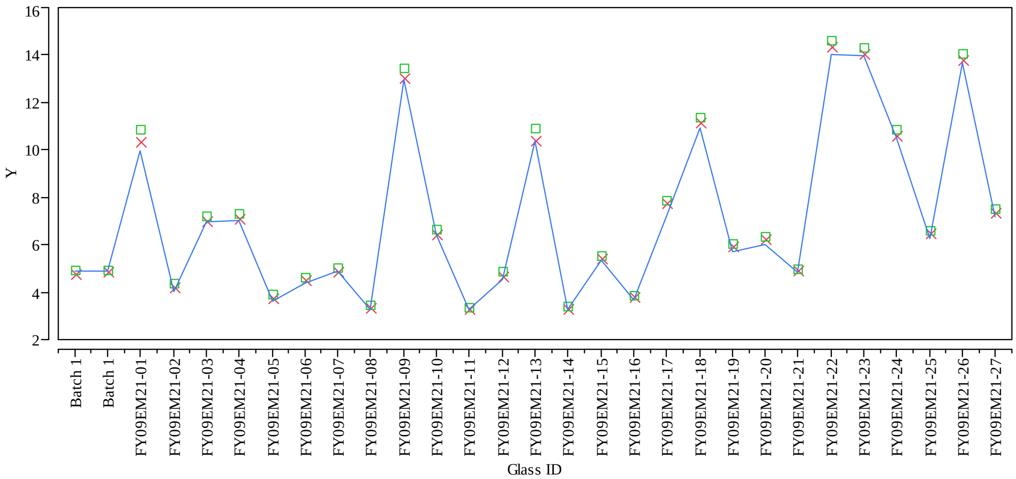
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1/1	3	0.087352	0.00039	0.08653	0.08818
1/1/2	3	0.086001	0.00039	0.08517	0.08683
1/2/1	3	0.085551	0.00039	0.08472	0.08638
1/2/2	3	0.086451	0.00039	0.08562	0.08728
2/1/1	3	0.085100	0.00039	0.08427	0.08593
2/1/2	3	0.081498	0.00039	0.08067	0.08232
2/2/1	3	0.086001	0.00039	0.08517	0.08683
2/2/2	3	0.084200	0.00039	0.08337	0.08503

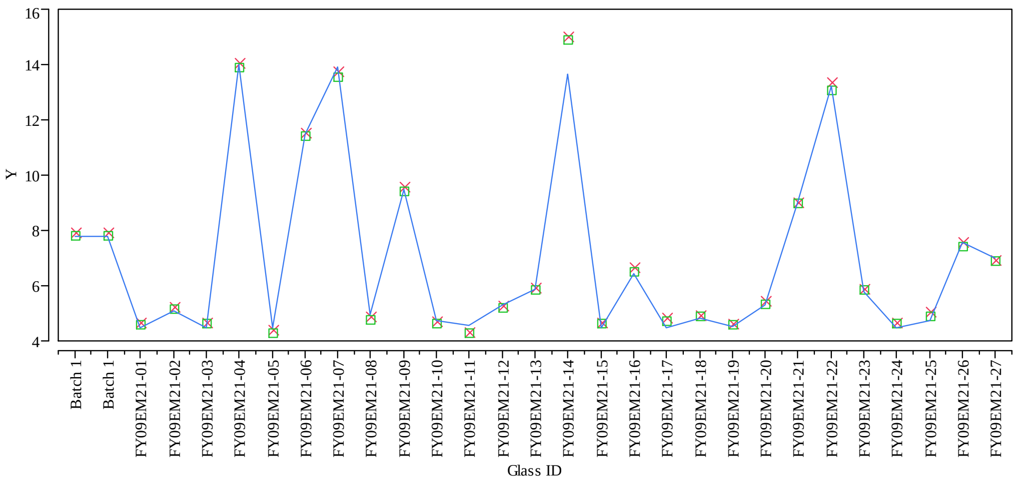
Std Error uses a pooled estimate of error variance

Exhibit A4. Average Measured and Bias-Corrected (bc) Versus Targeted Compositions by Glass ID by Oxide for the Non-Rad Matrix 2 Study

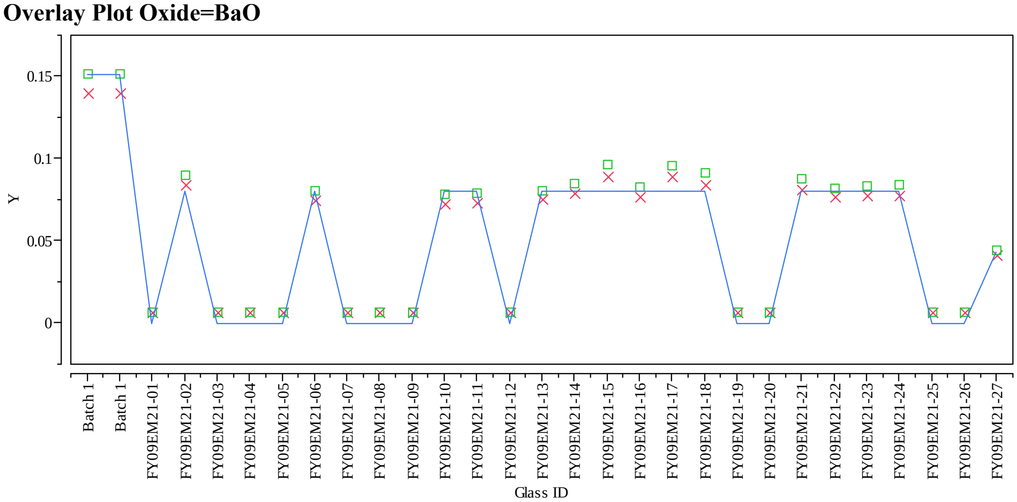
Overlay Plot Oxide=Al2O3



Overlay Plot Oxide=B2O3



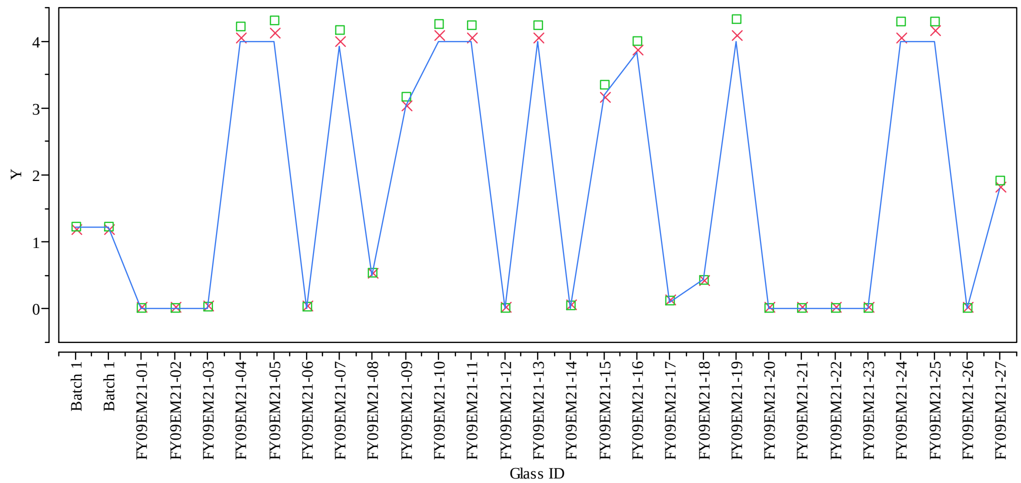
Overlay Plot Oxide=BaO



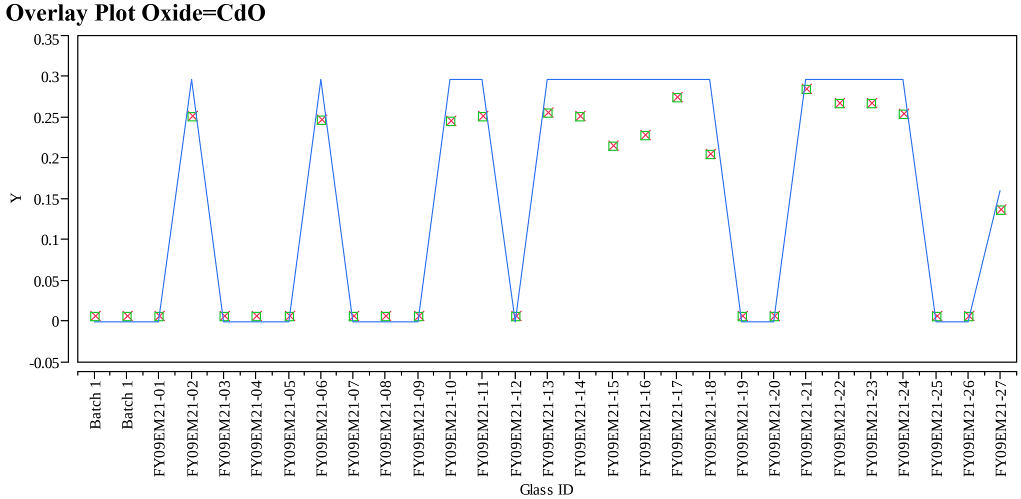
Y × Measured ▫ Measured bc — Targeted

Exhibit A4. Average Measured and Bias-Corrected (bc) Versus Targeted Compositions by Glass ID by Oxide for the Non-Rad Matrix 2 Study

Overlay Plot Oxide=CaO



Overlay Plot Oxide=CdO



Overlay Plot Oxide=Ce2O3

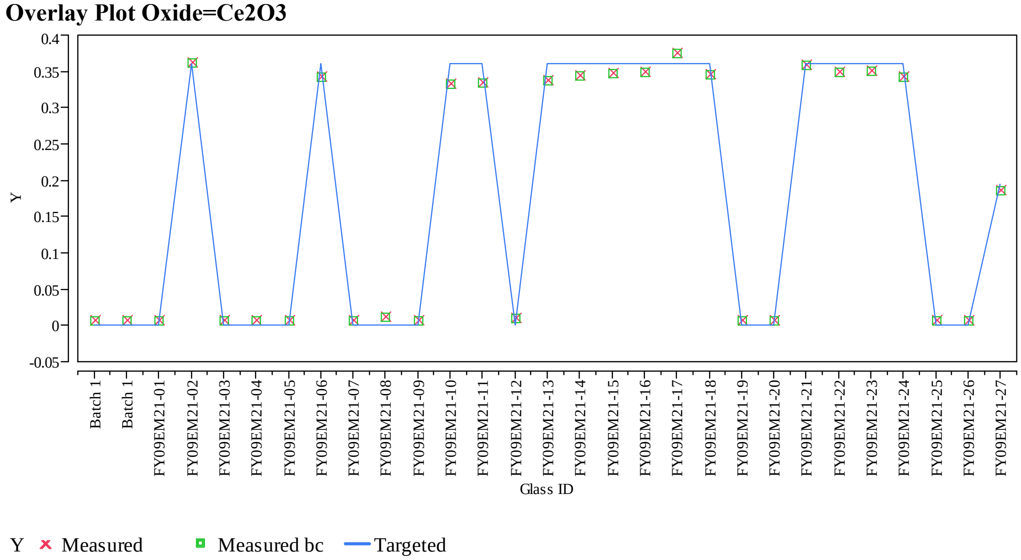
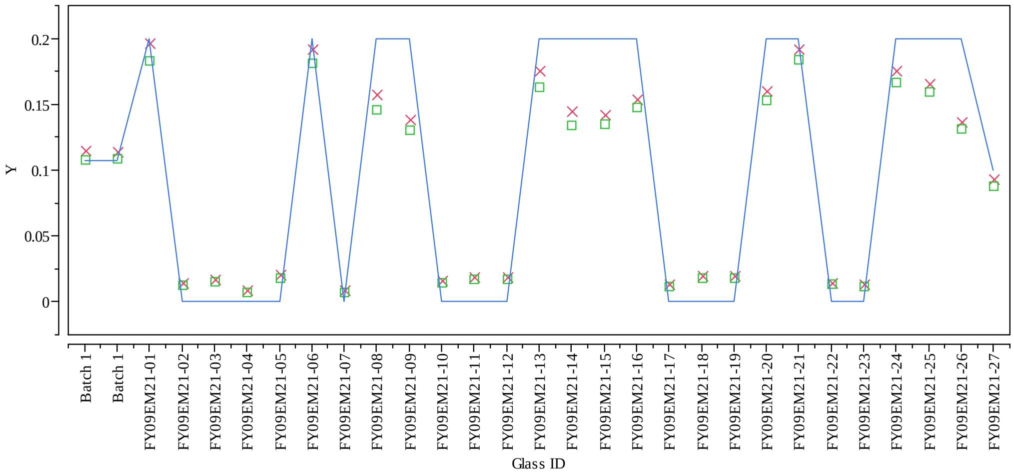
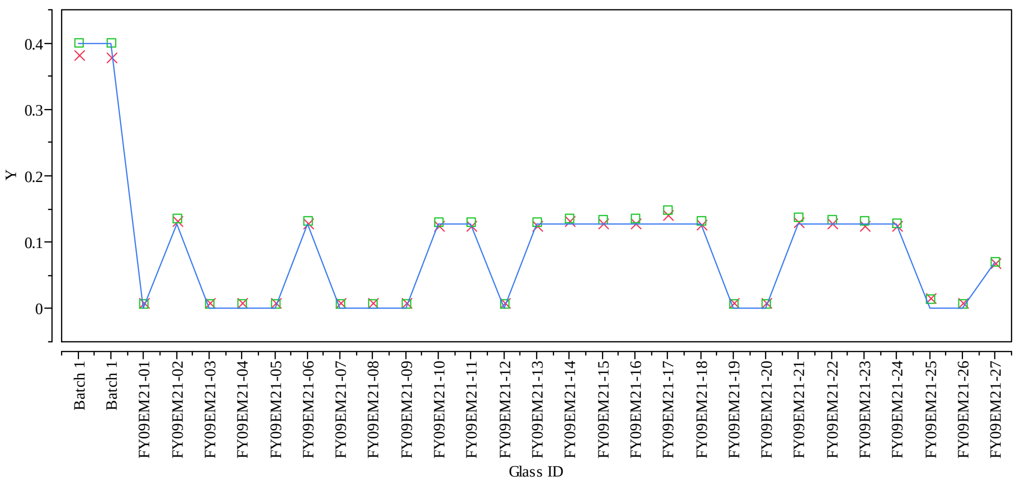


Exhibit A4. Average Measured and Bias-Corrected (bc) Versus Targeted Compositions by Glass ID by Oxide for the Non-Rad Matrix 2 Study

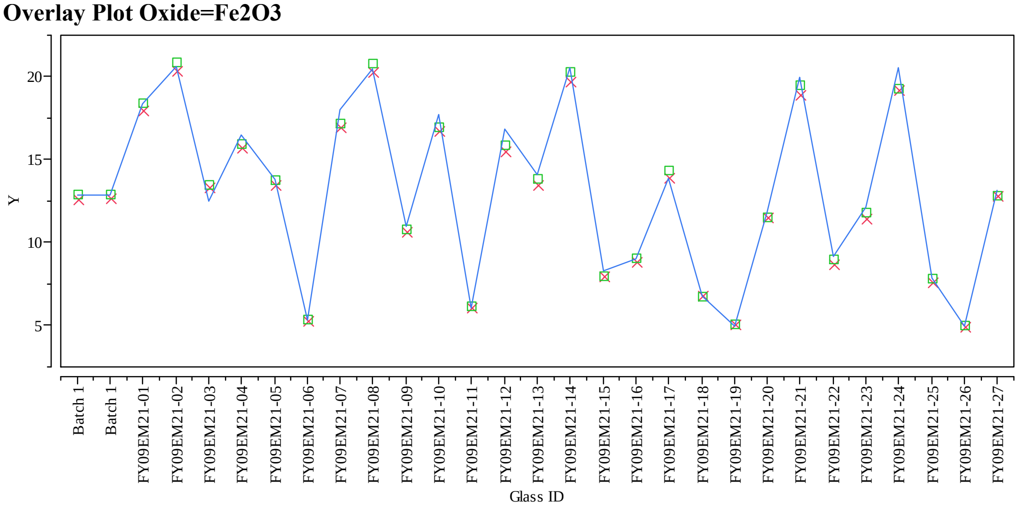
Overlay Plot Oxide=Cr2O3



Overlay Plot Oxide=CuO



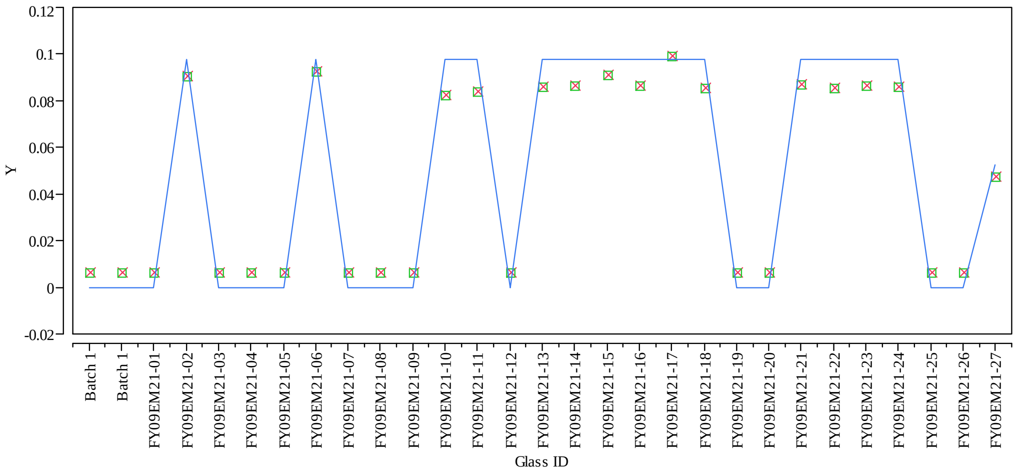
Overlay Plot Oxide=Fe2O3



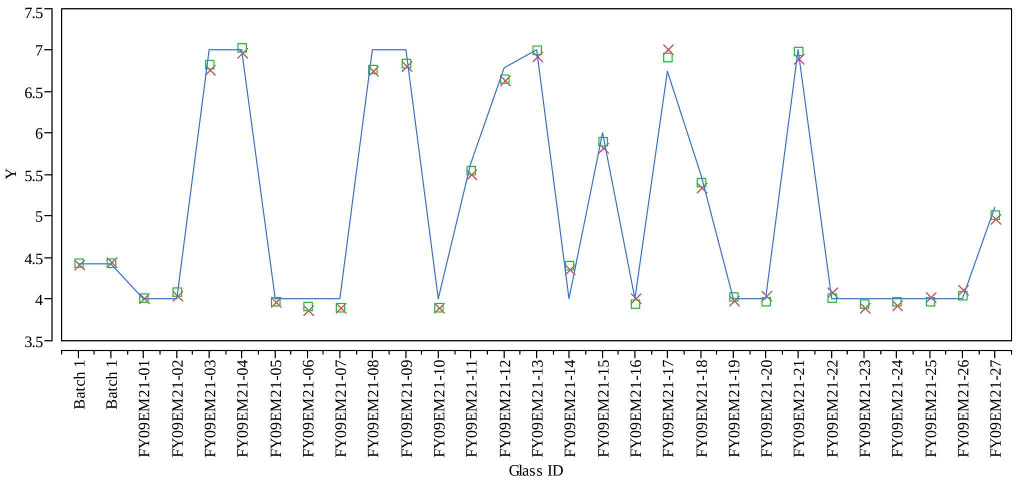
Y × Measured ▫ Measured bc — Targeted

Exhibit A4. Average Measured and Bias-Corrected (bc) Versus Targeted Compositions by Glass ID by Oxide for the Non-Rad Matrix 2 Study

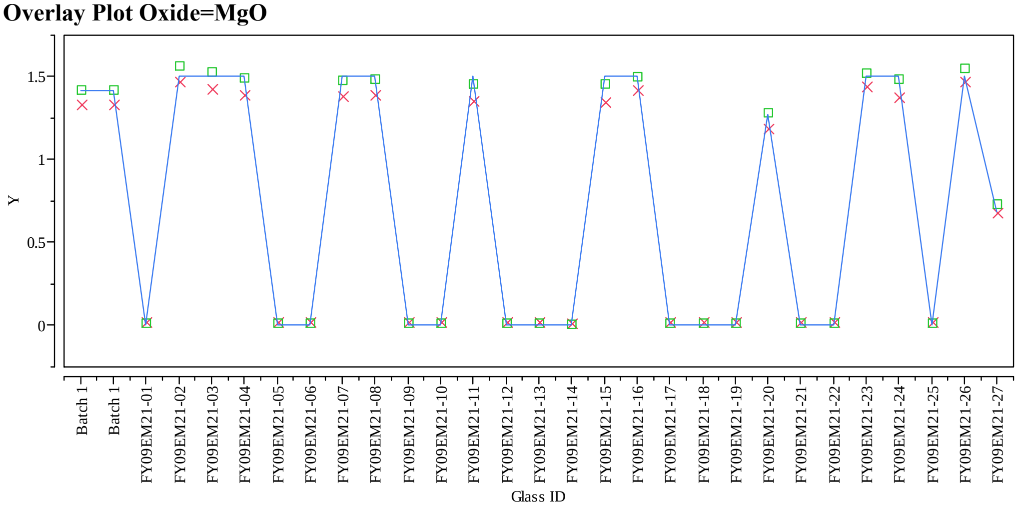
Overlay Plot Oxide=La2O3



Overlay Plot Oxide=Li2O

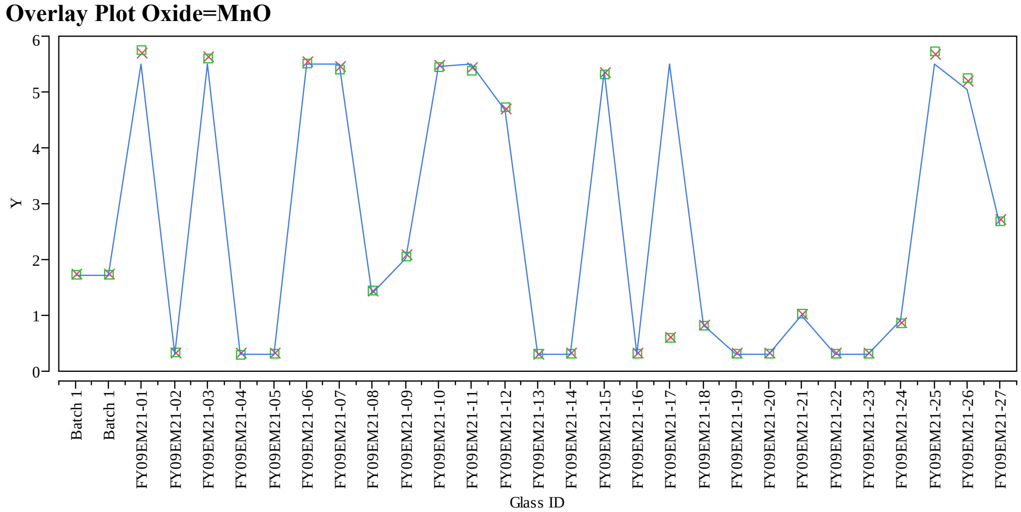


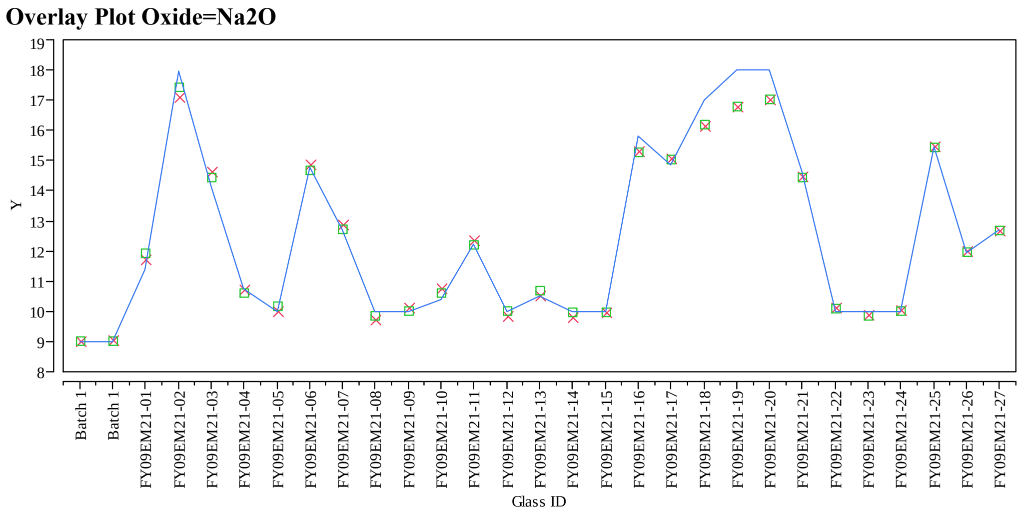
Overlay Plot Oxide=MgO



Y × Measured ▫ Measured bc — Targeted

Exhibit A4. Average Measured and Bias-Corrected (bc) Versus Targeted Compositions by Glass ID by Oxide for the Non-Rad Matrix 2 Study





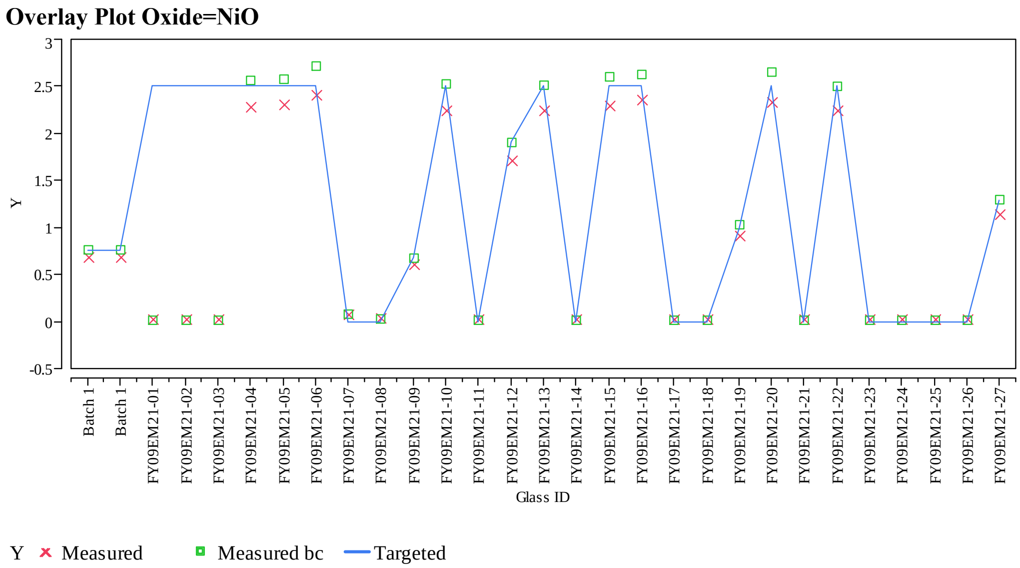
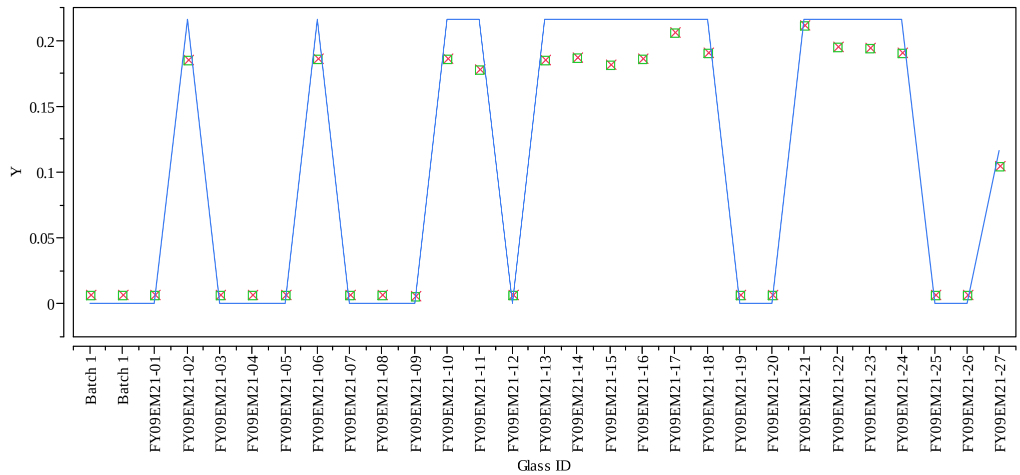
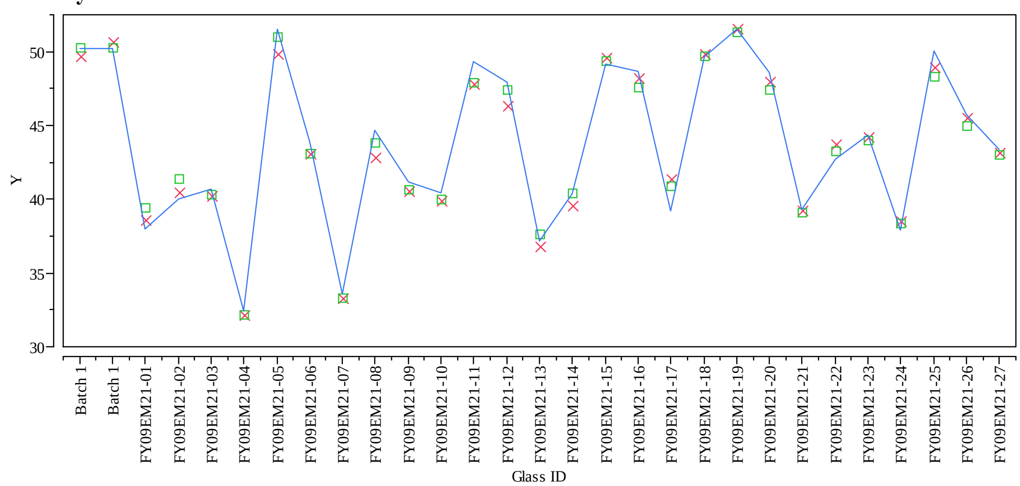


Exhibit A4. Average Measured and Bias-Corrected (bc) Versus Targeted Compositions by Glass ID by Oxide for the Non-Rad Matrix 2 Study

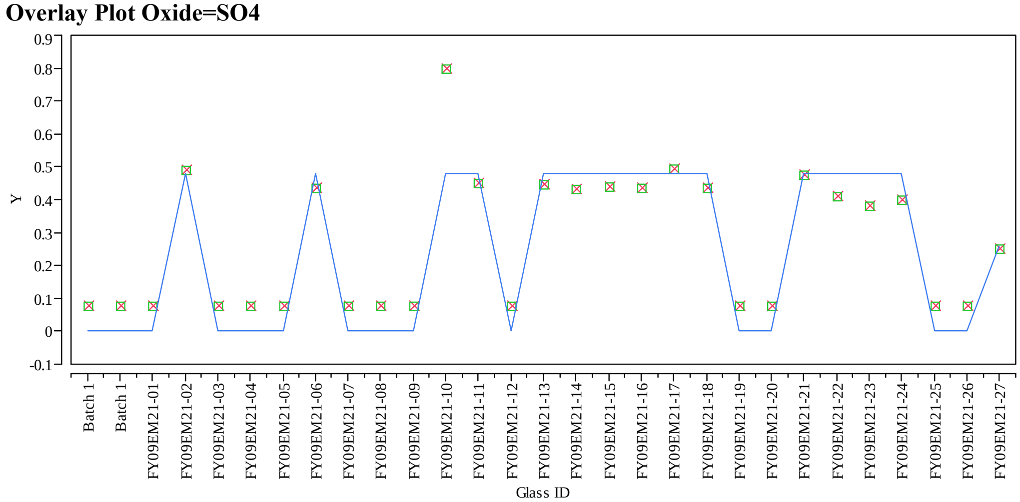
Overlay Plot Oxide=PbO



Overlay Plot Oxide=SiO2



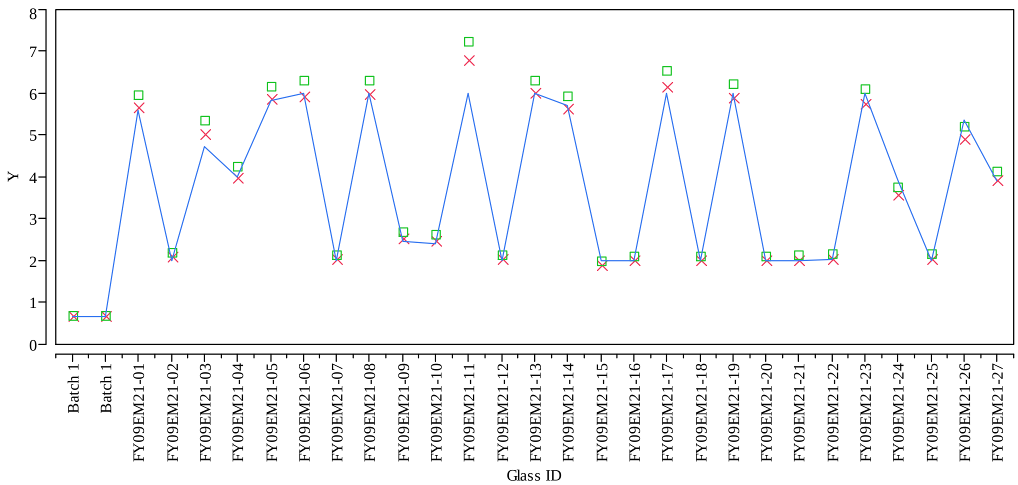
Overlay Plot Oxide=SO4



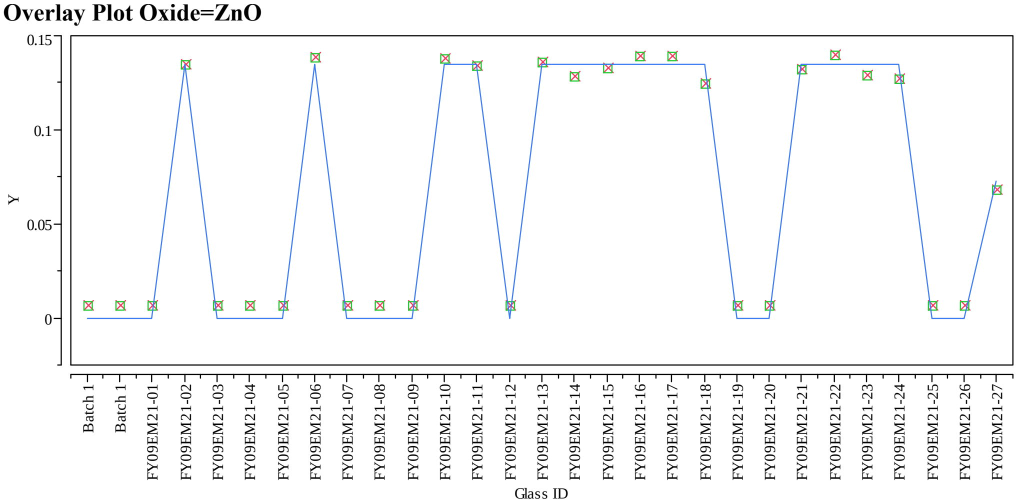
Y × Measured ▫ Measured bc — Targeted

Exhibit A4. Average Measured and Bias-Corrected (bc) Versus Targeted Compositions by Glass ID by Oxide for the Non-Rad Matrix 2 Study

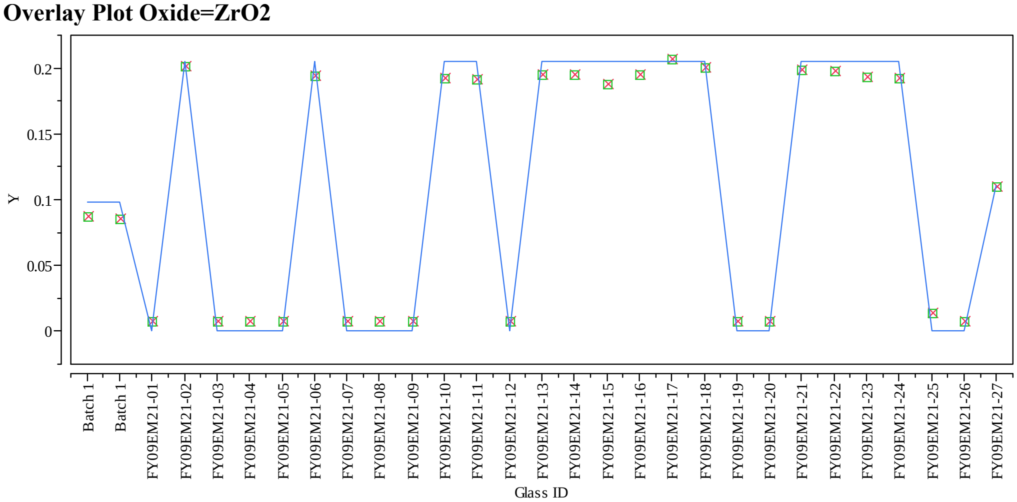
Overlay Plot Oxide=TiO2



Overlay Plot Oxide=ZnO



Overlay Plot Oxide=ZrO2



Y × Measured ▫ Measured bc — Targeted

Exhibit A4. Average Measured and Bias-Corrected (bc) Versus Targeted Compositions by Glass ID by Oxide for the Non-Rad Matrix 2 Study

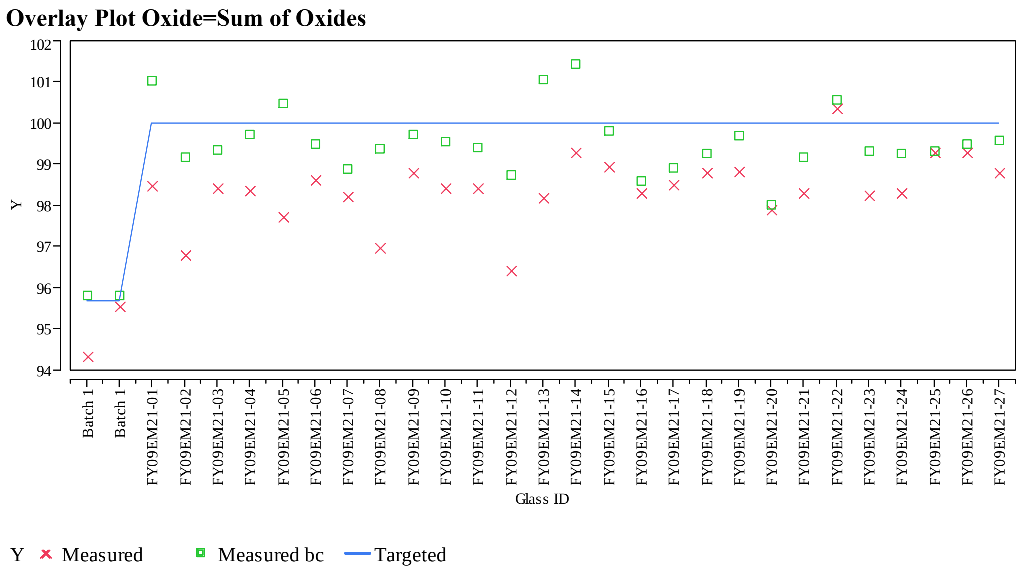
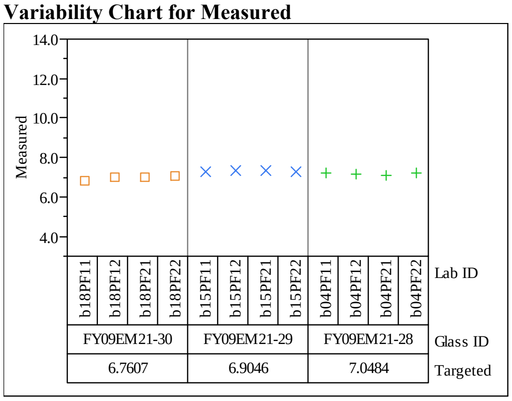
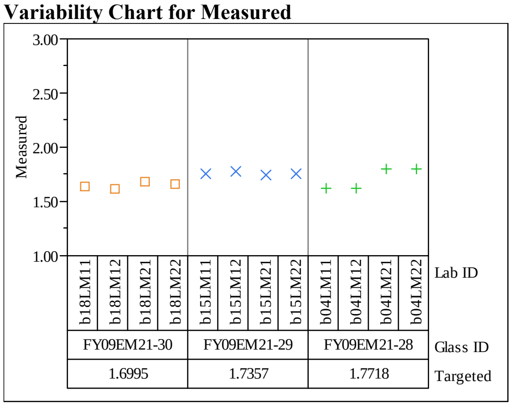


Exhibit A5. Sample Measurements by Lab ID within Glass ID for the Rad Glasses of the Matrix 2 Study by Oxide by Analytical Block

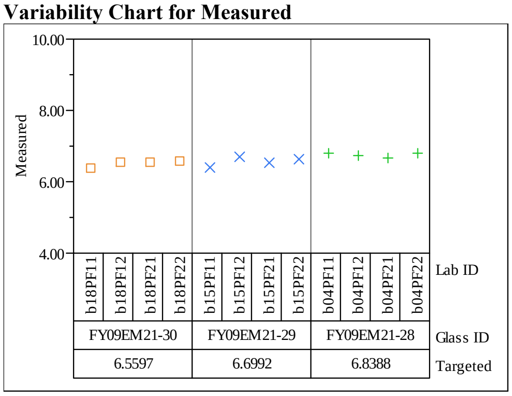
Analyte=Al2O3 (wt%)
Variability Chart for Measured



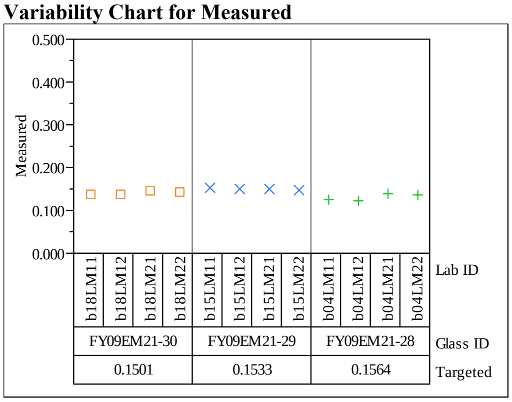
Analyte=CaO (wt%)
Variability Chart for Measured



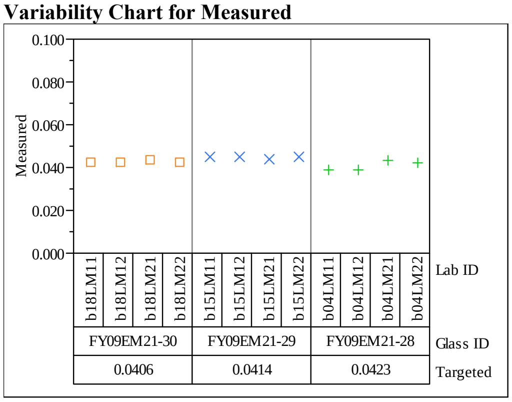
Analyte=B2O3 (wt%)
Variability Chart for Measured



Analyte=CdO (wt%)
Variability Chart for Measured



Analyte=BaO (wt%)
Variability Chart for Measured



Analyte=Ce2O3 (wt%)
Variability Chart for Measured

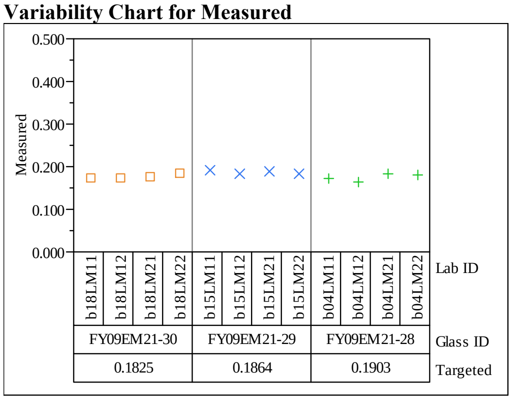
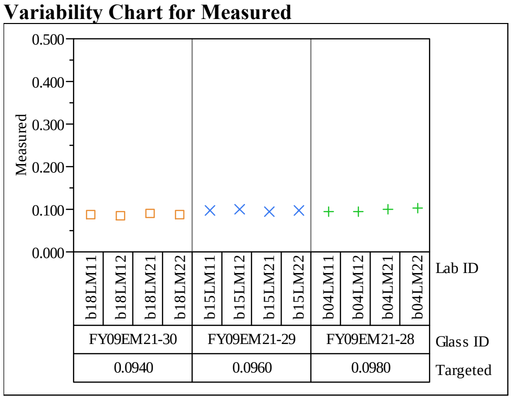
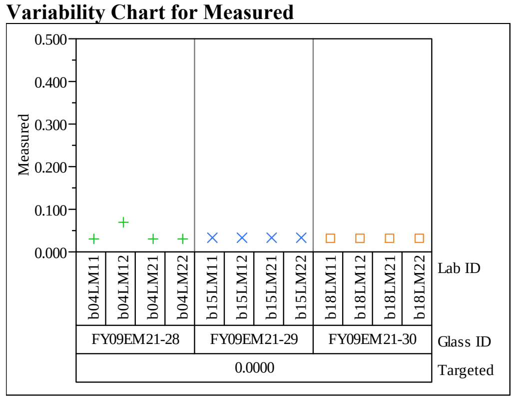


Exhibit A5. Sample Measurements by Lab ID within Glass ID for the Rad Glasses of the Matrix 2 Study by Oxide by Analytical Block

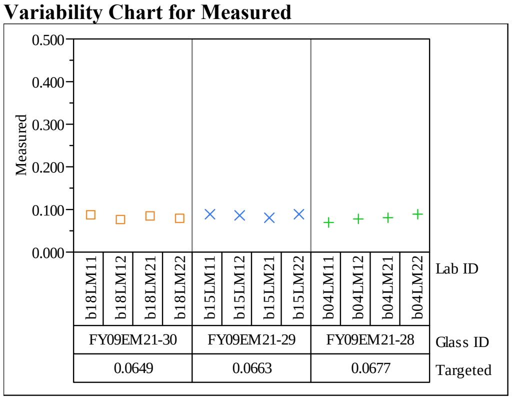
Analyte=Cr2O3 (wt%)
Variability Chart for Measured



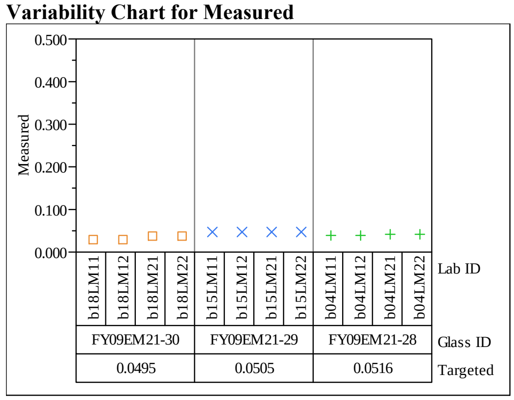
Analyte=K2O (wt%)
Variability Chart for Measured



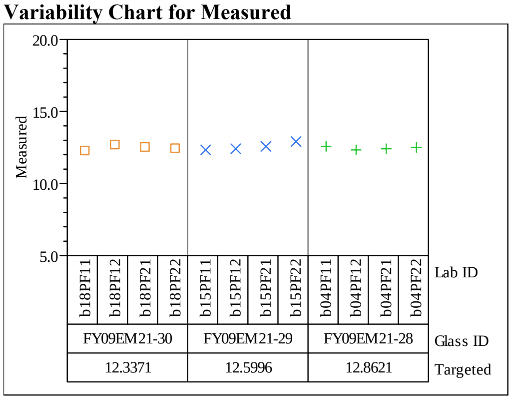
Analyte=CuO (wt%)
Variability Chart for Measured



Analyte=La2O3 (wt%)
Variability Chart for Measured



Analyte=Fe2O3 (wt%)
Variability Chart for Measured



Analyte=Li2O (wt%)
Variability Chart for Measured

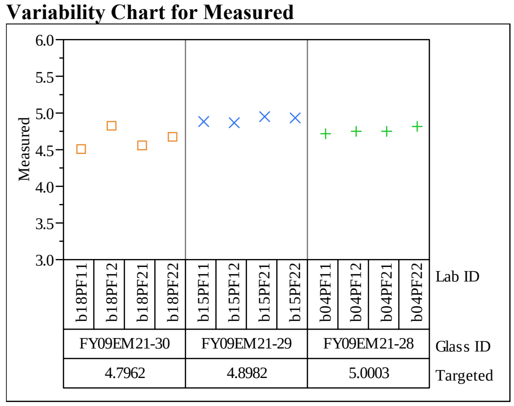
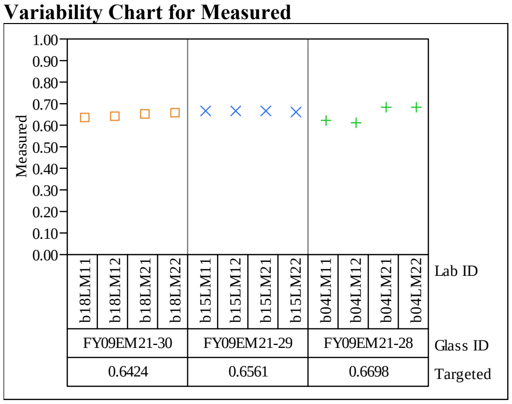
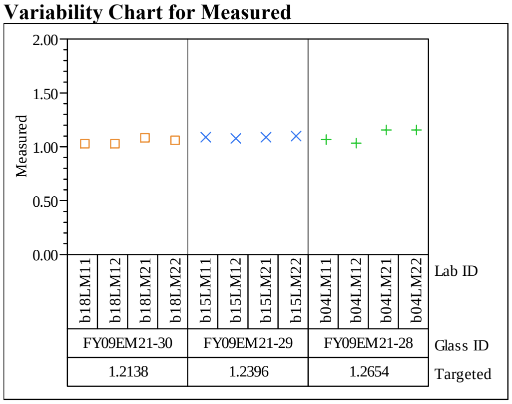


Exhibit A5. Sample Measurements by Lab ID within Glass ID for the Rad Glasses of the Matrix 2 Study by Oxide by Analytical Block

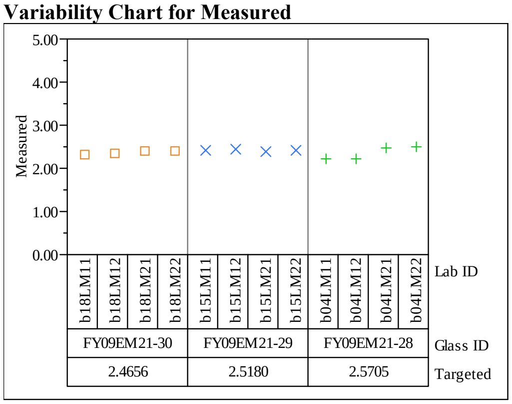
Analyte=MgO (wt%)
Variability Chart for Measured



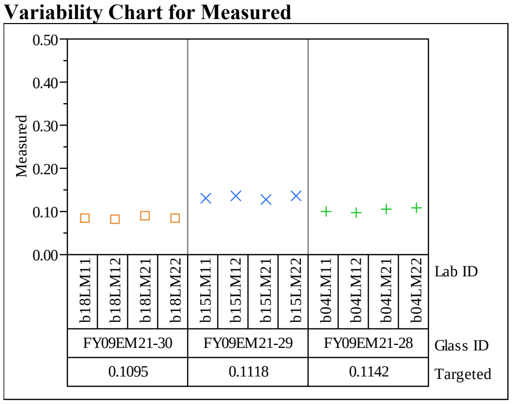
Analyte=NiO (wt%)
Variability Chart for Measured



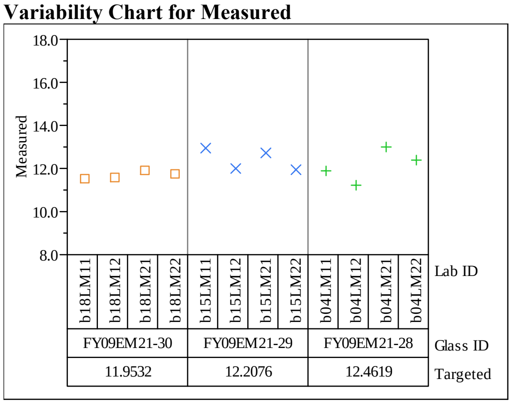
Analyte=MnO (wt%)
Variability Chart for Measured



Analyte=PbO (wt%)
Variability Chart for Measured



Analyte=Na2O (wt%)
Variability Chart for Measured



Analyte=SiO2 (wt%)
Variability Chart for Measured

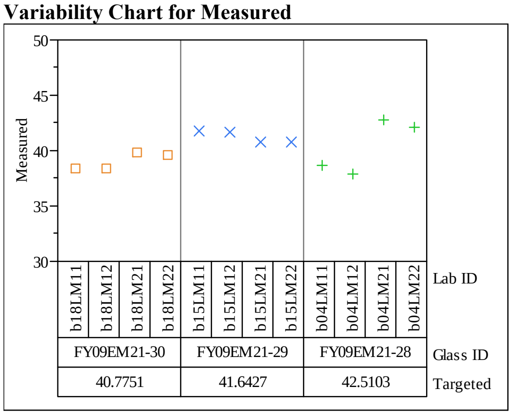
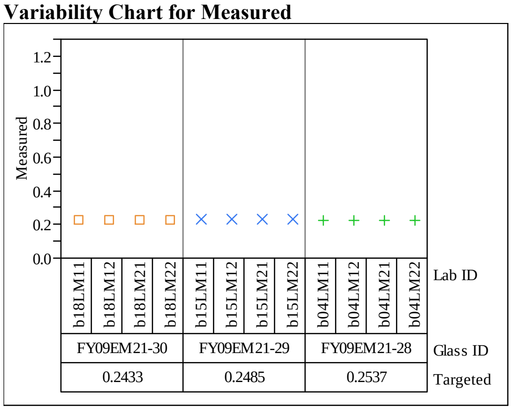
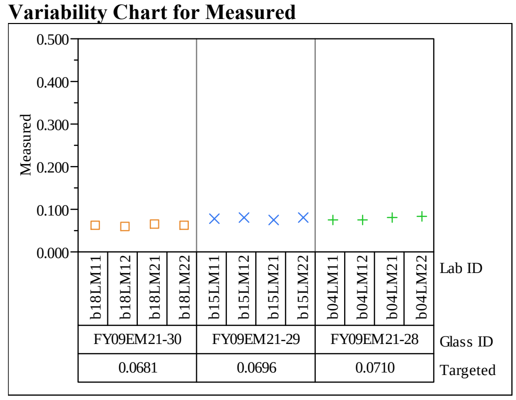


Exhibit A5. Sample Measurements by Lab ID within Glass ID for the Rad Glasses of the Matrix 2 Study by Oxide by Analytical Block

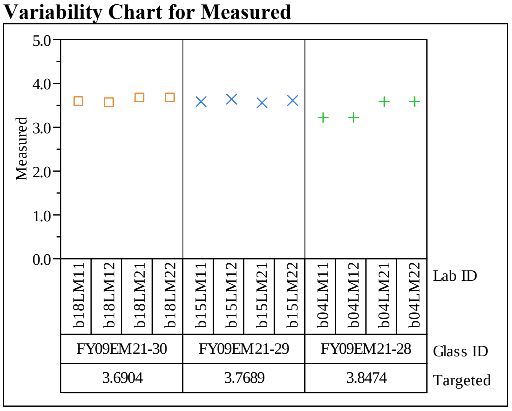
Analyte=SO4 (wt%)
Variability Chart for Measured



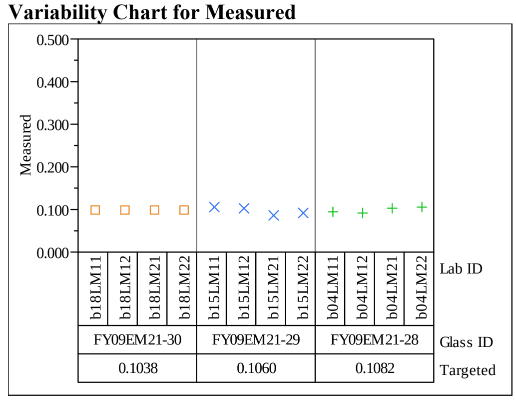
Analyte=ZnO (wt%)
Variability Chart for Measured



Analyte=TiO2 (wt%)
Variability Chart for Measured



Analyte=ZrO2 (wt%)
Variability Chart for Measured



Analyte=U3O8 (wt%)
Variability Chart for Measured

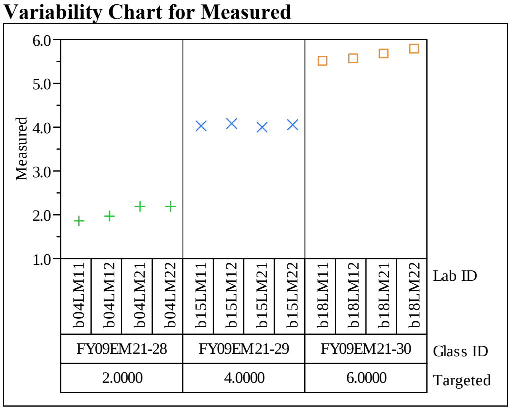
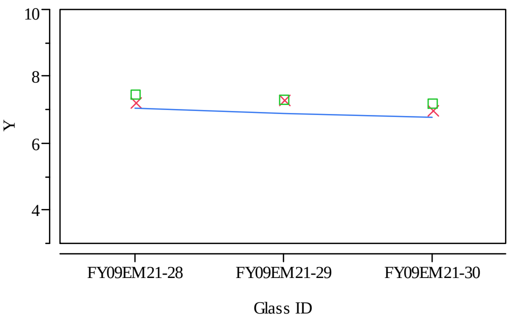
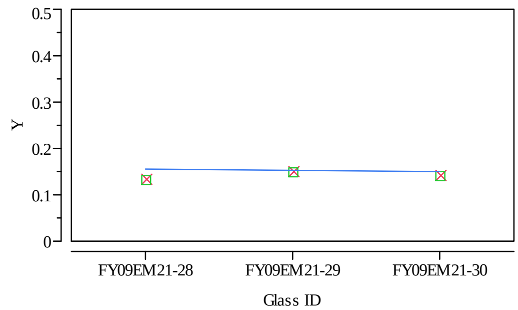


Exhibit A6. Average Measured and Bias-Corrected (bc) Versus Targeted Compositions by Glass ID by Oxide for the Rad Glasses of the Matrix 2 Study

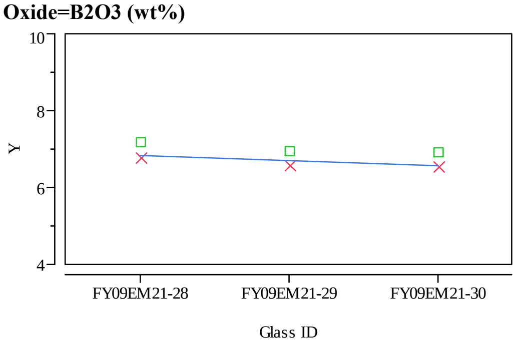
Oxide=Al2O3 (wt%)



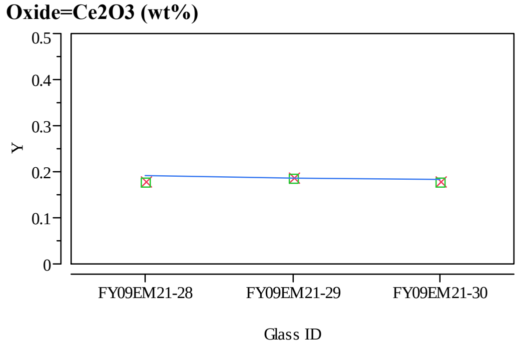
Oxide=CdO (wt%)



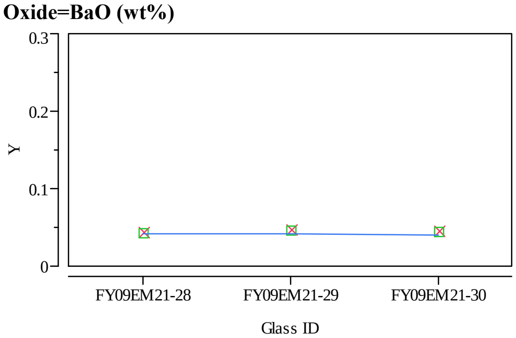
Oxide=B2O3 (wt%)



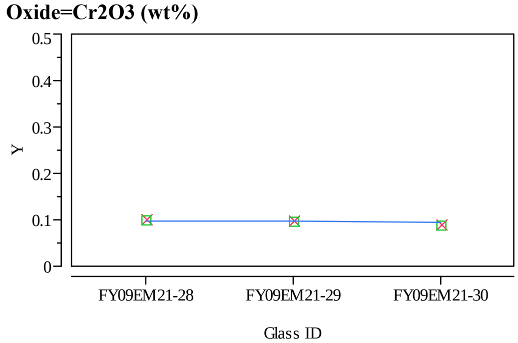
Oxide=Ce2O3 (wt%)



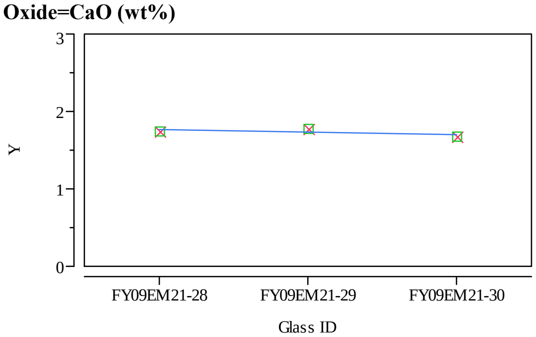
Oxide=BaO (wt%)



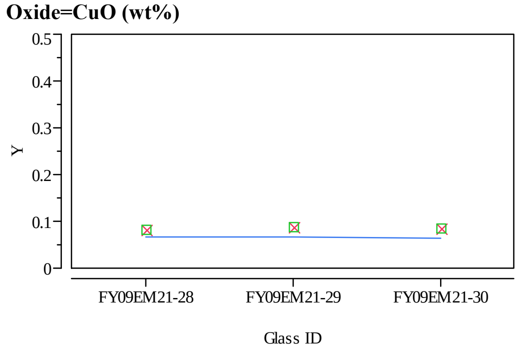
Oxide=Cr2O3 (wt%)



Oxide=CaO (wt%)



Oxide=CuO (wt%)

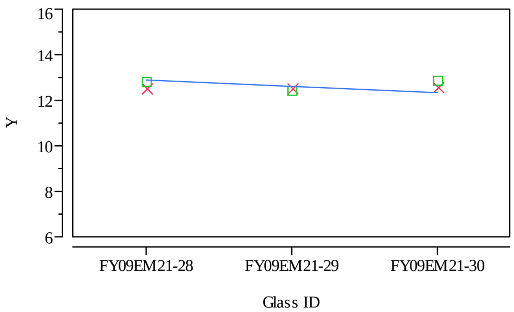


Y × Measured ▫ Measured bc — Targeted

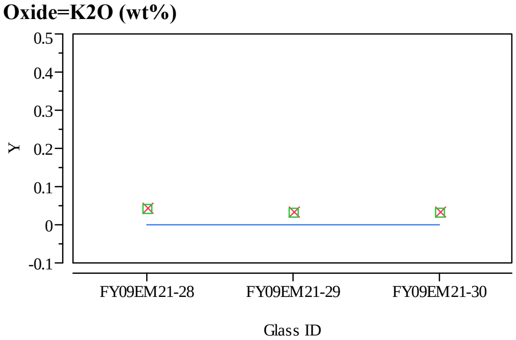
Y × Measured ▫ Measured bc — Targeted

Exhibit A6. Average Measured and Bias-Corrected (bc) Versus Targeted Compositions by Glass ID by Oxide for the Rad Glasses of the Matrix 2 Study

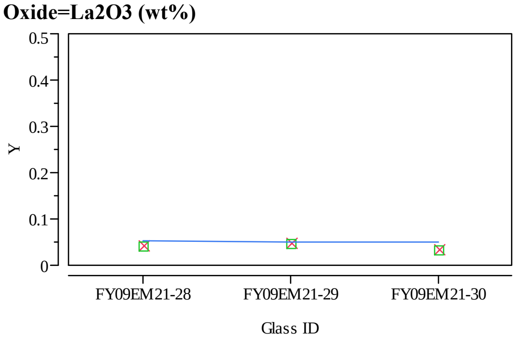
Oxide=Fe2O3 (wt%)



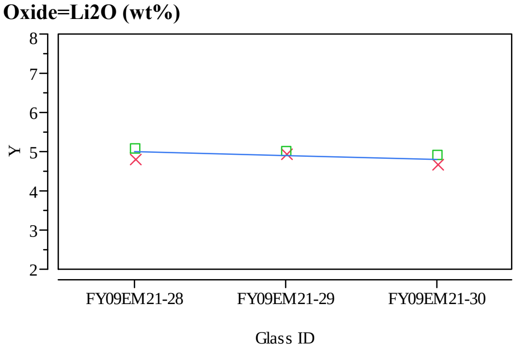
Oxide=K2O (wt%)



Oxide=La2O3 (wt%)

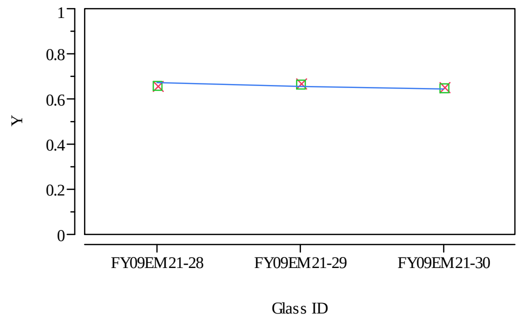


Oxide=Li2O (wt%)

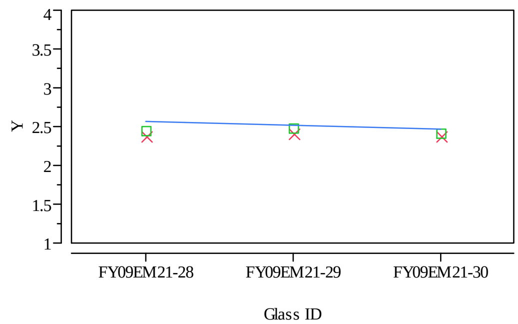


Y × Measured ◘ Measured bc — Targeted

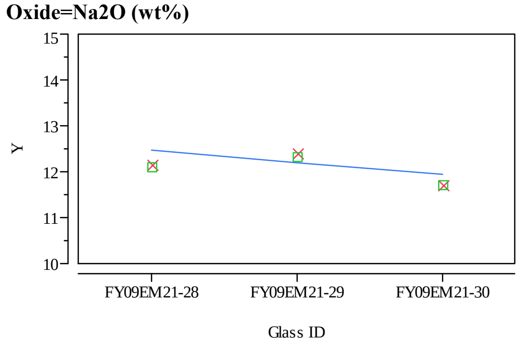
Oxide=MgO (wt%)



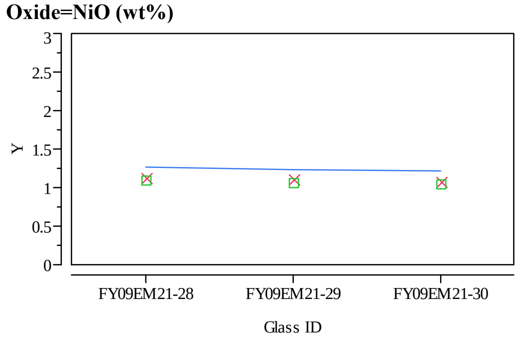
Oxide=MnO (wt%)



Oxide=Na2O (wt%)

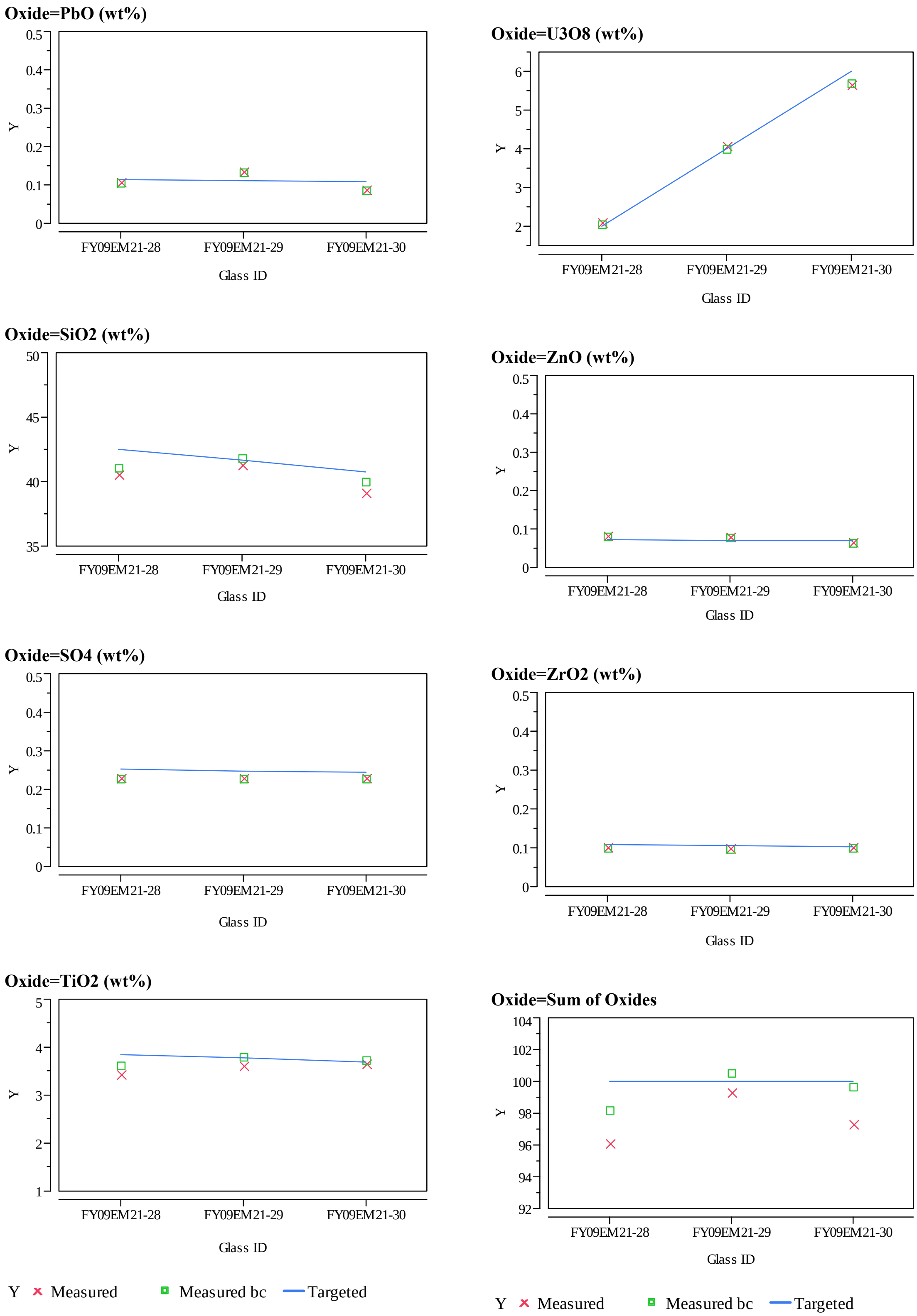


Oxide=NiO (wt%)



Y × Measured ◘ Measured bc — Targeted

Exhibit A6. Average Measured and Bias-Corrected (bc) Versus Targeted Compositions by Glass ID by Oxide for the Rad Glasses of the Matrix 2 Study



Appendix B:

Tables and Exhibits Supporting the Analysis of the PCT Results for the Matrix 2 Study Glasses

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Table B1. PSAL's Measurements of the PCT Solutions for the Matrix 2 Non-Rad Glasses As-Received (ar) and After Appropriate Adjustments (in ppm)

Set	Glass ID (w HT)	Block	Seq	Lab ID	B ar	Li ar	Na ar	Si ar	B (ppm)	Li (ppm)	Na (ppm)	Si (ppm)
1	Soln Std	1	1	std-11-1	21.5	10.0	82.7	52.7	21.50	10.00	82.70	52.70
1	FY09EM21-02	1	2	H21	116	64.0	771	322	193.34	106.67	1285.03	536.68
1	FY09EM21-09	1	3	H35	13.9	16.4	31.9	52.0	23.17	27.33	53.17	86.67
1	FY09EM21-03	1	4	H25	22.7	44.3	152	144	37.83	73.83	253.34	240.00
1	FY09EM21-07	1	5	H39	357	122	572	102	595.01	203.34	953.35	170.00
1	FY09EM21-04	1	6	H32	166	101	238	104	276.67	168.34	396.67	173.34
1	FY09EM21-06	1	7	H55	119	45.9	241	163	198.34	76.50	401.67	271.67
1	FY09EM21-01ccc	1	8	H27	10.8	8.79	39.1	66.5	18.00	14.65	65.17	110.84
1	FY09EM21-05	1	9	H05	9.56	10.5	39.7	74.8	15.93	17.50	66.17	124.67
1	FY09EM21-08	1	10	H54	48.8	71.0	160	215	81.33	118.34	266.67	358.34
1	FY09EM21-09ccc	1	11	H48	9.49	11.1	22.4	40.8	15.82	18.50	37.33	68.00
1	FY09EM21-04ccc	1	12	H37	55.2	39.6	97.8	78.4	92.00	66.00	163.00	130.67
1	Soln Std	1	13	std-11-2	20.5	9.99	81.9	51.5	20.50	9.99	81.90	51.50
1	blank	1	14	H07	1.01	<0.100	<0.100	<0.100	1.68	0.08	0.08	0.08
1	ARM-1	1	15	H10	10.7	7.75	20.7	38.1	17.83	12.92	34.50	63.50
1	FY09EM21-01	1	16	H43	6.67	8.71	39.3	56.6	11.12	14.52	65.50	94.34
1	FY09EM21-02ccc	1	17	H53	118	66.0	726	321	196.67	110.00	1210.02	535.01
1	FY09EM21-03ccc	1	18	H09	112	117	474	322	186.67	195.00	790.02	536.68
1	EA	1	19	H52	42.4	11.4	115	57.8	706.67	190.00	1916.67	963.34
1	FY09EM21-07ccc	1	20	H04	165	57.6	261	93.3	275.01	96.00	435.01	155.50
1	FY09EM21-08ccc	1	21	H40	41.2	90.4	162	278	68.67	150.67	270.01	463.34
1	FY09EM21-06ccc	1	22	H31	157	61.7	320	209	261.67	102.84	533.34	348.34
1	FY09EM21-05ccc	1	23	H47	8.30	8.39	28.3	54.7	13.83	13.98	47.17	91.17
1	Soln Std	1	24	std-11-3	19.9	10.0	84.0	52.1	19.90	10.00	84.00	52.10
1	Soln Std	2	1	std-12-1	20.4	9.91	84.4	52.5	20.40	9.91	84.40	52.50
1	FY09EM21-04ccc	2	2	H58	50.3	36.5	83.9	74.5	83.84	60.83	139.84	124.17
1	FY09EM21-05ccc	2	3	H19	5.37	8.61	27.3	54.0	8.95	14.35	45.50	90.00
1	EA	2	4	H30	35.7	10.9	94.6	55.3	595.00	181.67	1576.67	921.67
1	FY09EM21-06	2	5	H13	106	45.6	259	172	176.67	76.00	431.68	286.67
1	FY09EM21-01	2	6	H17	7.06	8.41	35.7	53.6	11.77	14.02	59.50	89.34
1	FY09EM21-09ccc	2	7	H45	8.06	10.8	20.1	39.6	13.43	18.00	33.50	66.00
1	FY09EM21-02ccc	2	8	H62	109	69.2	836	352	181.67	115.34	1393.36	586.68
1	FY09EM21-02	2	9	H06	106	66.4	822	345	176.67	110.67	1370.03	575.01
1	FY09EM21-08ccc	2	10	H38	37.0	83.4	145	329	61.67	139.00	241.67	548.34
1	FY09EM21-09	2	11	H11	14.5	17.0	32.4	52.8	24.17	28.33	54.00	88.00
1	FY09EM21-07	2	12	H16	349	111	586	104	581.68	185.00	976.69	173.34
1	Soln Std	2	13	std-12-2	19.2	10.0	85.1	52.6	19.20	10.00	85.10	52.60
1	FY09EM21-04	2	14	H22	149	99.6	243	102	248.34	166.00	405.01	170.00
1	ARM-1	2	15	H36	12.4	7.61	19.5	36.0	20.67	12.68	32.50	60.00
1	FY09EM21-03ccc	2	16	H29	91.1	109	474	324	151.84	181.67	790.02	540.01
1	FY09EM21-06ccc	2	17	H61	124	56.0	311	210	206.67	93.34	518.34	350.01
1	FY09EM21-07ccc	2	18	H18	150	56.6	296	90.8	250.01	94.34	493.34	151.34
1	FY09EM21-01ccc	2	19	H60	10.2	9.00	38.0	65.3	17.00	15.00	63.33	108.84
1	FY09EM21-08	2	20	H01	47.4	67.6	151	205	79.00	112.67	251.67	341.67
1	FY09EM21-05	2	21	H57	8.63	10.5	38.2	71.9	14.38	17.50	63.67	119.84
1	FY09EM21-03	2	22	H49	22.4	42.5	138	141	37.33	70.83	230.00	235.00
1	Soln Std	2	23	std-12-3	18.2	9.55	79.9	51.3	18.20	9.55	79.90	51.30
1	Soln Std	3	1	std13-1	22.0	10.2	83.4	51.9	22.00	10.20	83.40	51.90
1	FY09EM21-04	3	2	H33	167	100	236	107	278.34	166.67	393.34	178.34
1	ARM-1	3	3	H46	11.1	7.61	21.2	36.1	18.50	12.68	35.33	60.17
1	FY09EM21-07ccc	3	4	H41	147	52.2	251	88.3	245.00	87.00	418.34	147.17
1	FY09EM21-08	3	5	H15	46.5	64.7	152	213	77.50	107.84	253.34	355.01
1	FY09EM21-03ccc	3	6	H20	104	106	445	314	173.34	176.67	741.68	523.34
1	FY09EM21-01ccc	3	7	H28	8.23	9.34	21.2	66.1	13.72	15.57	35.33	110.17
1	FY09EM21-02	3	8	H03	118	64.6	757	324	196.67	107.67	1261.69	540.01
1	FY09EM21-04ccc	3	9	H24	54.8	38.2	88.8	78.3	91.34	63.67	148.00	130.50
1	FY09EM21-08ccc	3	10	H51	37.3	82.2	129	304	62.17	137.00	215.00	506.68
1	FY09EM21-06ccc	3	11	H42	138	54.6	274	204	230.00	91.00	456.68	340.01
1	FY09EM21-05	3	12	H23	9.05	10.4	36.3	71.6	15.08	17.33	60.50	119.34
1	Soln Std	3	13	std-13-2	19.9	9.89	77.7	50.6	19.90	9.89	77.70	50.60
1	FY09EM21-09ccc	3	14	H34	8.23	11.4	22.9	40.4	13.72	19.00	38.17	67.33
1	FY09EM21-06	3	15	H14	121	49.5	242	172	201.67	82.50	403.34	286.67
1	FY09EM21-05ccc	3	16	H02	5.95	8.90	28.0	54.9	9.92	14.83	46.67	91.50
1	FY09EM21-02ccc	3	17	H59	119	65.8	755	337	198.34	109.67	1258.36	561.68
1	FY09EM21-01	3	18	H50	7.33	8.97	37.8	56.2	12.22	14.95	63.00	93.67
1	EA	3	19	H12	40.3	11.7	102	57.1	671.67	195.00	1700.00	951.67
1	FY09EM21-07	3	20	H08	356	113	555	104	593.35	188.34	925.02	173.34
1	FY09EM21-09	3	21	H56	17.4	16.9	32.5	51.9	29.00	28.17	54.17	86.50
1	FY09EM21-03	3	22	H26	23.6	42.2	132	139	39.33	70.33	220.00	231.67
1	blank	3	23	H44	0.697	<0.100	<0.100	<0.100	1.16	0.08	0.08	0.08
1	Soln Std	3	24	std-13-3	20.4	10.1	80.6	51.5009	20.40	10.10	80.60	51.50

Table B1. PSAL's Measurements of the PCT Solutions for the Matrix 2 Non-Rad Glasses As-Received (ar) and After Appropriate Adjustments (in ppm)

Set	Glass ID (w HT)	Block	Seq	Lab ID	B ar	Li ar	Na ar	Si ar	B (ppm)	Li (ppm)	Na (ppm)	Si (ppm)
2	Soln Std	1	1	std-21-1	21.4	9.82	81.7	50.1	21.40	9.82	81.70	50.10
2	FY09EM21-13	1	2	I59	13.3	26.4	62.7	66.8	22.17	44.00	104.50	111.34
2	FY09EM21-10ccc	1	3	I03	6.68	11.7	40.6	53.6	11.13	19.50	67.67	89.34
2	FY09EM21-11ccc	1	4	I25	19.0	32.1	108	160	31.67	53.50	180.00	266.67
2	FY09EM21-18	1	5	I52	5.76	11.1	82.8	78.6	9.60	18.50	138.00	131.00
2	FY09EM21-15ccc	1	6	I43	14.1	38.1	63.8	128	23.50	63.50	106.34	213.34
2	FY09EM21-17ccc	1	7	I09	24.7	69.2	152	211	41.17	115.34	253.34	351.67
2	FY09EM21-18ccc	1	8	I31	5.89	11.8	75.7	79.1	9.82	19.67	126.17	131.84
2	ARM-1	1	9	I40	9.53	7.65	19.4	34.7	15.88	12.75	32.33	57.83
2	FY09EM21-14ccc	1	10	I21	108	40.7	119	109	180.00	67.83	198.34	181.67
2	FY09EM21-15	1	11	I37	11.1	18.2	48.2	81.3	18.50	30.33	80.33	135.50
2	blank	1	12	I14	0.867	<0.100	<0.100	<0.100	1.45	0.08	0.08	0.08
2	Soln Std	1	13	std-21-2	20.5	9.87	81.4	50.5	20.50	9.87	81.40	50.50
2	EA	1	14	I44	22.8	7.82	61.6	38.2	380.00	130.33	1026.67	636.67
2	FY09EM21-16	1	15	I41	34.4	25.6	200	174	57.33	42.67	333.34	290.01
2	FY09EM21-13ccc	1	16	I10	9.12	23.1	42.0	46.0	15.20	38.50	70.00	76.67
2	FY09EM21-10	1	17	I28	10.9	13.2	56.4	61.4	18.17	22.00	94.00	102.34
2	FY09EM21-14	1	18	I58	29.0	12.4	33.0	51.7	48.33	20.67	55.00	86.17
2	FY09EM21-12	1	19	I18	14.3	24.5	51.6	109	23.83	40.83	86.00	181.67
2	FY09EM21-11	1	20	I51	19.4	32.3	122	161	32.33	53.83	203.34	268.34
2	FY09EM21-17	1	21	I45	10.2	23.7	107	105	17.00	39.50	178.34	175.00
2	FY09EM21-12ccc	1	22	I05	17.0	58.2	67.4	171	28.33	97.00	112.34	285.01
2	FY09EM21-16ccc	1	23	I20	21.2	17.3	134	121	35.33	28.83	223.34	201.67
2	Soln Std	1	24	std-21-3	20.1	9.64	78.7	49.3	20.10	9.64	78.70	49.30
2	Soln Std	2	1	std-22-1	21.6	10.0	82.4	50.4	21.60	10.00	82.40	50.40
2	FY09EM21-13ccc	2	2	I19	9.67	24.5	43.5	49.6	16.12	40.83	72.50	82.67
2	FY09EM21-16	2	3	I46	34.2	25.8	190	168	57.00	43.00	316.67	280.01
2	FY09EM21-17	2	4	I57	10.4	24.7	114	107	17.33	41.17	190.00	178.34
2	FY09EM21-10ccc	2	5	I38	6.45	11.6	41.2	52.9	10.75	19.33	68.67	88.17
2	FY09EM21-11ccc	2	6	I47	19.5	33.0	112	157	32.50	55.00	186.67	261.67
2	FY09EM21-18ccc	2	7	I48	5.58	12.0	78.3	79.8	9.30	20.00	130.50	133.00
2	EA	2	8	I56	20.6	7.54	59.4	37.3	343.33	125.67	990.00	621.67
2	FY09EM21-14	2	9	I29	28.2	12.3	33.0	50.7	47.00	20.50	55.00	84.50
2	FY09EM21-17ccc	2	10	I60	24.7	69.4	155	209	41.17	115.67	258.34	348.34
2	FY09EM21-16ccc	2	11	I42	21.2	17.4	124	117	35.33	29.00	206.67	195.00
2	FY09EM21-18	2	12	I49	5.77	11.5	85.1	80.2	9.62	19.17	141.84	133.67
2	Soln Std	2	13	std-22-2	19.9	9.87	80.7	50.2	19.90	9.87	80.70	50.20
2	FY09EM21-12ccc	2	14	I30	17.6	59.6	70.1	168	29.33	99.34	116.84	280.01
2	FY09EM21-14ccc	2	15	I23	107	40.1	117	108	178.34	66.83	195.00	180.00
2	FY09EM21-11	2	16	I61	21.3	33.3	117	164	35.50	55.50	195.00	273.34
2	FY09EM21-10	2	17	I01	12.1	14.3	61.0	66.3	20.17	23.83	101.67	110.50
2	FY09EM21-13	2	18	I15	12.5	25.5	61.1	64.2	20.83	42.50	101.84	107.00
2	FY09EM21-15ccc	2	19	I39	14.9	39.0	66.7	125	24.83	65.00	111.17	208.34
2	FY09EM21-15	2	20	I35	9.20	18.2	48.3	81.0	15.33	30.33	80.50	135.00
2	ARM-1	2	21	I62	9.04	7.56	19.4	34.2	15.07	12.60	32.33	57.00
2	FY09EM21-12	2	22	I54	13.6	24.9	54.5	109	22.67	41.50	90.84	181.67
2	Soln Std	2	23	std-22-3	20.0	9.94	81.3	50.6	20.00	9.94	81.30	50.60
2	Soln Std	3	1	std 23-1	21.3	9.89	83.0	51.6	21.30	9.89	83.00	51.60
2	FY09EM21-16	3	2	I53	35.8	26.3	197	170	59.67	43.83	328.34	283.34
2	FY09EM21-13	3	3	I06	13.2	25.9	62.2	66.0	22.00	43.17	103.67	110.00
2	FY09EM21-16ccc	3	4	I36	20.7	16.9	130	115	34.50	28.17	216.67	191.67
2	FY09EM21-11	3	5	I22	19.9	33.2	124	158	33.17	55.33	206.67	263.34
2	FY09EM21-18	3	6	I07	5.39	11.2	85.6	79.6	8.98	18.67	142.67	132.67
2	FY09EM21-10	3	7	I08	10.2	13.3	57.8	63.1	17.00	22.17	96.34	105.17
2	FY09EM21-17	3	8	I16	9.32	23.9	109	106	15.53	39.83	181.67	176.67
2	FY09EM21-13ccc	3	9	I13	8.00	23.3	41.4	47.6	13.33	38.83	69.00	79.33
2	FY09EM21-14	3	10	I32	27.9	12.2	32.9	51.5	46.50	20.33	54.83	85.84
2	EA	3	11	I04	22.6	7.89	64.4	40.4	376.67	131.50	1073.34	673.33
2	FY09EM21-12ccc	3	12	I33	16.8	58.3	68.8	162	28.00	97.17	114.67	270.01
2	Soln Std	3	13	std-23-2	20.3	9.90	82.5	51.7	20.30	9.90	82.50	51.70
2	FY09EM21-18ccc	3	14	I17	5.56	11.6	74.6	80.3	9.27	19.33	124.34	133.84
2	blank	3	15	I12	<0.100	<0.100	<0.100	<0.100	0.08	0.08	0.08	0.08
2	FY09EM21-14ccc	3	16	I24	109	40.1	117	110	181.67	66.83	195.00	183.34
2	ARM-1	3	17	I34	10.3	7.48	19.2	35.2	17.17	12.47	32.00	58.67
2	FY09EM21-11ccc	3	18	I27	18.7	31.3	107	154	31.17	52.17	178.34	256.67
2	FY09EM21-17ccc	3	19	I11	24.7	68.6	153	340	41.17	114.34	255.01	566.68
2	FY09EM21-12	3	20	I26	13.6	24.2	52.9	109	22.67	40.33	88.17	181.67
2	FY09EM21-15ccc	3	21	I55	13.6	37.2	62.4	119	22.67	62.00	104.00	198.34
2	FY09EM21-15	3	22	I02	8.85	17.9	47.3	81.4	14.75	29.83	78.83	135.67
2	FY09EM21-10ccc	3	23	I50	5.80	11.5	40.9	54.0	9.67	19.17	68.17	90.00
2	Soln Std	3	24	std-23-3	20.1	9.91	82.7	51.6	20.10	9.91	82.70	51.60

Table B1. PSAL's Measurements of the PCT Solutions for the Matrix 2 Non-Rad Glasses As-Received (ar) and After Appropriate Adjustments (in ppm)

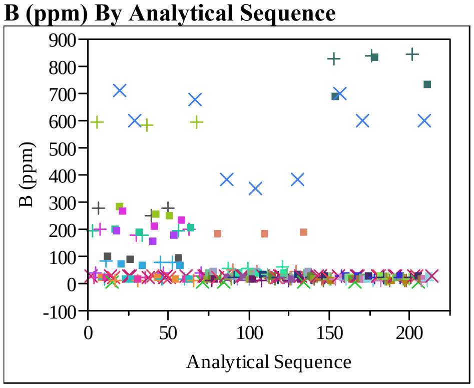
Set	Glass ID (w HT)	Block	Seq	Lab ID	B ar	Li ar	Na ar	Si ar	B (ppm)	Li (ppm)	Na (ppm)	Si (ppm)
3	Soln Std	1	1	std-31-1	21.2	10.1	83.1	51.1	21.20	10.10	83.10	51.10
3	FY09EM21-24	1	2	J22	8.37	11.0	42.6	42.9	13.95	18.33	71.00	71.50
3	FY09EM21-19	1	3	J05	5.92	11.4	108	78.6	9.87	19.00	180.00	131.00
3	FY09EM21-27	1	4	J61	14.0	14.8	60.4	70.9	23.33	24.67	100.67	118.17
3	FY09EM21-27ccc	1	5	J33	12.9	14.3	57.7	71.7	21.50	23.83	96.17	119.50
3	ARM-1	1	6	J60	11.2	8.9	23.4	37.9	18.67	14.83	39.00	63.17
3	FY09EM21-20	1	7	J10	11.6	11.1	121	119	19.33	18.50	201.67	198.34
3	FY09EM21-25	1	8	J36	9.16	13.6	91.1	84.9	15.27	22.67	151.84	141.50
3	FY09EM21-24ccc	1	9	J54	3.41	6.17	24.5	28.9	5.68	10.28	40.83	48.17
3	FY09EM21-21	1	10	J25	498	272	1380	409	830.02	453.34	2300.05	681.68
3	FY09EM21-23	1	11	J03	10.7	9.89	13.3	48.1	17.83	16.48	22.17	80.17
3	FY09EM21-21ccc	1	12	J58	409	247	1160	368	681.68	411.67	1933.37	613.35
3	Soln Std	1	13	std-31-2	20.2	9.92	82.7	49.5	20.20	9.92	82.70	49.50
3	EA	1	14	J19	41.8	11.2	104	54.1	696.67	186.67	1733.34	901.67
3	FY09EM21-22	1	15	J40	17.3	9.91	13.2	51.5	28.83	16.52	22.00	85.84
3	FY09EM21-23ccc	1	16	J45	8.60	9.52	19.2	60.6	14.33	15.87	32.00	101.00
3	FY09EM21-26	1	17	J01	10.1	8.04	29.8	55.6	16.83	13.40	49.67	92.67
3	FY09EM21-22ccc	1	18	J35	14.1	8.19	14.2	49.6	23.50	13.65	23.67	82.67
3	FY09EM21-25ccc	1	19	J42	10.5	14.2	91.9	84.8	17.50	23.67	153.17	141.34
3	FY09EM21-26ccc	1	20	J24	9.36	7.92	30.4	55.8	15.60	13.20	50.67	93.00
3	FY09EM21-20ccc	1	21	J52	11.5	11.5	114	114	19.17	19.17	190.00	190.00
3	FY09EM21-19ccc	1	22	J06	6.87	12.6	117	79.6	11.45	21.00	195.00	132.67
3	blank	1	23	J47	<0.100	<0.500	<0.100	<0.100	0.08	0.42	0.08	0.08
3	Soln Std	1	24	std-31-3	20.7	10.2	86.4	50.1	20.70	10.20	86.40	50.10
3	Soln Std	2	1	std-32-1	21.0	10.2	81.9	51.3	21.00	10.20	81.90	51.30
3	FY09EM21-22ccc	2	2	J31	13.1	8.34	14.2	50.9	21.83	13.90	23.67	84.84
3	FY09EM21-19ccc	2	3	J50	6.27	12.5	111	81.2	10.45	20.83	185.00	135.34
3	EA	2	4	J27	35.8	11.1	97.9	54.8	596.67	185.00	1631.67	913.34
3	FY09EM21-25ccc	2	5	J38	9.29	14.1	86.4	85.9	15.48	23.50	144.00	143.17
3	FY09EM21-23ccc	2	6	J09	6.11	9.50	19.0	60.9	10.18	15.83	31.67	101.50
3	FY09EM21-26ccc	2	7	J23	7.27	7.24	26.7	51.5	12.12	12.07	44.50	85.84
3	FY09EM21-27ccc	2	8	J62	12.8	14.8	58.3	74.5	21.33	24.67	97.17	124.17
3	FY09EM21-21	2	9	J57	503	276	1420	418	838.35	460.01	2366.71	696.68
3	FY09EM21-26	2	10	J15	8.18	8.28	29.9	57.0	13.63	13.80	49.83	95.00
3	FY09EM21-22	2	11	J11	14.0	10.0	12.7	52.0	23.33	16.67	21.17	86.67
3	FY09EM21-21ccc	2	12	J16	495	274	1420	418	825.02	456.68	2366.71	696.68
3	Soln Std	2	13	std-32-2	20.2	10.1	80.8	50.8	20.20	10.10	80.80	50.80
3	ARM-1	2	14	J20	13.3	9.08	24.1	38.8	22.17	15.13	40.17	64.67
3	FY09EM21-23	2	15	J26	7.29	10.1	12.9	50.2	12.15	16.83	21.50	83.67
3	FY09EM21-20ccc	2	16	J55	11.8	10.6	125	115	19.67	17.67	208.34	191.67
3	FY09EM21-27	2	17	J32	14.7	14.8	59.1	72.7	24.50	24.67	98.50	121.17
3	FY09EM21-25	2	18	J07	9.73	13.7	88.1	86.4	16.22	22.83	146.84	144.00
3	FY09EM21-24	2	19	J48	8.43	11.2	41.9	43.7	14.05	18.67	69.83	72.83
3	FY09EM21-20	2	20	J04	11.6	10.9	120	120	19.33	18.17	200.00	200.00
3	FY09EM21-19	2	21	J59	6.11	11.7	122	81.5	10.18	19.50	203.34	135.84
3	FY09EM21-24ccc	2	22	J21	3.55	6.29	24.2	29.4	5.92	10.48	40.33	49.00
3	Soln Std	2	23	std-32-3	20.4	10.2	81.6	51.6	20.40	10.20	81.60	51.60
3	Soln Std	3	1	std 33-1	20.3	9.95	82.8	50.4	20.30	9.95	82.80	50.40
3	FY09EM21-20ccc	3	2	J46	10.2	10.9	107	110	17.00	18.17	178.34	183.34
3	FY09EM21-25ccc	3	3	J18	8.93	13.9	85.9	84.3	14.88	23.17	143.17	140.50
3	FY09EM21-22	3	4	J51	13.6	9.60	12.2	49.9	22.67	16.00	20.33	83.17
3	FY09EM21-22ccc	3	5	J41	11.7	7.67	13.7	46.7	19.50	12.78	22.83	77.83
3	FY09EM21-25	3	6	J14	8.62	13.3	87.7	83.2	14.37	22.17	146.17	138.67
3	FY09EM21-24	3	7	J37	7.46	10.8	41.4	42.3	12.43	18.00	69.00	70.50
3	FY09EM21-19	3	8	J17	5.49	11.8	114	81.4	9.15	19.67	190.00	135.67
3	FY09EM21-24ccc	3	9	J44	2.84	6.32	24.9	30.0	4.73	10.53	41.50	50.00
3	FY09EM21-20	3	10	J43	10.7	10.9	119	115	17.83	18.17	198.34	191.67
3	FY09EM21-27	3	11	J49	13.5	14.8	61.1	71.2	22.50	24.67	101.84	118.67
3	FY09EM21-21	3	12	J08	508	277	1420	423	846.68	461.68	2366.71	705.01
3	Soln Std	3	13	std-33-2	20.2	10.1	83.8	50.6	20.20	10.10	83.80	50.60
3	ARM-1	3	14	J12	12.4	8.85	23.1	38.2	20.67	14.75	38.50	63.67
3	blank	3	15	J28	<0.100	<0.500	0.717	<0.100	0.08	0.42	1.20	0.08
3	FY09EM21-27ccc	3	16	J53	13.0	14.1	56.4	70.4	21.67	23.50	94.00	117.34
3	FY09EM21-23	3	17	J30	6.05	9.97	14.5	49.4	10.08	16.62	24.17	82.33
3	FY09EM21-19ccc	3	18	J02	5.88	12.0	114	77.0	9.80	20.00	190.00	128.34
3	EA	3	19	J29	35.6	11.0	98.1	54.2	593.33	183.33	1635.00	903.34
3	FY09EM21-23ccc	3	20	J39	6.04	9.06	18.4	58.2	10.07	15.10	30.67	97.00
3	FY09EM21-26	3	21	J56	8.06	7.87	28.0	54.4	13.43	13.12	46.67	90.67
3	FY09EM21-21ccc	3	22	J13	437	259	1200	392	728.35	431.68	2000.04	653.35
3	FY09EM21-26ccc	3	23	J34	12.3	7.47	27.0	53.4	20.50	12.45	45.00	89.00
3	Soln Std	3	24	std-33-3	22.9	10.1	82.1	50.8	22.90	10.10	82.10	50.80

Table B2. Analytical Development's Measurements (in ppm) of the PCT Solutions for the Rad Glasses from the Matrix 2 Study

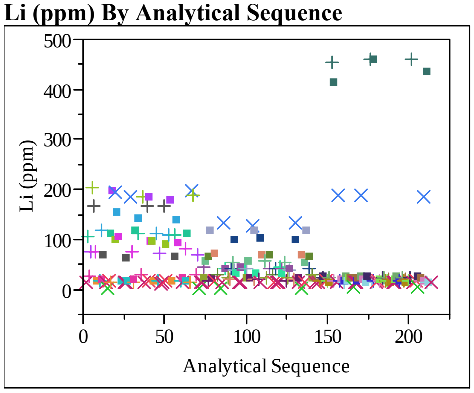
Glass ID	Heat Treatment	Lab ID	B (ppm)	Li (ppm)	Na (ppm)	Si (ppm)
FY09EM21-28	ccc	e72	17.50	22.00	85.67	114.50
FY09EM21-28	quenched	e74	22.33	24.33	95.67	114.84
FY09EM21-28	ccc	e76	16.40	20.83	80.83	111.17
FY09EM21-28	quenched	e79	23.17	24.83	98.00	119.34
FY09EM21-28	ccc	e80	16.13	20.67	78.33	110.84
FY09EM21-28	quenched	e85	23.00	25.33	96.50	120.67
FY09EM21-29	quenched	e73	24.33	26.83	102.34	127.67
FY09EM21-29	quenched	e77	23.83	26.00	99.17	124.17
FY09EM21-29	ccc	e78	16.52	20.67	81.83	110.84
FY09EM21-29	ccc	e81	18.00	21.83	84.17	118.17
FY09EM21-29	quenched	e83	23.00	25.17	97.00	121.67
FY09EM21-29	ccc	e84	15.83	19.83	78.17	109.00
FY09EM21-30	quenched	e69	22.17	24.33	91.00	114.67
FY09EM21-30	ccc	e70	16.63	21.17	78.50	111.84
FY09EM21-30	quenched	e71	22.50	24.50	92.84	115.34
FY09EM21-30	ccc	e75	17.17	21.50	78.00	115.34
FY09EM21-30	ccc	e82	16.63	21.67	78.83	114.34
FY09EM21-30	quenched	e86	23.33	25.50	96.17	121.17

Exhibit B1. PCT Measurements in Analytical Sequence over All of the Analytical Plans for the Matrix 2 Non-Rad Glasses

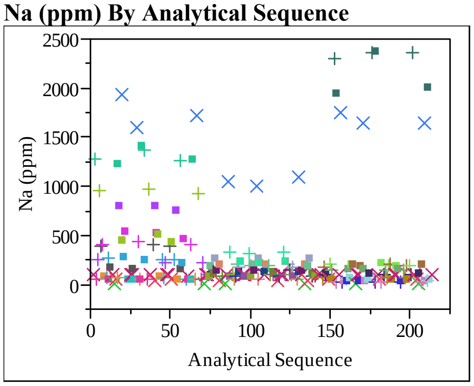
B (ppm) By Analytical Sequence



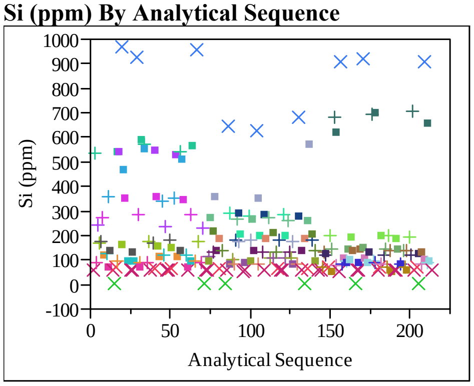
Li (ppm) By Analytical Sequence



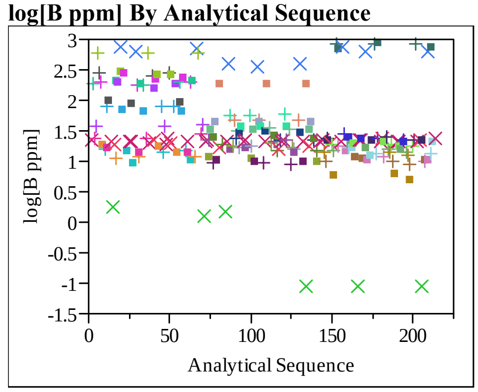
Na (ppm) By Analytical Sequence



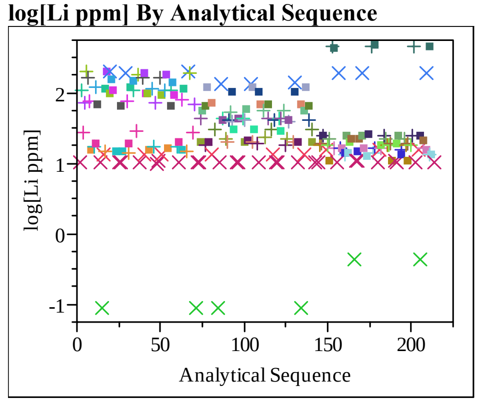
Si (ppm) By Analytical Sequence



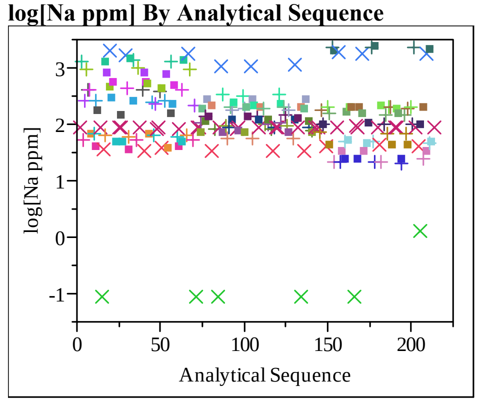
log[B ppm] By Analytical Sequence



log[Li ppm] By Analytical Sequence



log[Na ppm] By Analytical Sequence



log[Si ppm] By Analytical Sequence

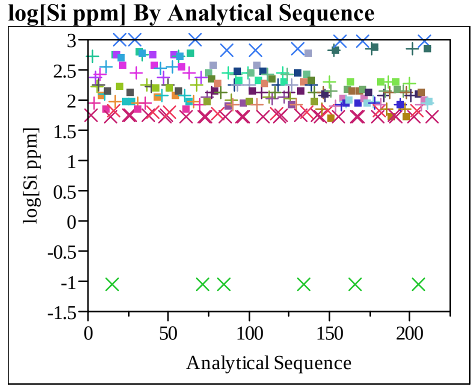
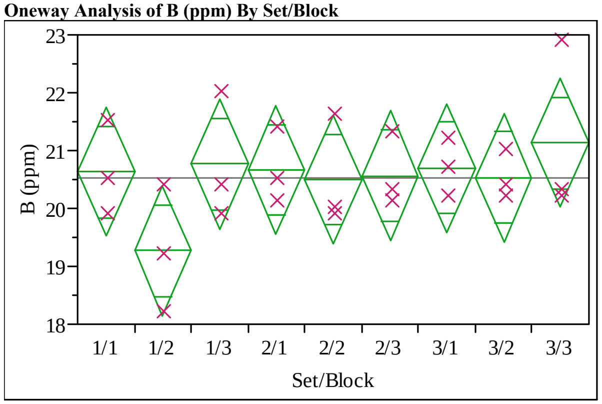


Exhibit B2. Measurements of the Multi-Element Solution Standard by ICP Block for the Non-Rad Matrix 2 Study

Oneway Analysis of B (ppm) By Set/Block



Oneway Anova
Summary of Fit

Rsquare	0.290611
Adj Rsquare	-0.02467
Root Mean Square Error	0.919138
Mean of Response	20.52963
Observations (or Sum Wgts)	27

Analysis of Variance

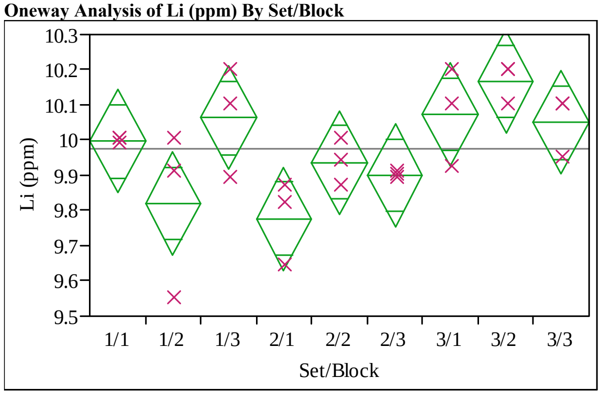
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block	8	6.229630	0.778704	0.9217	0.5216
Error	18	15.206667	0.844815		
C. Total	26	21.436296			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1	3	20.6333	0.53066	19.518	21.748
1/2	3	19.2667	0.53066	18.152	20.382
1/3	3	20.7667	0.53066	19.652	21.882
2/1	3	20.6667	0.53066	19.552	21.782
2/2	3	20.5000	0.53066	19.385	21.615
2/3	3	20.5667	0.53066	19.452	21.682
3/1	3	20.7000	0.53066	19.585	21.815
3/2	3	20.5333	0.53066	19.418	21.648
3/3	3	21.1333	0.53066	20.018	22.248

Std Error uses a pooled estimate of error variance

Oneway Analysis of Li (ppm) By Set/Block



Oneway Anova
Summary of Fit

Rsquare	0.598262
Adj Rsquare	0.419712
Root Mean Square Error	0.120968
Mean of Response	9.975926
Observations (or Sum Wgts)	27

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block	8	0.39225185	0.049031	3.3507	0.0158
Error	18	0.26340000	0.014633		
C. Total	26	0.65565185			

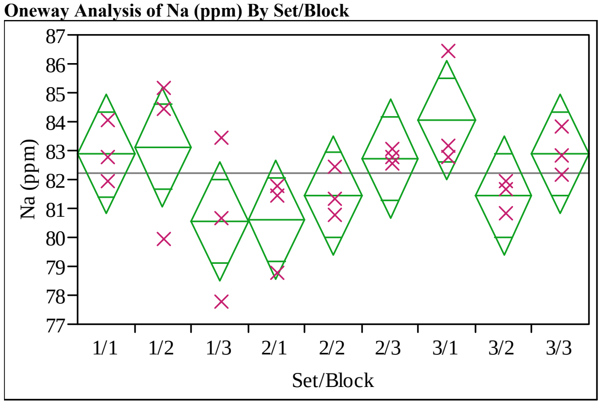
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1	3	9.9967	0.06984	9.850	10.143
1/2	3	9.8200	0.06984	9.673	9.967
1/3	3	10.0633	0.06984	9.917	10.210
2/1	3	9.7767	0.06984	9.630	9.923
2/2	3	9.9367	0.06984	9.790	10.083
2/3	3	9.9000	0.06984	9.753	10.047
3/1	3	10.0733	0.06984	9.927	10.220
3/2	3	10.1667	0.06984	10.020	10.313
3/3	3	10.0500	0.06984	9.903	10.197

Std Error uses a pooled estimate of error variance

Exhibit B2. Measurements of the Multi-Element Solution Standard by ICP Block for the Non-Rad Matrix 2 Study

Oneway Analysis of Na (ppm) By Set/Block



Oneway Anova
Summary of Fit

Rsquare	0.408343
Adj Rsquare	0.145385
Root Mean Square Error	1.697165
Mean of Response	82.1963
Observations (or Sum Wgts)	27

Analysis of Variance

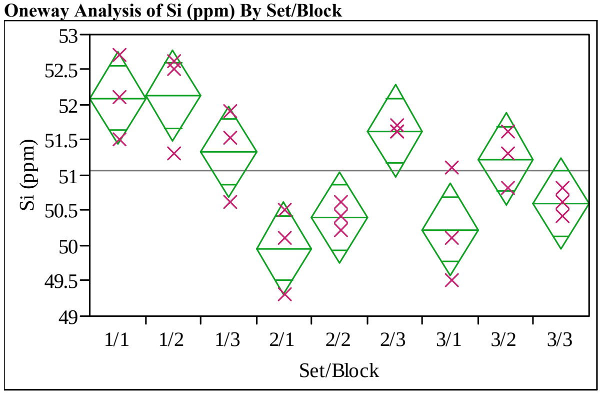
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block	8	35.782963	4.47287	1.5529	0.2080
Error	18	51.846667	2.88037		
C. Total	26	87.629630			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1	3	82.8667	0.97986	80.808	84.925
1/2	3	83.1333	0.97986	81.075	85.192
1/3	3	80.5667	0.97986	78.508	82.625
2/1	3	80.6000	0.97986	78.541	82.659
2/2	3	81.4667	0.97986	79.408	83.525
2/3	3	82.7333	0.97986	80.675	84.792
3/1	3	84.0667	0.97986	82.008	86.125
3/2	3	81.4333	0.97986	79.375	83.492
3/3	3	82.9000	0.97986	80.841	84.959

Std Error uses a pooled estimate of error variance

Oneway Analysis of Si (ppm) By Set/Block



Oneway Anova
Summary of Fit

Rsquare	0.74971
Adj Rsquare	0.638469
Root Mean Square Error	0.537499
Mean of Response	51.0704
Observations (or Sum Wgts)	27

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block	8	15.576770	1.94710	6.7396	0.0004
Error	18	5.200301	0.28891		
C. Total	26	20.777070			

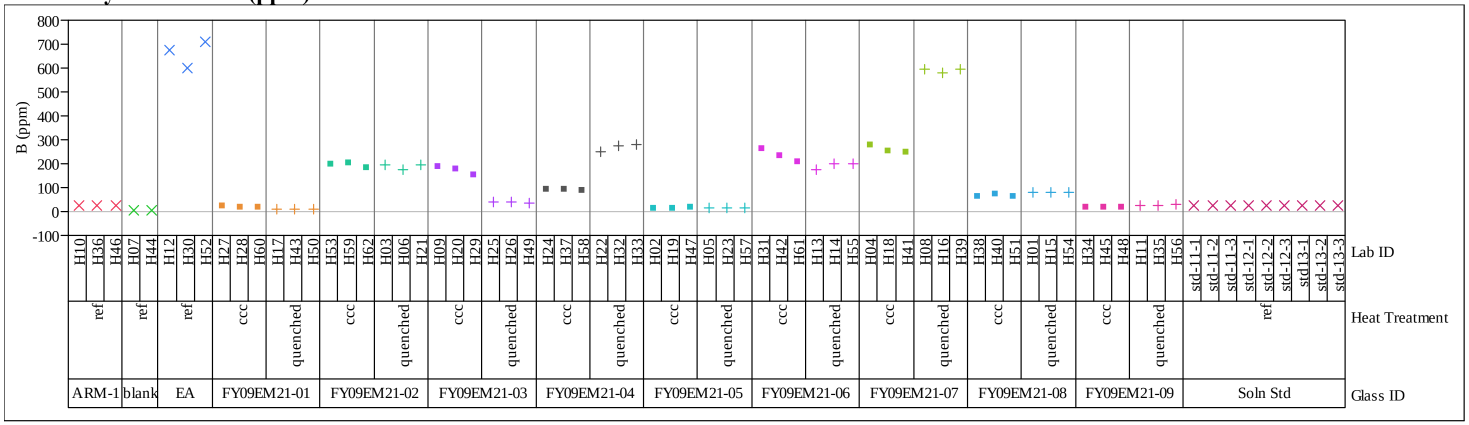
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1	3	52.1000	0.31033	51.448	52.752
1/2	3	52.1333	0.31033	51.481	52.785
1/3	3	51.3336	0.31033	50.682	51.986
2/1	3	49.9667	0.31033	49.315	50.619
2/2	3	50.4000	0.31033	49.748	51.052
2/3	3	51.6333	0.31033	50.981	52.285
3/1	3	50.2333	0.31033	49.581	50.885
3/2	3	51.2333	0.31033	50.581	51.885
3/3	3	50.6000	0.31033	49.948	51.252

Std Error uses a pooled estimate of error variance

Exhibit B3. Laboratory PCT Measurements by Glass Identifier for Matrix 2 Non-Rad Glasses and Standards

Set=1
Variability Chart for B (ppm)



Set=1
Variability Chart for Li (ppm)

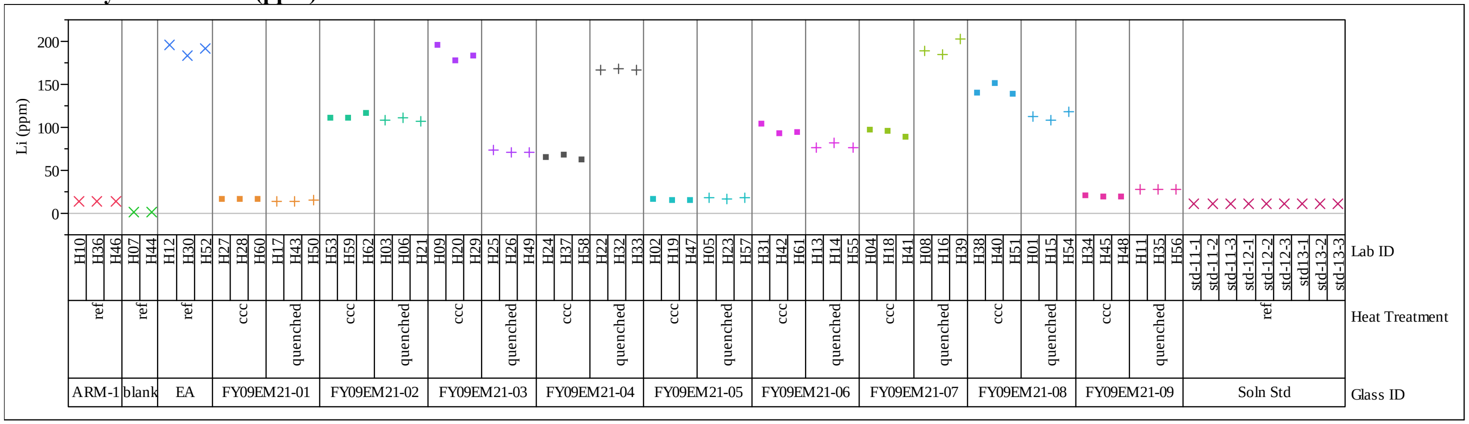
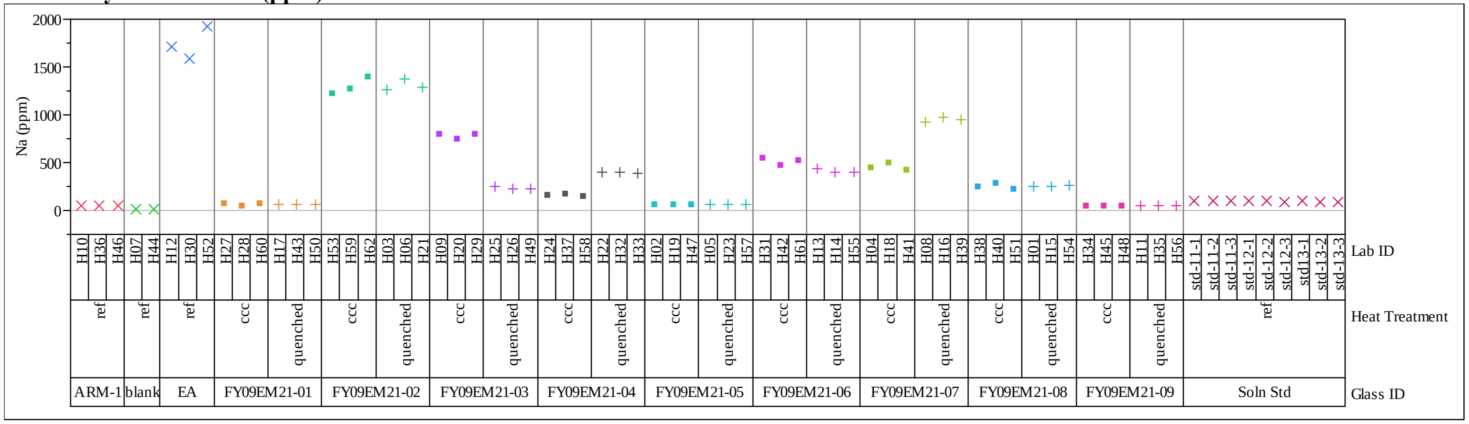


Exhibit B3. Laboratory PCT Measurements by Glass Identifier for Matrix 2 Non-Rad Glasses and Standards

Set=1

Variability Chart for Na (ppm)



Set=1

Variability Chart for Si (ppm)

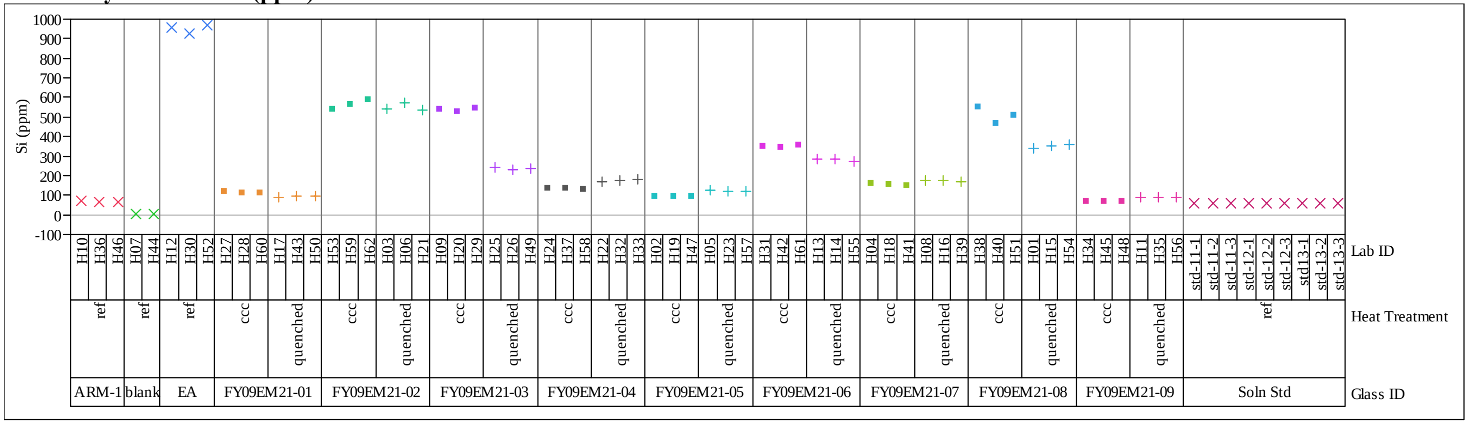
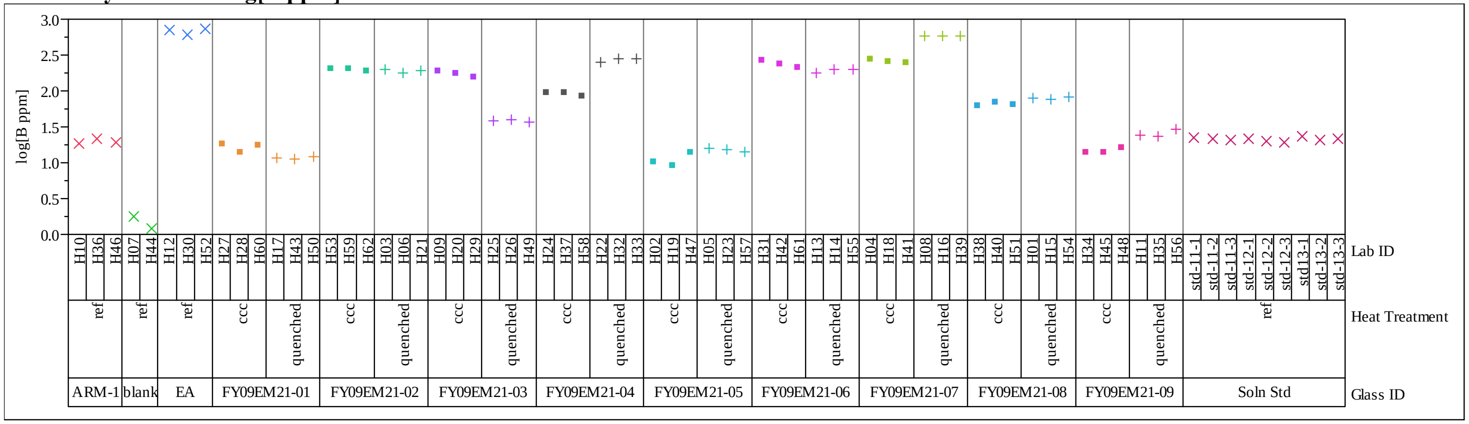


Exhibit B3. Laboratory PCT Measurements by Glass Identifier for Matrix 2 Non-Rad Glasses and Standards

Set=1
Variability Chart for log[B ppm]



Set=1
Variability Chart for log[Li ppm]

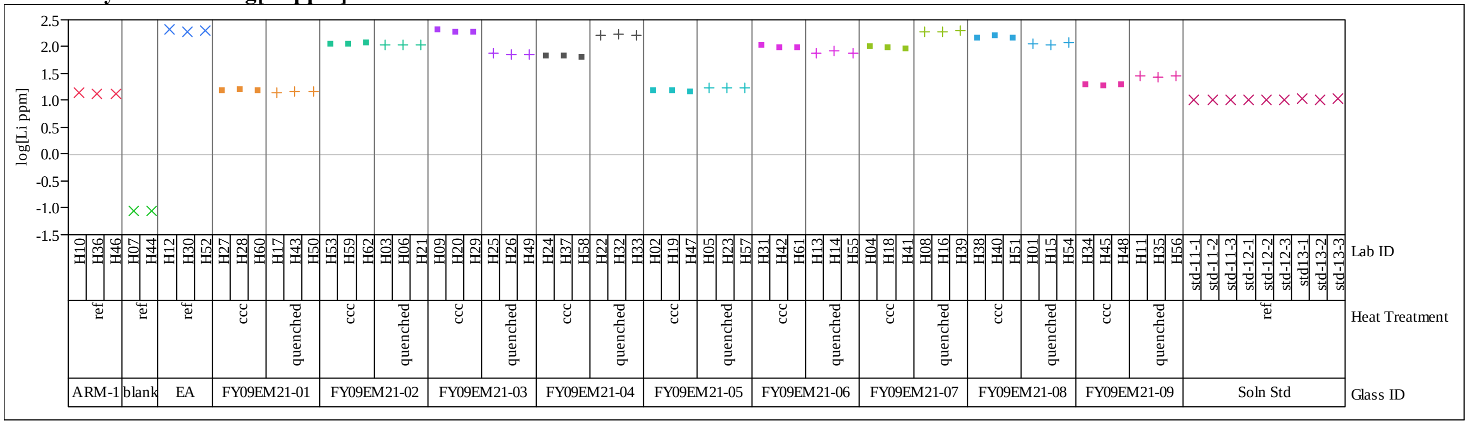
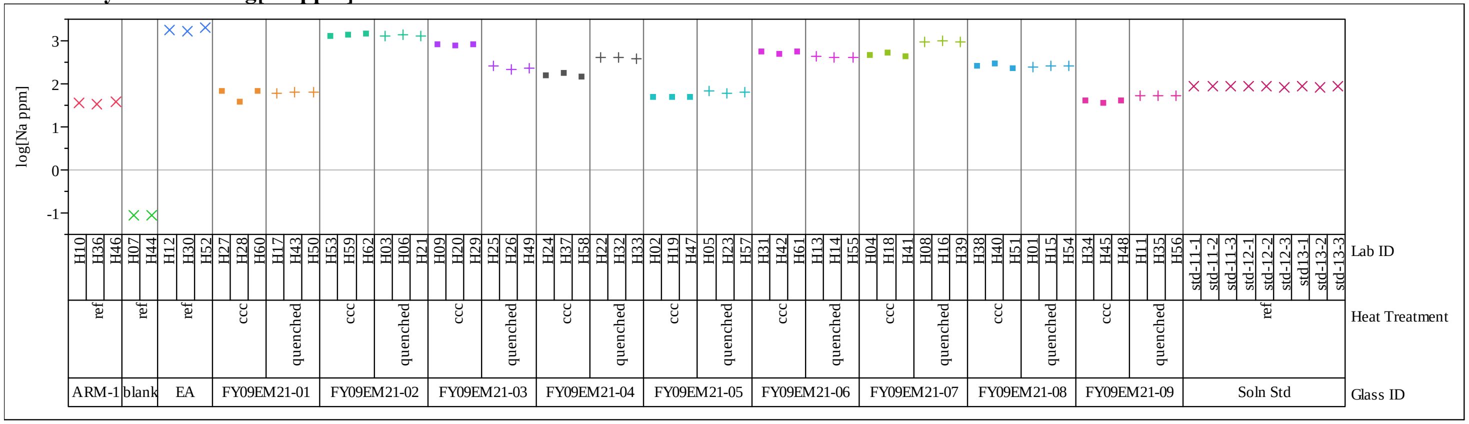


Exhibit B3. Laboratory PCT Measurements by Glass Identifier for Matrix 2 Non-Rad Glasses and Standards

Set=1
Variability Chart for log[Na ppm]



Set=1
Variability Chart for log[Si ppm]

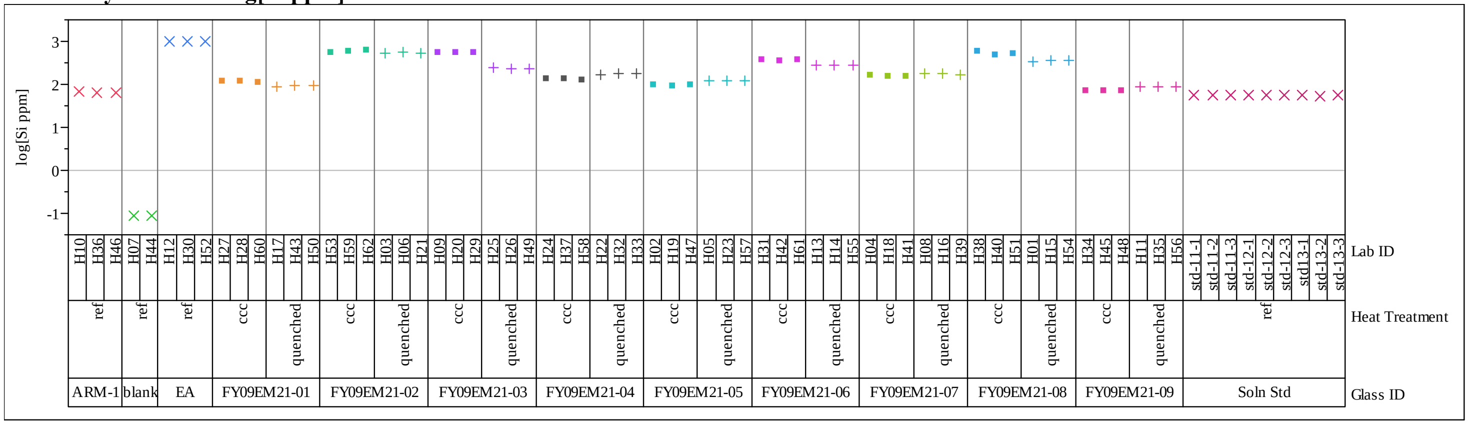
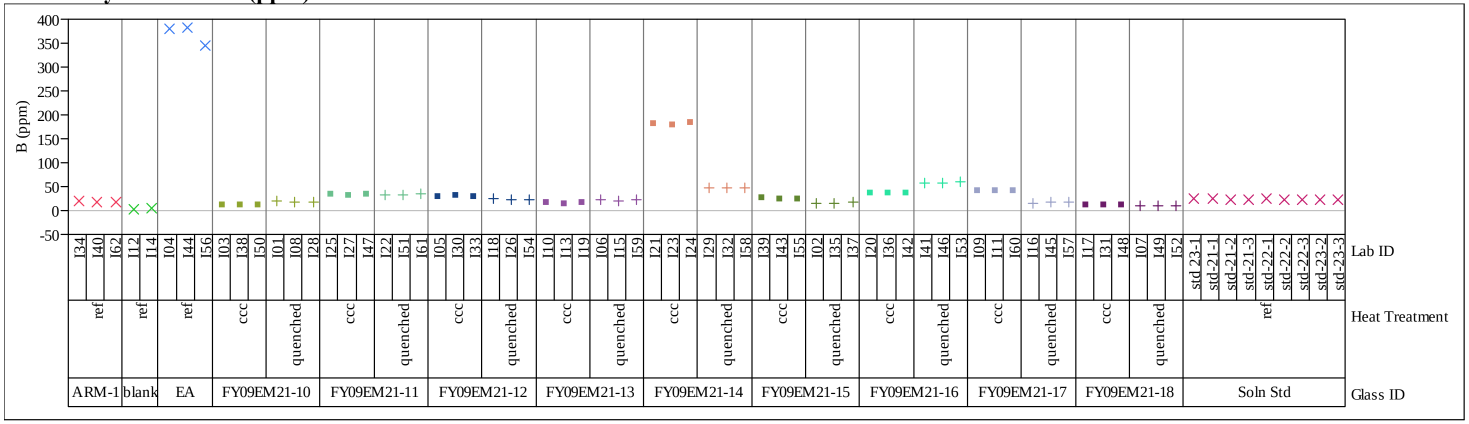


Exhibit B3. Laboratory PCT Measurements by Glass Identifier for Matrix 2 Non-Rad Glasses and Standards

Set=2
Variability Chart for B (ppm)



Set=2
Variability Chart for Li (ppm)

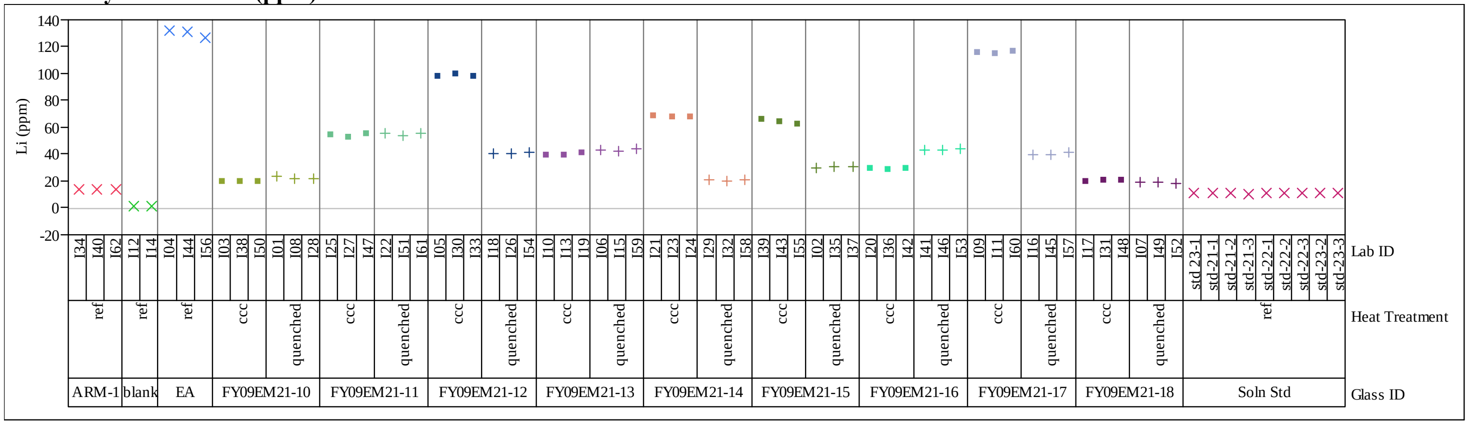
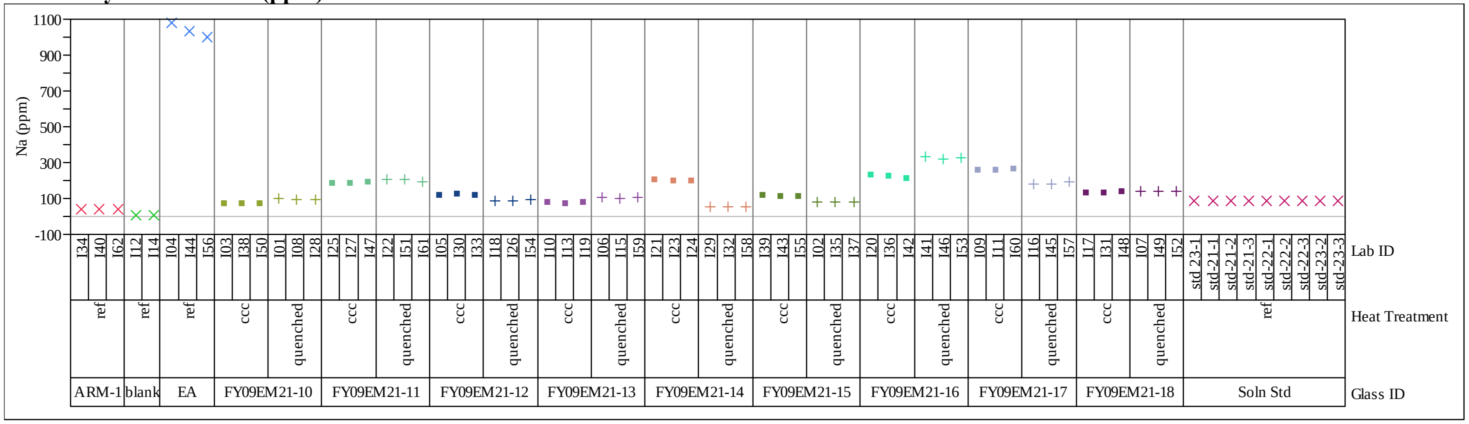


Exhibit B3. Laboratory PCT Measurements by Glass Identifier for Matrix 2 Non-Rad Glasses and Standards

Set=2

Variability Chart for Na (ppm)



Set=2

Variability Chart for Si (ppm)

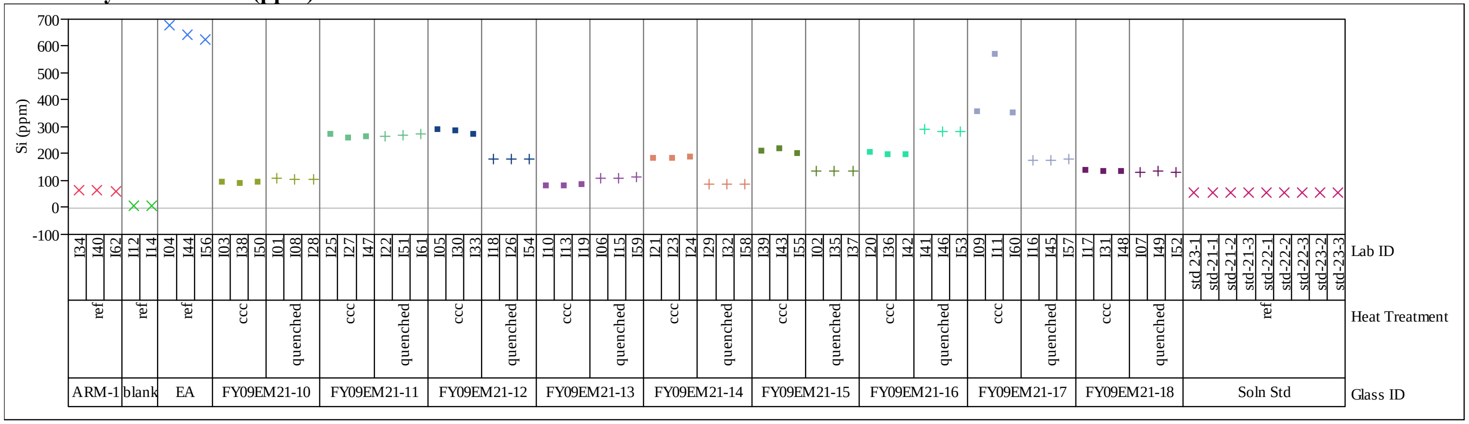
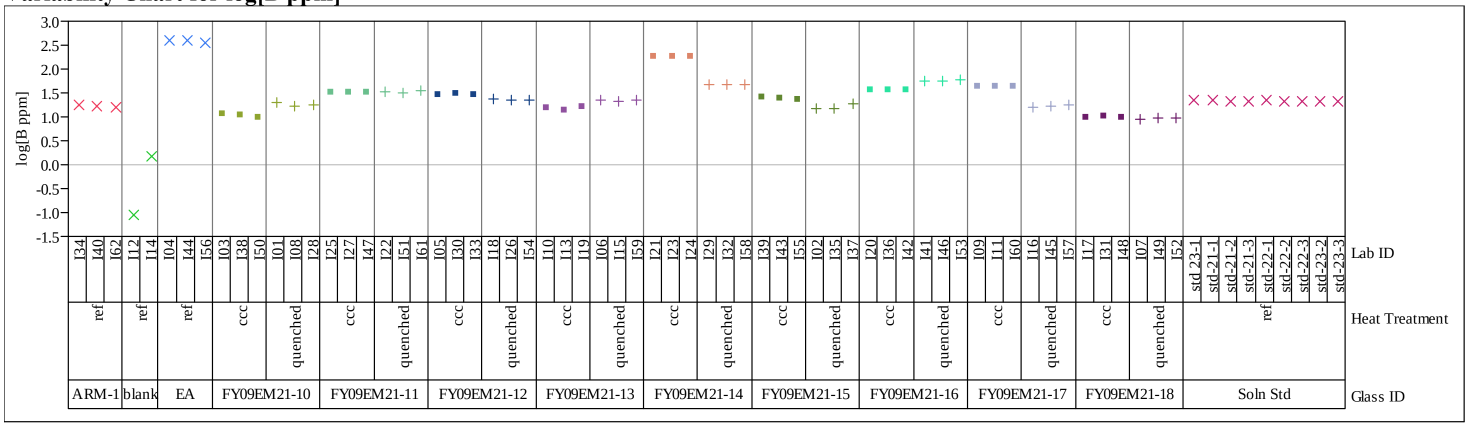


Exhibit B3. Laboratory PCT Measurements by Glass Identifier for Matrix 2 Non-Rad Glasses and Standards

Set=2
Variability Chart for log[B ppm]



Set=2
Variability Chart for log[Li ppm]

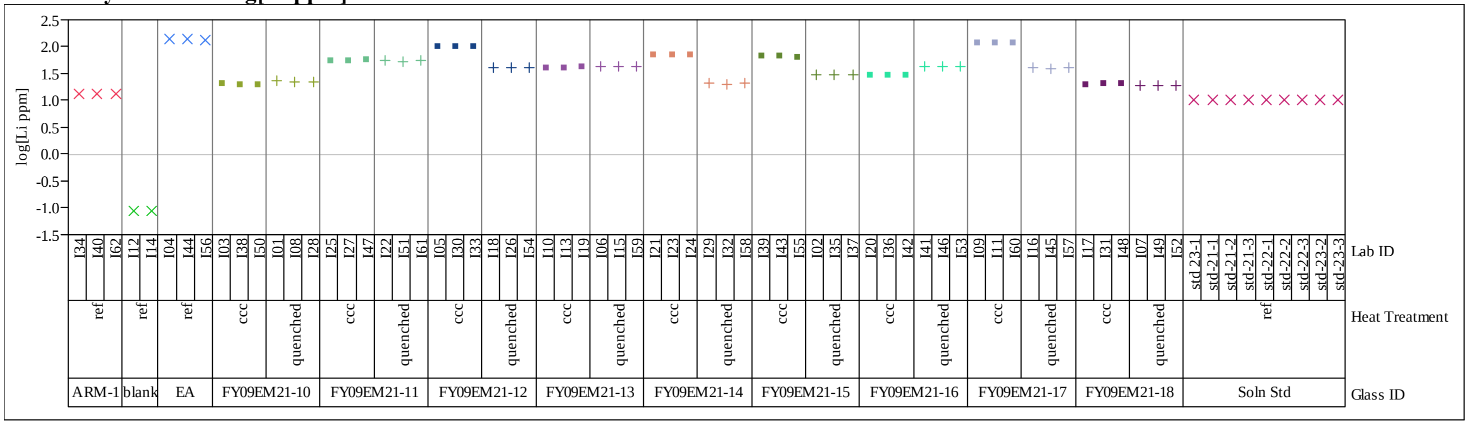
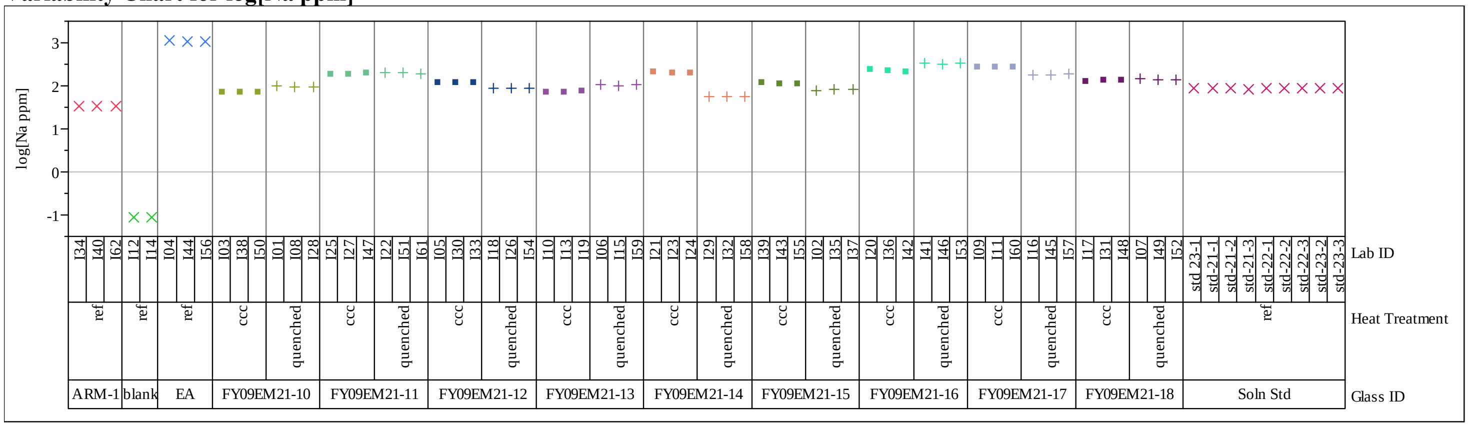


Exhibit B3. Laboratory PCT Measurements by Glass Identifier for Matrix 2 Non-Rad Glasses and Standards

Set=2
Variability Chart for log[Na ppm]



Set=2
Variability Chart for log[Si ppm]

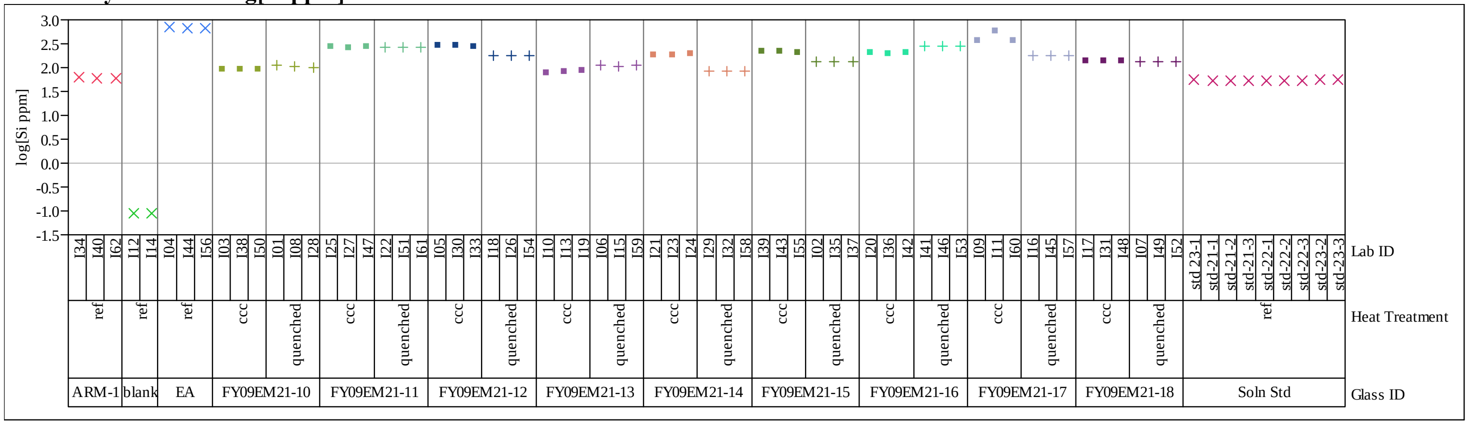
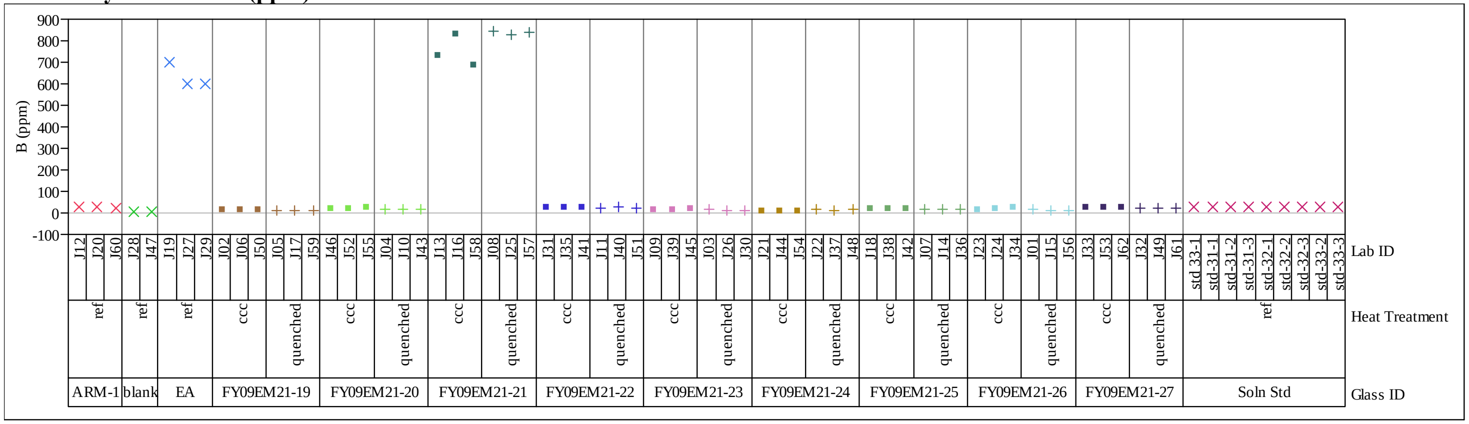


Exhibit B3. Laboratory PCT Measurements by Glass Identifier for Matrix 2 Non-Rad Glasses and Standards

Set=3
Variability Chart for B (ppm)



Set=3
Variability Chart for Li (ppm)

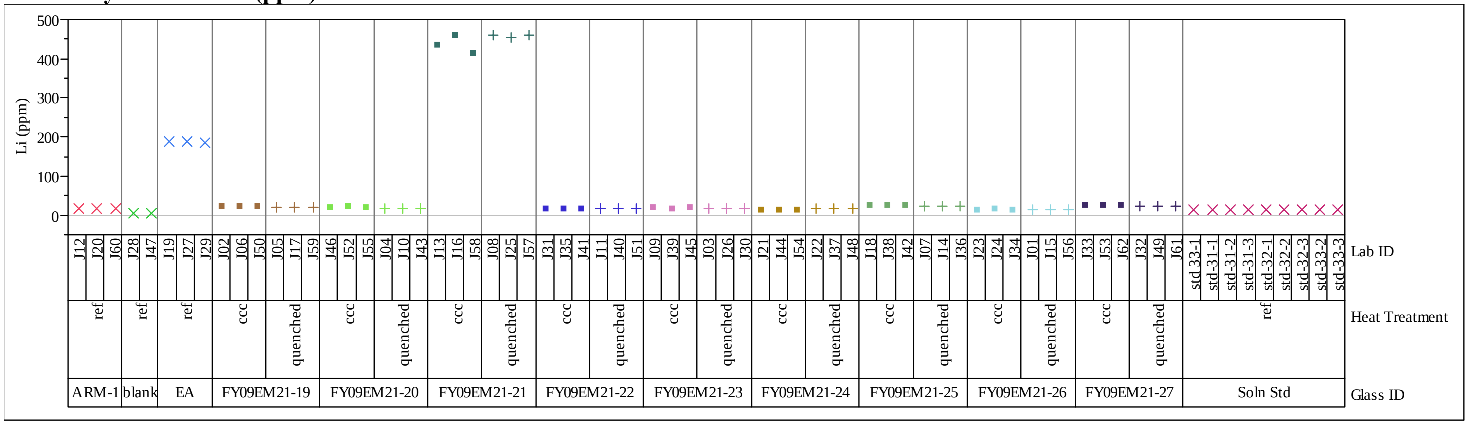
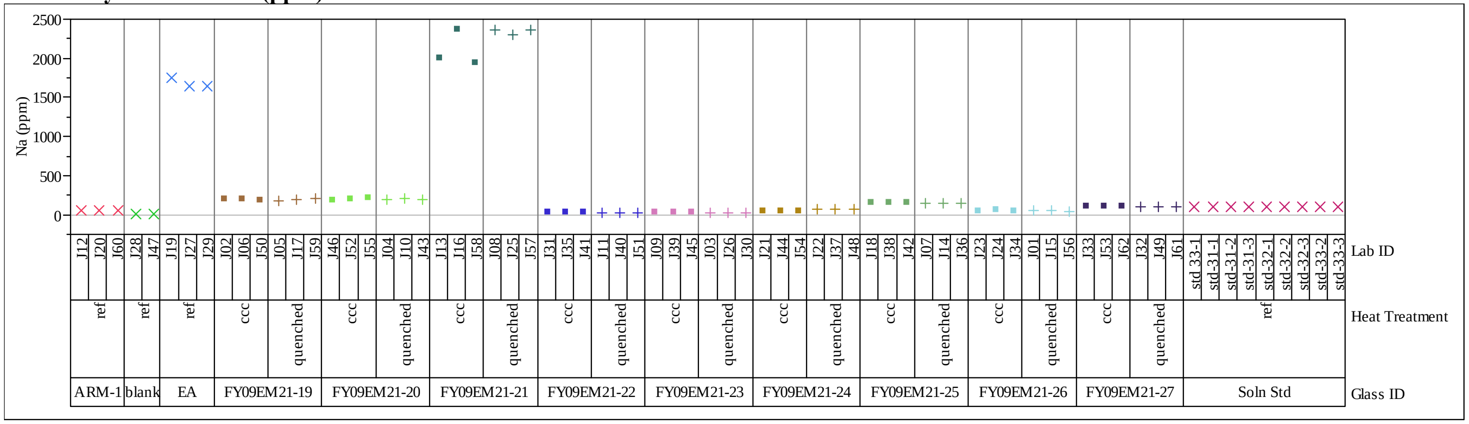


Exhibit B3. Laboratory PCT Measurements by Glass Identifier for Matrix 2 Non-Rad Glasses and Standards

Set=3
Variability Chart for Na (ppm)



Set=3
Variability Chart for Si (ppm)

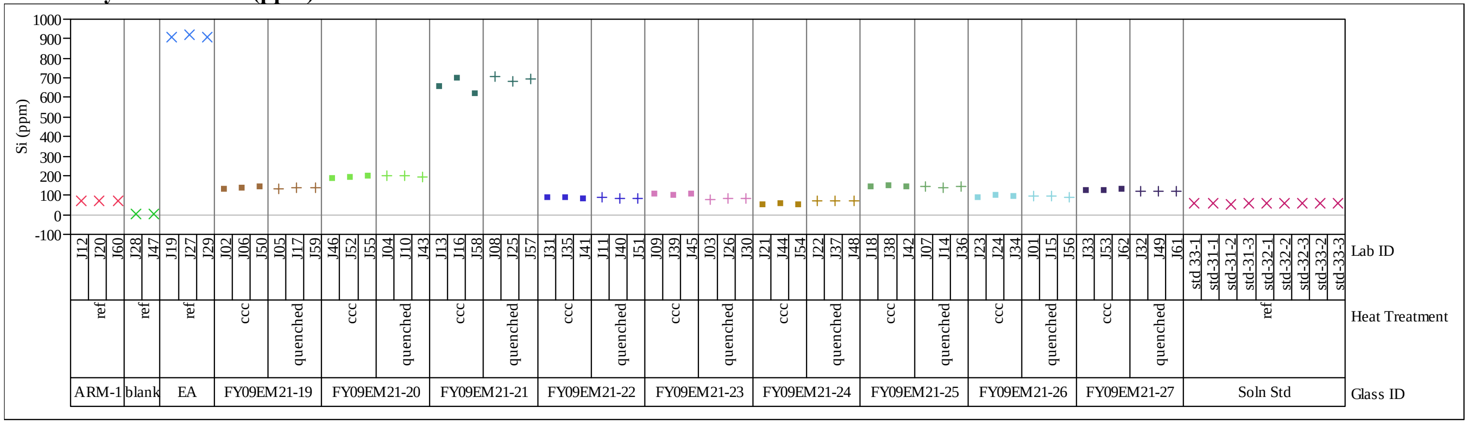
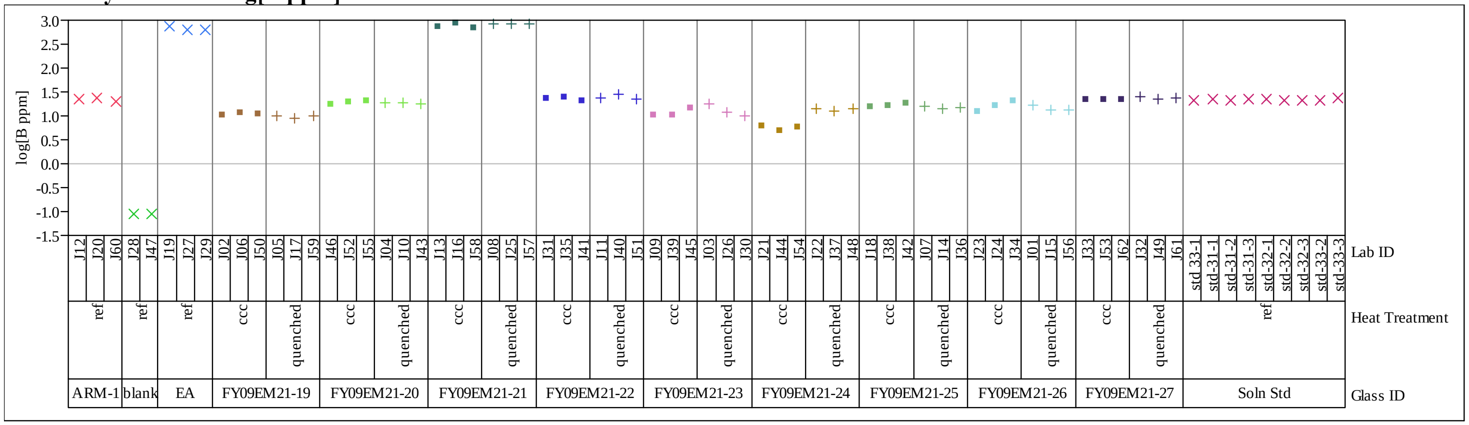


Exhibit B3. Laboratory PCT Measurements by Glass Identifier for Matrix 2 Non-Rad Glasses and Standards

Set=3
Variability Chart for log[B ppm]



Set=3
Variability Chart for log[Li ppm]

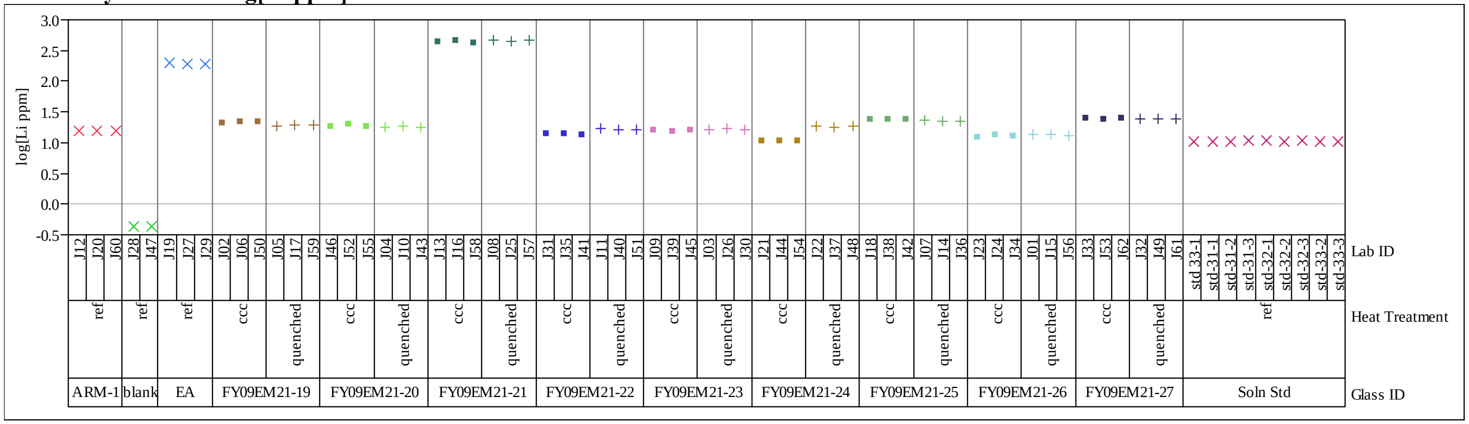
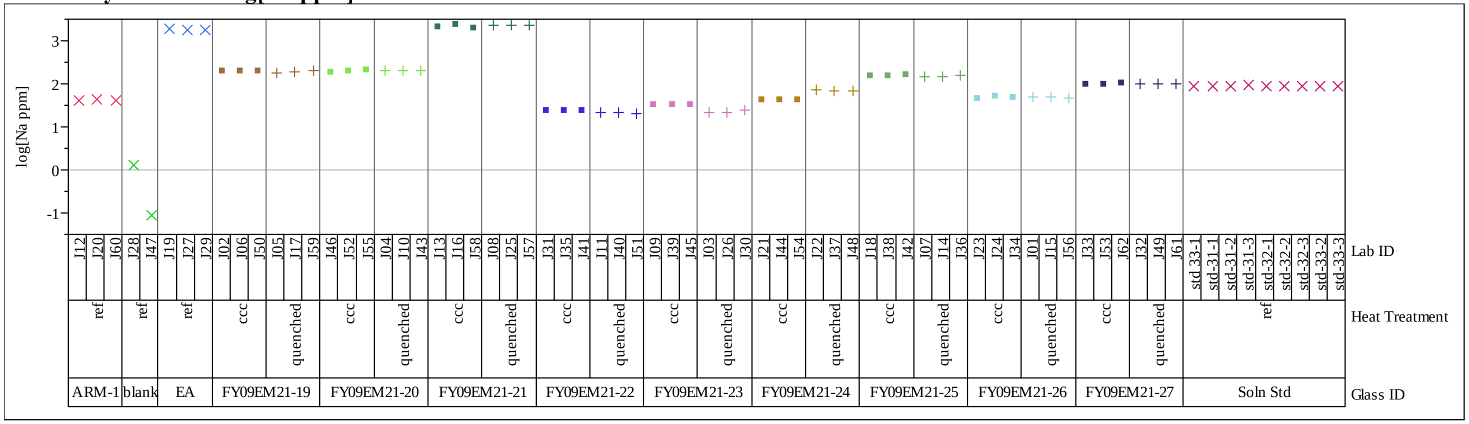


Exhibit B3. Laboratory PCT Measurements by Glass Identifier for Matrix 2 Non-Rad Glasses and Standards

Set=3
Variability Chart for log[Na ppm]



Set=3
Variability Chart for log[Si ppm]

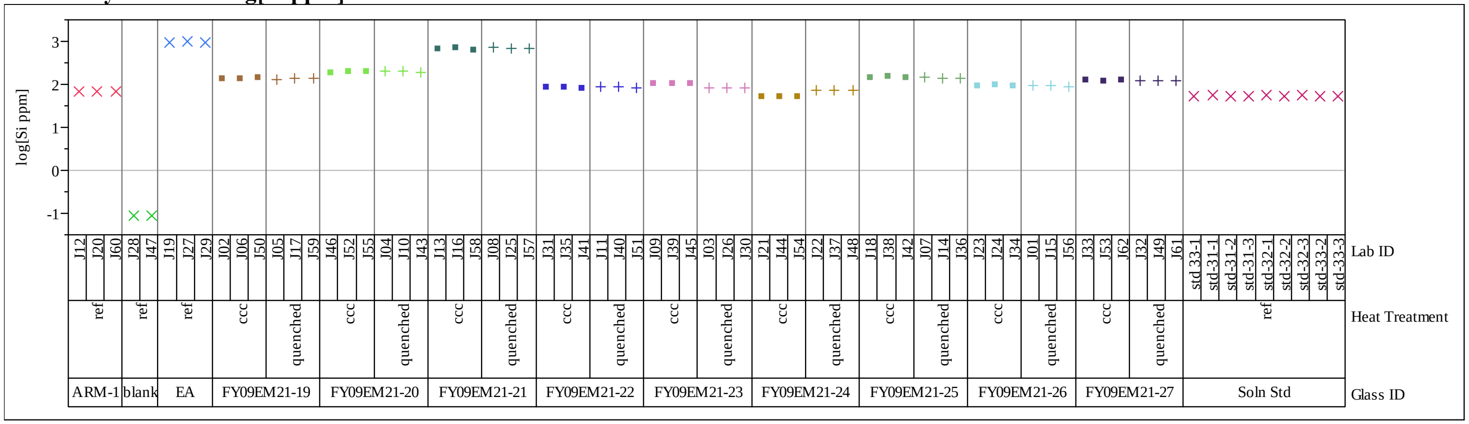


Exhibit B4. Correlations and Scatter Plots of Normalized PCTs Over All Compositional Views and Heat Treatments for the Non-Rad Matrix 2 Study

Multivariate Correlations

	log NL[B (g/L)]	log NL[Li(g/L)]	log NL[Na (g/L)]	log NL[Si (g/L)]
log NL[B (g/L)]	1.0000	0.9770	0.9547	0.9226
log NL[Li(g/L)]	0.9770	1.0000	0.9422	0.9132
log NL[Na (g/L)]	0.9547	0.9422	1.0000	0.9128
log NL[Si (g/L)]	0.9226	0.9132	0.9128	1.0000

Scatterplot Matrix

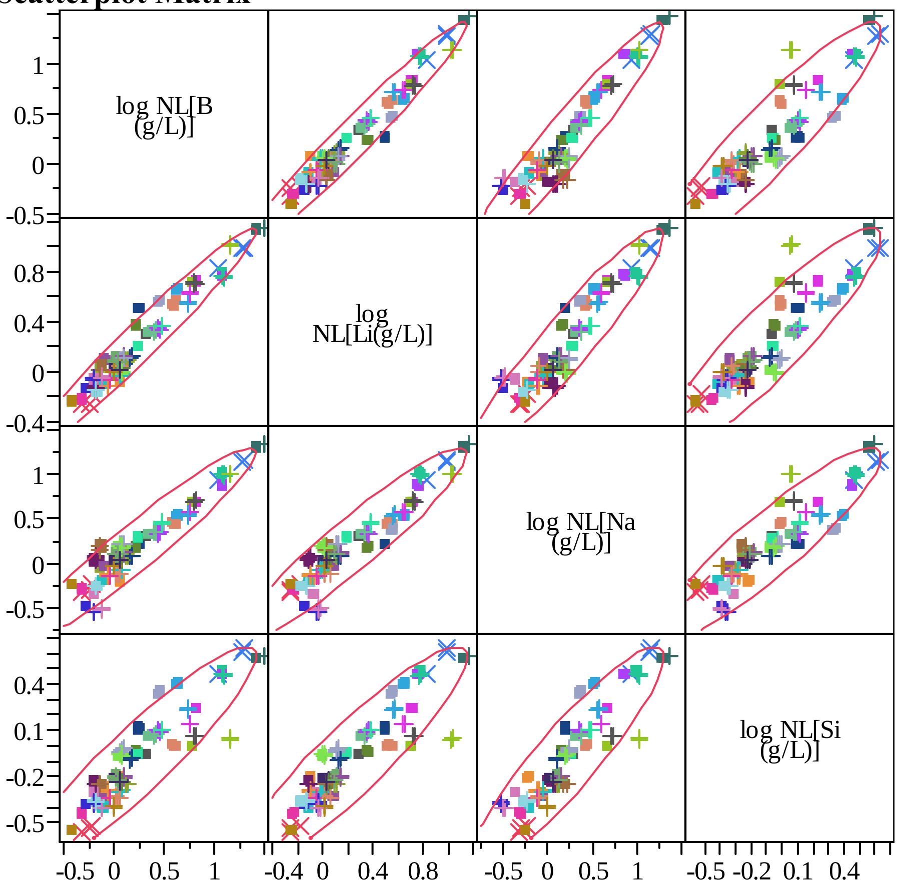
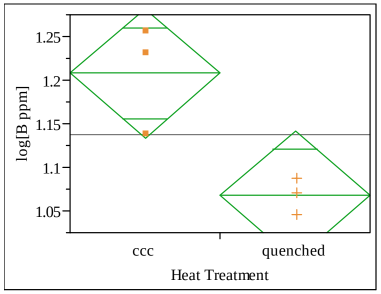


Exhibit B5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of Matrix 2 Non-Rad Glasses

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=FY09EM21-01



Oneway Anova
Summary of Fit

Rsquare	0.773269
Adj Rsquare	0.716586
Root Mean Square Error	0.046356
Mean of Response	1.137767
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.13980	t Ratio	-3.69351
Std Err Dif	0.03785	DF	4
Upper CL Dif	-0.03471	Prob > |t|	0.0210
Lower CL Dif	-0.24488	Prob > t	0.9895
Confidence	0.95	Prob < t	0.0105

Analysis of Variance

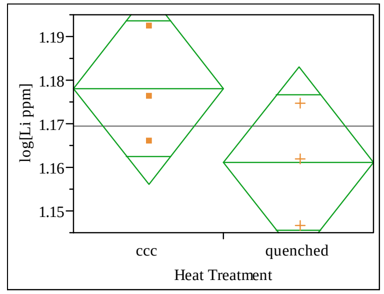
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.02931456	0.029315	13.6420	0.0210
Error	4	0.00859536	0.002149		
C. Total	5	0.03790992			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.20767	0.02676	1.1334	1.2820
quenched	3	1.06787	0.02676	0.9936	1.1422

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=FY09EM21-01



Oneway Anova
Summary of Fit

Rsquare	0.367278
Adj Rsquare	0.209097
Root Mean Square Error	0.013656
Mean of Response	1.169555
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.01699	t Ratio	-1.52377
Std Err Dif	0.01115	DF	4
Upper CL Dif	0.01397	Prob > |t|	0.2022
Lower CL Dif	-0.04795	Prob > t	0.8989
Confidence	0.95	Prob < t	0.1011

Analysis of Variance

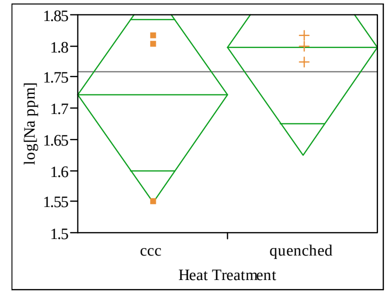
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00043302	0.000433	2.3219	0.2022
Error	4	0.00074598	0.000186		
C. Total	5	0.00117899			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.17805	0.00788	1.1562	1.1999
quenched	3	1.16106	0.00788	1.1392	1.1830

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=FY09EM21-01



Oneway Anova
Summary of Fit

Rsquare	0.156743
Adj Rsquare	-0.05407
Root Mean Square Error	0.107123
Mean of Response	1.758999
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.07542	t Ratio	0.86227
Std Err Dif	0.08747	DF	4
Upper CL Dif	0.31826	Prob > |t|	0.4372
Lower CL Dif	-0.16742	Prob > t	0.2186
Confidence	0.95	Prob < t	0.7814

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00853199	0.008532	0.7435	0.4372
Error	4	0.04590116	0.011475		
C. Total	5	0.05443315			

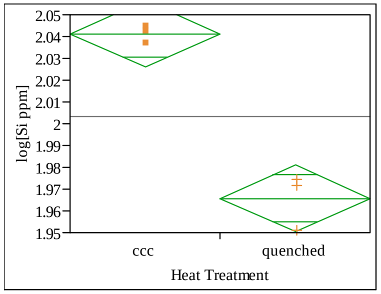
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.72129	0.06185	1.5496	1.8930
quenched	3	1.79671	0.06185	1.6250	1.9684

Std Error uses a pooled estimate of error variance

Exhibit B5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of Matrix 2 Non-Rad Glasses

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=FY09EM21-01



Oneway Anova
Summary of Fit

Rsquare	0.959161
Adj Rsquare	0.948952
Root Mean Square Error	0.009528
Mean of Response	2.003466
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.07541	t Ratio	-9.69259
Std Err Dif	0.00778	DF	4
Upper CL Dif	-0.05381	Prob > |t|	0.0006
Lower CL Dif	-0.09701	Prob > t	0.9997
Confidence	0.95	Prob < t	0.0003

Analysis of Variance

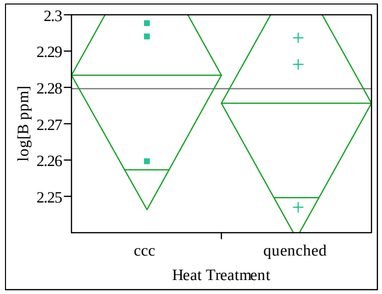
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00852915	0.008529	93.9463	0.0006
Error	4	0.00036315	0.000091		
C. Total	5	0.00889230			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.04117	0.00550	2.0259	2.0564
quenched	3	1.96576	0.00550	1.9505	1.9810

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=FY09EM21-02



Oneway Anova
Summary of Fit

Rsquare	0.040318
Adj Rsquare	-0.1996
Root Mean Square Error	0.023114
Mean of Response	2.279608
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.00774	t Ratio	-0.40994
Std Err Dif	0.01887	DF	4
Upper CL Dif	0.04466	Prob > |t|	0.7029
Lower CL Dif	-0.06014	Prob > t	0.6486
Confidence	0.95	Prob < t	0.3514

Analysis of Variance

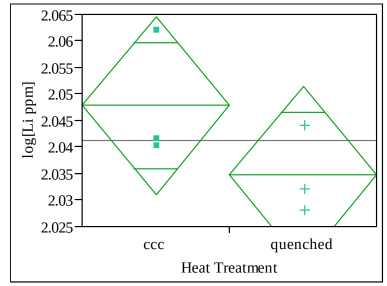
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00008978	0.000090	0.1680	0.7029
Error	4	0.00213704	0.000534		
C. Total	5	0.00222682			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.28348	0.01334	2.2464	2.3205
quenched	3	2.27574	0.01334	2.2387	2.3128

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=FY09EM21-02



Oneway Anova
Summary of Fit

Rsquare	0.369435
Adj Rsquare	0.211794
Root Mean Square Error	0.010479
Mean of Response	2.041267
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.01310	t Ratio	-1.53086
Std Err Dif	0.00856	DF	4
Upper CL Dif	0.01066	Prob > |t|	0.2006
Lower CL Dif	-0.03685	Prob > t	0.8997
Confidence	0.95	Prob < t	0.1003

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00025735	0.000257	2.3435	0.2006
Error	4	0.00043926	0.000110		
C. Total	5	0.00069662			

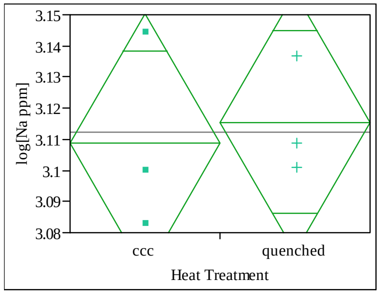
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.04782	0.00605	2.0310	2.0646
quenched	3	2.03472	0.00605	2.0179	2.0515

Std Error uses a pooled estimate of error variance

Exhibit B5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of Matrix 2 Non-Rad Glasses

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=FY09EM21-02



Oneway Anova
Summary of Fit

Rsquare	0.023882
Adj Rsquare	-0.22015
Root Mean Square Error	0.026012
Mean of Response	3.112209
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.00664	t Ratio	0.312833
Std Err Dif	0.02124	DF	4
Upper CL Dif	0.06561	Prob > |t|	0.7700
Lower CL Dif	-0.05232	Prob > t	0.3850
Confidence	0.95	Prob < t	0.6150

Analysis of Variance

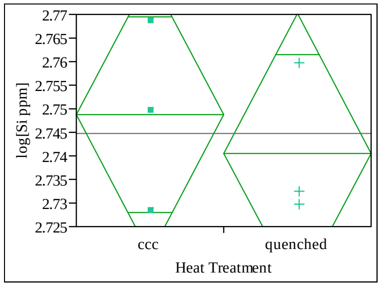
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00006622	0.000066	0.0979	0.7700
Error	4	0.00270643	0.000677		
C. Total	5	0.00277264			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	3.10889	0.01502	3.0672	3.1506
quenched	3	3.11553	0.01502	3.0738	3.1572

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=FY09EM21-02



Oneway Anova
Summary of Fit

Rsquare	0.068678
Adj Rsquare	-0.16415
Root Mean Square Error	0.018384
Mean of Response	2.744674
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.00815	t Ratio	-0.54311
Std Err Dif	0.01501	DF	4
Upper CL Dif	0.03352	Prob > |t|	0.6159
Lower CL Dif	-0.04983	Prob > t	0.6920
Confidence	0.95	Prob < t	0.3080

Analysis of Variance

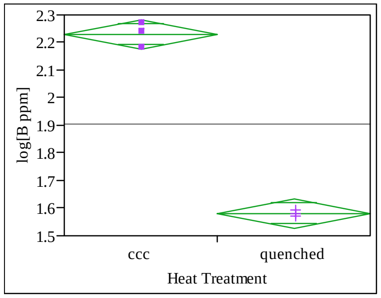
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00009970	0.000100	0.2950	0.6159
Error	4	0.00135196	0.000338		
C. Total	5	0.00145165			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.74875	0.01061	2.7193	2.7782
quenched	3	2.74060	0.01061	2.7111	2.7701

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=FY09EM21-03



Oneway Anova
Summary of Fit

Rsquare	0.99307
Adj Rsquare	0.991337
Root Mean Square Error	0.033194
Mean of Response	1.906017
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.64886	t Ratio	-23.9408
Std Err Dif	0.02710	DF	4
Upper CL Dif	-0.57361	Prob > |t|	<.0001
Lower CL Dif	-0.72411	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.63153145	0.631531	573.1628	<.0001
Error	4	0.00440734	0.001102		
C. Total	5	0.63593880			

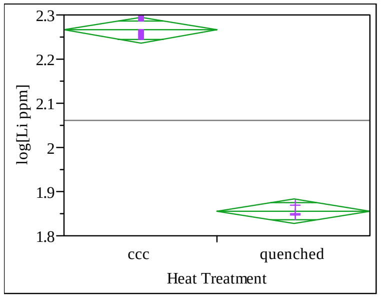
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.23045	0.01916	2.1772	2.2837
quenched	3	1.58159	0.01916	1.5284	1.6348

Std Error uses a pooled estimate of error variance

Exhibit B5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of Matrix 2 Non-Rad Glasses

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=FY09EM21-03



Oneway Anova
Summary of Fit

Rsquare	0.995125
Adj Rsquare	0.993906
Root Mean Square Error	0.017585
Mean of Response	2.060361
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.41027	t Ratio	-28.575
Std Err Dif	0.01436	DF	4
Upper CL Dif	-0.37041	Prob > |t|	<.0001
Lower CL Dif	-0.45013	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

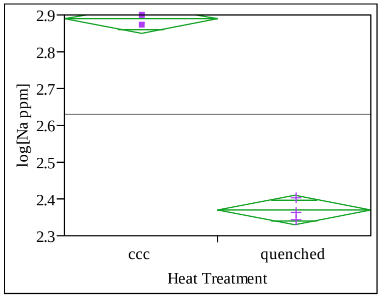
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.25248349	0.252483	816.5301	<.0001
Error	4	0.00123686	0.000309		
C. Total	5	0.25372035			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.26550	0.01015	2.2373	2.2937
quenched	3	1.85523	0.01015	1.8270	1.8834

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=FY09EM21-03



Oneway Anova
Summary of Fit

Rsquare	0.993944
Adj Rsquare	0.99243
Root Mean Square Error	0.024818
Mean of Response	2.628893
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.51921	t Ratio	-25.6223
Std Err Dif	0.02026	DF	4
Upper CL Dif	-0.46295	Prob > |t|	<.0001
Lower CL Dif	-0.57547	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

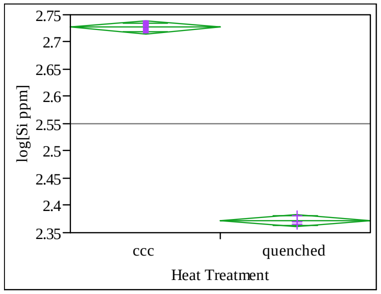
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.40436339	0.404363	656.5043	<.0001
Error	4	0.00246374	0.000616		
C. Total	5	0.40682713			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.88850	0.01433	2.8487	2.9283
quenched	3	2.36929	0.01433	2.3295	2.4091

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=FY09EM21-03



Oneway Anova
Summary of Fit

Rsquare	0.99882
Adj Rsquare	0.998525
Root Mean Square Error	0.00747
Mean of Response	2.549512
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.35491	t Ratio	-58.1883
Std Err Dif	0.00610	DF	4
Upper CL Dif	-0.33798	Prob > |t|	<.0001
Lower CL Dif	-0.37185	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.18894313	0.188943	3385.883	<.0001
Error	4	0.00022321	0.000056		
C. Total	5	0.18916634			

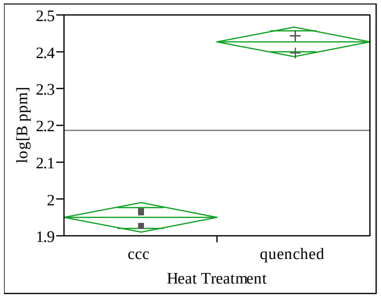
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.72697	0.00431	2.7150	2.7389
quenched	3	2.37206	0.00431	2.3601	2.3840

Std Error uses a pooled estimate of error variance

Exhibit B5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of Matrix 2 Non-Rad Glasses

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=FY09EM21-04



Oneway Anova
Summary of Fit

Rsquare	0.992577
Adj Rsquare	0.990721
Root Mean Square Error	0.025309
Mean of Response	2.188241
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.477908	t Ratio	23.12716
Std Err Dif	0.020664	DF	4
Upper CL Dif	0.535281	Prob > |t|	<.0001
Lower CL Dif	0.420534	Prob > t	<.0001
Confidence	0.95	Prob < t	1.0000

Analysis of Variance

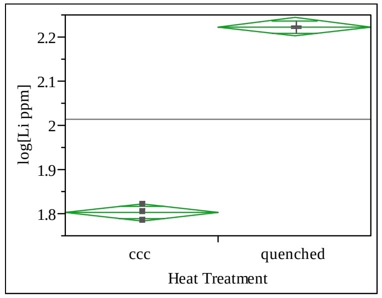
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.34259371	0.342594	534.8654	<.0001
Error	4	0.00256209	0.000641		
C. Total	5	0.34515580			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.94929	0.01461	1.9087	1.9899
quenched	3	2.42719	0.01461	2.3866	2.4678

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=FY09EM21-04



Oneway Anova
Summary of Fit

Rsquare	0.997555
Adj Rsquare	0.996944
Root Mean Square Error	0.012738
Mean of Response	2.012629
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.420176	t Ratio	40.4003
Std Err Dif	0.010400	DF	4
Upper CL Dif	0.449052	Prob > |t|	<.0001
Lower CL Dif	0.391300	Prob > t	<.0001
Confidence	0.95	Prob < t	1.0000

Analysis of Variance

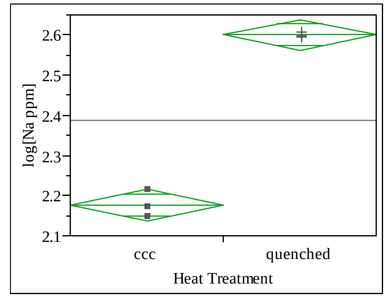
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.26482235	0.264822	1632.184	<.0001
Error	4	0.00064900	0.000162		
C. Total	5	0.26547135			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.80254	0.00735	1.7821	1.8230
quenched	3	2.22272	0.00735	2.2023	2.2431

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=FY09EM21-04



Oneway Anova
Summary of Fit

Rsquare	0.991364
Adj Rsquare	0.989205
Root Mean Square Error	0.024245
Mean of Response	2.388126
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.424194	t Ratio	21.428
Std Err Dif	0.019796	DF	4
Upper CL Dif	0.479157	Prob > |t|	<.0001
Lower CL Dif	0.369231	Prob > t	<.0001
Confidence	0.95	Prob < t	1.0000

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.26991059	0.269911	459.1592	<.0001
Error	4	0.00235135	0.000588		
C. Total	5	0.27226194			

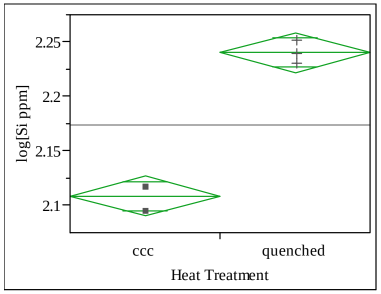
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.17603	0.01400	2.1372	2.2149
quenched	3	2.60022	0.01400	2.5614	2.6391

Std Error uses a pooled estimate of error variance

Exhibit B5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of Matrix 2 Non-Rad Glasses

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=FY09EM21-04



Oneway Anova
Summary of Fit

Rsquare	0.979711
Adj Rsquare	0.974639
Root Mean Square Error	0.011597
Mean of Response	2.174399
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.131594	t Ratio	13.89801
Std Err Dif	0.009469	DF	4
Upper CL Dif	0.157883	Prob > |t|	0.0002
Lower CL Dif	0.105305	Prob > t	<.0001
Confidence	0.95	Prob < t	0.9999

Analysis of Variance

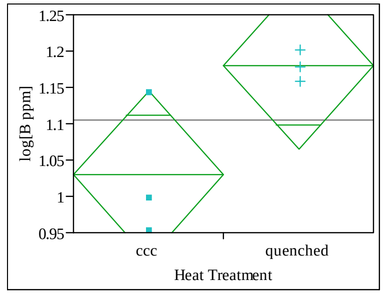
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.02597563	0.025976	193.1548	0.0002
Error	4	0.00053792	0.000134		
C. Total	5	0.02651355			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.10860	0.00670	2.0900	2.1272
quenched	3	2.24020	0.00670	2.2216	2.2588

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=FY09EM21-05



Oneway Anova
Summary of Fit

Rsquare	0.621225
Adj Rsquare	0.526531
Root Mean Square Error	0.071653
Mean of Response	1.104639
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.14985	t Ratio	2.561317
Std Err Dif	0.05850	DF	4
Upper CL Dif	0.31228	Prob > |t|	0.0626
Lower CL Dif	-0.01259	Prob > t	0.0313
Confidence	0.95	Prob < t	0.9687

Analysis of Variance

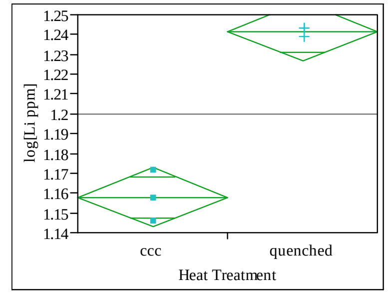
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.03368222	0.033682	6.5603	0.0626
Error	4	0.02053686	0.005134		
C. Total	5	0.05421908			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.02971	0.04137	0.9149	1.1446
quenched	3	1.17956	0.04137	1.0647	1.2944

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=FY09EM21-05



Oneway Anova
Summary of Fit

Rsquare	0.968558
Adj Rsquare	0.960697
Root Mean Square Error	0.009241
Mean of Response	1.199785
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.083752	t Ratio	11.10037
Std Err Dif	0.007545	DF	4
Upper CL Dif	0.104701	Prob > |t|	0.0004
Lower CL Dif	0.062804	Prob > t	0.0002
Confidence	0.95	Prob < t	0.9998

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.01052166	0.010522	123.2181	0.0004
Error	4	0.00034156	0.000085		
C. Total	5	0.01086323			

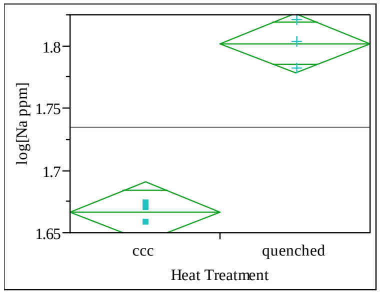
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.15791	0.00534	1.1431	1.1727
quenched	3	1.24166	0.00534	1.2268	1.2565

Std Error uses a pooled estimate of error variance

Exhibit B5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of Matrix 2 Non-Rad Glasses

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=FY09EM21-05



Oneway Anova
Summary of Fit

Rsquare	0.968579
Adj Rsquare	0.960724
Root Mean Square Error	0.014914
Mean of Response	1.734502
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.135218	t Ratio	11.10421
Std Err Dif	0.012177	DF	4
Upper CL Dif	0.169027	Prob > |t|	0.0004
Lower CL Dif	0.101409	Prob > t	0.0002
Confidence	0.95	Prob < t	0.9998

Analysis of Variance

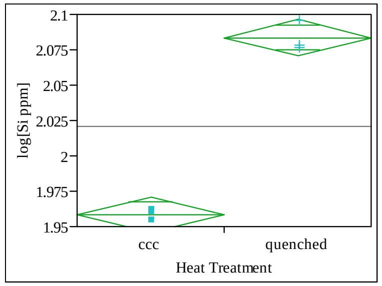
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.02742578	0.027426	123.3036	0.0004
Error	4	0.00088970	0.000222		
C. Total	5	0.02831548			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.66689	0.00861	1.6430	1.6908
quenched	3	1.80211	0.00861	1.7782	1.8260

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=FY09EM21-05



Oneway Anova
Summary of Fit

Rsquare	0.989561
Adj Rsquare	0.986951
Root Mean Square Error	0.007875
Mean of Response	2.021107
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.125197	t Ratio	19.47216
Std Err Dif	0.006430	DF	4
Upper CL Dif	0.143048	Prob > |t|	<.0001
Lower CL Dif	0.107345	Prob > t	<.0001
Confidence	0.95	Prob < t	1.0000

Analysis of Variance

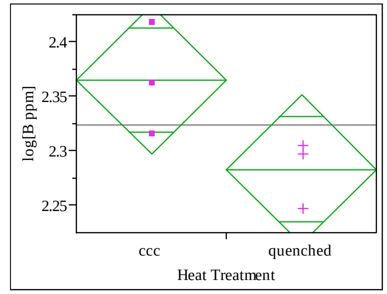
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.02351132	0.023511	379.1651	<.0001
Error	4	0.00024803	0.000062		
C. Total	5	0.02375935			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.95851	0.00455	1.9459	1.9711
quenched	3	2.08371	0.00455	2.0711	2.0963

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=FY09EM21-06



Oneway Anova
Summary of Fit

Rsquare	0.581726
Adj Rsquare	0.477158
Root Mean Square Error	0.042504
Mean of Response	2.323997
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.08185	t Ratio	-2.35863
Std Err Dif	0.03470	DF	4
Upper CL Dif	0.01450	Prob > |t|	0.0778
Lower CL Dif	-0.17821	Prob > t	0.9611
Confidence	0.95	Prob < t	0.0389

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.01005013	0.010050	5.5631	0.0778
Error	4	0.00722626	0.001807		
C. Total	5	0.01727640			

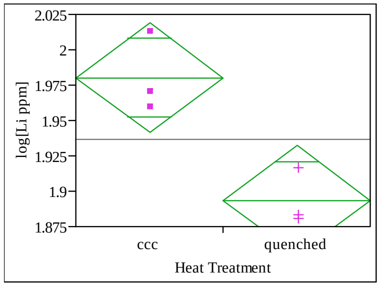
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.36492	0.02454	2.2968	2.4331
quenched	3	2.28307	0.02454	2.2149	2.3512

Std Error uses a pooled estimate of error variance

Exhibit B5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of Matrix 2 Non-Rad Glasses

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=FY09EM21-06



Oneway Anova
Summary of Fit

Rsquare	0.827413
Adj Rsquare	0.784266
Root Mean Square Error	0.024265
Mean of Response	1.937032
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.08676	t Ratio	-4.37912
Std Err Dif	0.01981	DF	4
Upper CL Dif	-0.03175	Prob > |t|	0.0119
Lower CL Dif	-0.14177	Prob > t	0.9941
Confidence	0.95	Prob < t	0.0059

Analysis of Variance

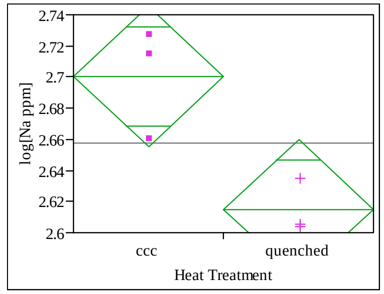
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.01129122	0.011291	19.1767	0.0119
Error	4	0.00235519	0.000589		
C. Total	5	0.01364641			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.98041	0.01401	1.9415	2.0193
quenched	3	1.89365	0.01401	1.8548	1.9325

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=FY09EM21-06



Oneway Anova
Summary of Fit

Rsquare	0.77462
Adj Rsquare	0.718275
Root Mean Square Error	0.028245
Mean of Response	2.657656
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.08551	t Ratio	-3.70781
Std Err Dif	0.02306	DF	4
Upper CL Dif	-0.02148	Prob > |t|	0.0207
Lower CL Dif	-0.14954	Prob > t	0.9897
Confidence	0.95	Prob < t	0.0103

Analysis of Variance

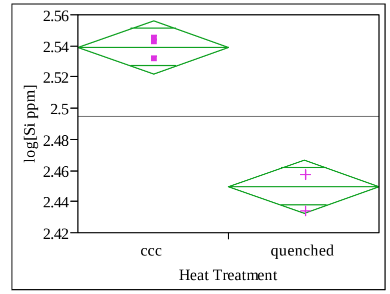
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.01096783	0.010968	13.7478	0.0207
Error	4	0.00319115	0.000798		
C. Total	5	0.01415898			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.70041	0.01631	2.6551	2.7457
quenched	3	2.61490	0.01631	2.5696	2.6602

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=FY09EM21-06



Oneway Anova
Summary of Fit

Rsquare	0.963632
Adj Rsquare	0.95454
Root Mean Square Error	0.010657
Mean of Response	2.494397
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.08958	t Ratio	-10.2949
Std Err Dif	0.00870	DF	4
Upper CL Dif	-0.06542	Prob > |t|	0.0005
Lower CL Dif	-0.11374	Prob > t	0.9997
Confidence	0.95	Prob < t	0.0003

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.01203787	0.012038	105.9857	0.0005
Error	4	0.00045432	0.000114		
C. Total	5	0.01249219			

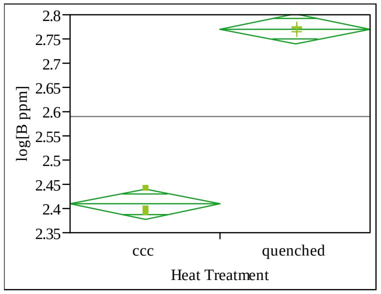
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.53919	0.00615	2.5221	2.5563
quenched	3	2.44961	0.00615	2.4325	2.4667

Std Error uses a pooled estimate of error variance

Exhibit B5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of Matrix 2 Non-Rad Glasses

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=FY09EM21-07



Oneway Anova
Summary of Fit

Rsquare	0.992461
Adj Rsquare	0.990577
Root Mean Square Error	0.019321
Mean of Response	2.58983
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.362017	t Ratio	22.9476
Std Err Dif	0.015776	DF	4
Upper CL Dif	0.405818	Prob > |t|	<.0001
Lower CL Dif	0.318216	Prob > t	<.0001
Confidence	0.95	Prob < t	1.0000

Analysis of Variance

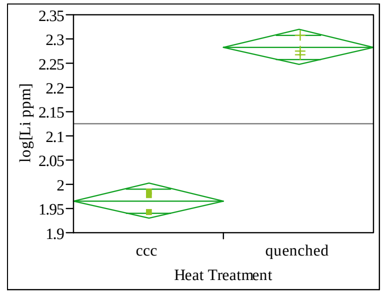
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.19658450	0.196584	526.5924	<.0001
Error	4	0.00149326	0.000373		
C. Total	5	0.19807776			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.40882	0.01116	2.3778	2.4398
quenched	3	2.77084	0.01116	2.7399	2.8018

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=FY09EM21-07



Oneway Anova
Summary of Fit

Rsquare	0.987041
Adj Rsquare	0.983801
Root Mean Square Error	0.02231
Mean of Response	2.124469
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.317951	t Ratio	17.45471
Std Err Dif	0.018216	DF	4
Upper CL Dif	0.368526	Prob > |t|	<.0001
Lower CL Dif	0.267376	Prob > t	<.0001
Confidence	0.95	Prob < t	1.0000

Analysis of Variance

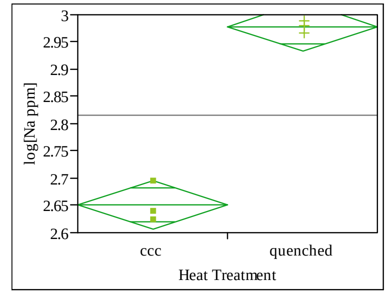
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.15163889	0.151639	304.6670	<.0001
Error	4	0.00199088	0.000498		
C. Total	5	0.15362977			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.96549	0.01288	1.9297	2.0013
quenched	3	2.28344	0.01288	2.2477	2.3192

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=FY09EM21-07



Oneway Anova
Summary of Fit

Rsquare	0.98119
Adj Rsquare	0.976488
Root Mean Square Error	0.027753
Mean of Response	2.814723
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.327327	t Ratio	14.44486
Std Err Dif	0.022660	DF	4
Upper CL Dif	0.390242	Prob > |t|	0.0001
Lower CL Dif	0.264411	Prob > t	<.0001
Confidence	0.95	Prob < t	0.9999

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.16071435	0.160714	208.6541	0.0001
Error	4	0.00308097	0.000770		
C. Total	5	0.16379532			

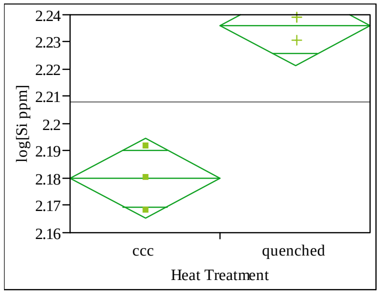
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.65106	0.01602	2.6066	2.6955
quenched	3	2.97839	0.01602	2.9339	3.0229

Std Error uses a pooled estimate of error variance

Exhibit B5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of Matrix 2 Non-Rad Glasses

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=FY09EM21-07



Oneway Anova
Summary of Fit

Rsquare	0.93433
Adj Rsquare	0.917913
Root Mean Square Error	0.009131
Mean of Response	2.207957
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.056246	t Ratio	7.543929
Std Err Dif	0.007456	DF	4
Upper CL Dif	0.076947	Prob > |t|	0.0017
Lower CL Dif	0.035546	Prob > t	0.0008
Confidence	0.95	Prob < t	0.9992

Analysis of Variance

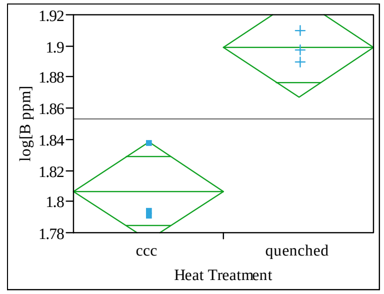
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00474546	0.004745	56.9109	0.0017
Error	4	0.00033354	0.000083		
C. Total	5	0.00507899			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.17983	0.00527	2.1652	2.1945
quenched	3	2.23608	0.00527	2.2214	2.2507

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=FY09EM21-08



Oneway Anova
Summary of Fit

Rsquare	0.890198
Adj Rsquare	0.862748
Root Mean Square Error	0.019847
Mean of Response	1.852934
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.092281	t Ratio	5.694669
Std Err Dif	0.016205	DF	4
Upper CL Dif	0.137273	Prob > |t|	0.0047
Lower CL Dif	0.047289	Prob > t	0.0023
Confidence	0.95	Prob < t	0.9977

Analysis of Variance

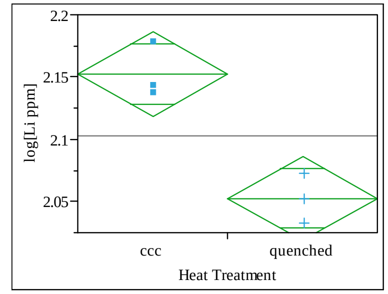
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.01277371	0.012774	32.4293	0.0047
Error	4	0.00157558	0.000394		
C. Total	5	0.01434928			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.80679	0.01146	1.7750	1.8386
quenched	3	1.89907	0.01146	1.8673	1.9309

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=FY09EM21-08



Oneway Anova
Summary of Fit

Rsquare	0.892646
Adj Rsquare	0.865807
Root Mean Square Error	0.021244
Mean of Response	2.102577
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.10003	t Ratio	-5.76713
Std Err Dif	0.01735	DF	4
Upper CL Dif	-0.05187	Prob > |t|	0.0045
Lower CL Dif	-0.14819	Prob > t	0.9978
Confidence	0.95	Prob < t	0.0022

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.01500970	0.015010	33.2598	0.0045
Error	4	0.00180515	0.000451		
C. Total	5	0.01681485			

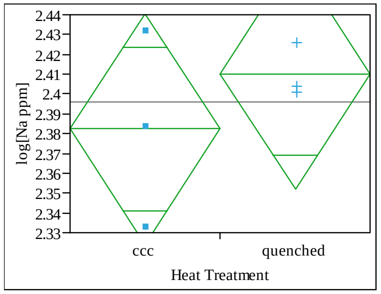
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.15259	0.01226	2.1185	2.1866
quenched	3	2.05256	0.01226	2.0185	2.0866

Std Error uses a pooled estimate of error variance

Exhibit B5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of Matrix 2 Non-Rad Glasses

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=FY09EM21-08



Oneway Anova
Summary of Fit

Rsquare	0.180462
Adj Rsquare	-0.02442
Root Mean Square Error	0.036308
Mean of Response	2.39626
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.02782	t Ratio	0.93851
Std Err Dif	0.02965	DF	4
Upper CL Dif	0.11013	Prob > |t|	0.4011
Lower CL Dif	-0.05449	Prob > t	0.2006
Confidence	0.95	Prob < t	0.7994

Analysis of Variance

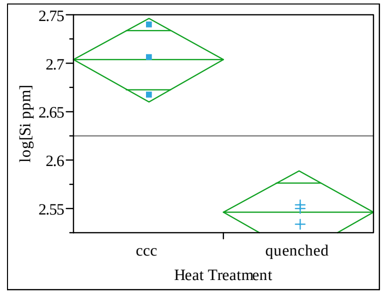
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00116115	0.001161	0.8808	0.4011
Error	4	0.00527314	0.001318		
C. Total	5	0.00643428			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.38235	0.02096	2.3241	2.4405
quenched	3	2.41017	0.02096	2.3520	2.4684

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=FY09EM21-08



Oneway Anova
Summary of Fit

Rsquare	0.92698
Adj Rsquare	0.908725
Root Mean Square Error	0.027015
Mean of Response	2.624638
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.15718	t Ratio	-7.12599
Std Err Dif	0.02206	DF	4
Upper CL Dif	-0.09594	Prob > |t|	0.0021
Lower CL Dif	-0.21842	Prob > t	0.9990
Confidence	0.95	Prob < t	0.0010

Analysis of Variance

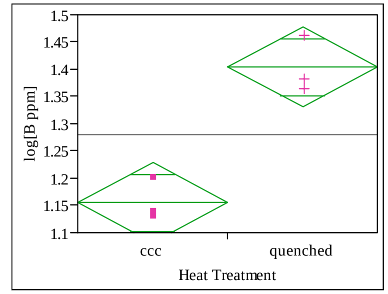
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.03705870	0.037059	50.7797	0.0021
Error	4	0.00291917	0.000730		
C. Total	5	0.03997787			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.70323	0.01560	2.6599	2.7465
quenched	3	2.54605	0.01560	2.5027	2.5894

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=FY09EM21-09



Oneway Anova
Summary of Fit

Rsquare	0.917365
Adj Rsquare	0.896707
Root Mean Square Error	0.045699
Mean of Response	1.27918
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.248644	t Ratio	6.663774
Std Err Dif	0.037313	DF	4
Upper CL Dif	0.352240	Prob > |t|	0.0026
Lower CL Dif	0.145047	Prob > t	0.0013
Confidence	0.95	Prob < t	0.9987

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.09273550	0.092735	44.4059	0.0026
Error	4	0.00835344	0.002088		
C. Total	5	0.10108894			

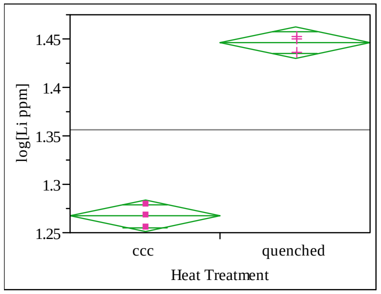
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.15486	0.02638	1.0816	1.2281
quenched	3	1.40350	0.02638	1.3302	1.4768

Std Error uses a pooled estimate of error variance

Exhibit B5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of Matrix 2 Non-Rad Glasses

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=FY09EM21-09



Oneway Anova
Summary of Fit

Rsquare	0.99144
Adj Rsquare	0.9893
Root Mean Square Error	0.010195
Mean of Response	1.356663
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.179176	t Ratio	21.52444
Std Err Dif	0.008324	DF	4
Upper CL Dif	0.202288	Prob > |t|	<.0001
Lower CL Dif	0.156064	Prob > t	<.0001
Confidence	0.95	Prob < t	1.0000

Analysis of Variance

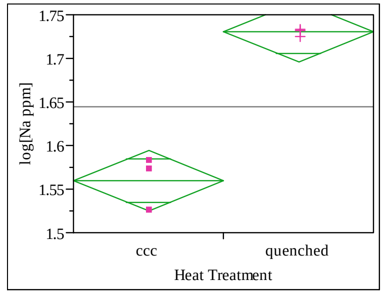
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.04815604	0.048156	463.3015	<.0001
Error	4	0.00041576	0.000104		
C. Total	5	0.04857180			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.26707	0.00589	1.2507	1.2834
quenched	3	1.44625	0.00589	1.4299	1.4626

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=FY09EM21-09



Oneway Anova
Summary of Fit

Rsquare	0.958983
Adj Rsquare	0.948729
Root Mean Square Error	0.021654
Mean of Response	1.645107
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.170980	t Ratio	9.670589
Std Err Dif	0.017680	DF	4
Upper CL Dif	0.220068	Prob > |t|	0.0006
Lower CL Dif	0.121891	Prob > t	0.0003
Confidence	0.95	Prob < t	0.9997

Analysis of Variance

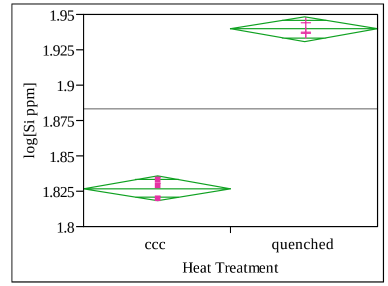
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.04385115	0.043851	93.5203	0.0006
Error	4	0.00187558	0.000469		
C. Total	5	0.04572673			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.55962	0.01250	1.5249	1.5943
quenched	3	1.73060	0.01250	1.6959	1.7653

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=FY09EM21-09



Oneway Anova
Summary of Fit

Rsquare	0.993737
Adj Rsquare	0.992172
Root Mean Square Error	0.005494
Mean of Response	1.883281
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.113023	t Ratio	25.19362
Std Err Dif	0.004486	DF	4
Upper CL Dif	0.125478	Prob > |t|	<.0001
Lower CL Dif	0.100567	Prob > t	<.0001
Confidence	0.95	Prob < t	1.0000

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.01916117	0.019161	634.7186	<.0001
Error	4	0.00012075	0.000030		
C. Total	5	0.01928193			

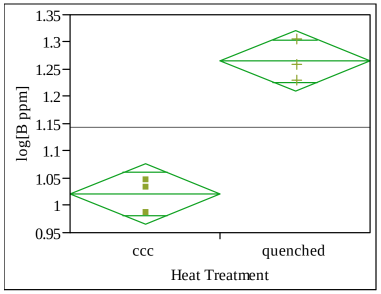
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.82677	0.00317	1.8180	1.8356
quenched	3	1.93979	0.00317	1.9310	1.9486

Std Error uses a pooled estimate of error variance

Exhibit B5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of Matrix 2 Non-Rad Glasses

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=FY09EM21-10



Oneway Anova
Summary of Fit

Rsquare	0.948479
Adj Rsquare	0.935598
Root Mean Square Error	0.034779
Mean of Response	1.142953
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.243683	t Ratio	8.581241
Std Err Dif	0.028397	DF	4
Upper CL Dif	0.322526	Prob > |t|	0.0010
Lower CL Dif	0.164840	Prob > t	0.0005
Confidence	0.95	Prob < t	0.9995

Analysis of Variance

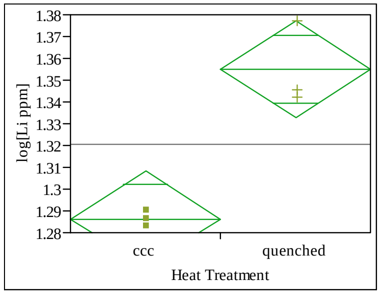
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.08907183	0.089072	73.6377	0.0010
Error	4	0.00483838	0.001210		
C. Total	5	0.09391021			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.02111	0.02008	0.9654	1.0769
quenched	3	1.26479	0.02008	1.2090	1.3205

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=FY09EM21-10



Oneway Anova
Summary of Fit

Rsquare	0.902771
Adj Rsquare	0.878464
Root Mean Square Error	0.013828
Mean of Response	1.320708
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.068807	t Ratio	6.094255
Std Err Dif	0.011290	DF	4
Upper CL Dif	0.100154	Prob > |t|	0.0037
Lower CL Dif	0.037459	Prob > t	0.0018
Confidence	0.95	Prob < t	0.9982

Analysis of Variance

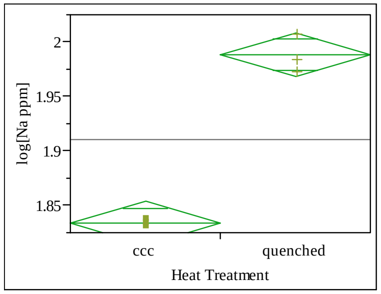
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00710153	0.007102	37.1399	0.0037
Error	4	0.00076484	0.000191		
C. Total	5	0.00786637			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.28630	0.00798	1.2641	1.3085
quenched	3	1.35511	0.00798	1.3329	1.3773

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=FY09EM21-10



Oneway Anova
Summary of Fit

Rsquare	0.982779
Adj Rsquare	0.978473
Root Mean Square Error	0.012521
Mean of Response	1.910805
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.154463	t Ratio	15.10854
Std Err Dif	0.010224	DF	4
Upper CL Dif	0.182849	Prob > |t|	0.0001
Lower CL Dif	0.126078	Prob > t	<.0001
Confidence	0.95	Prob < t	0.9999

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.03578842	0.035788	228.2680	0.0001
Error	4	0.00062713	0.000157		
C. Total	5	0.03641555			

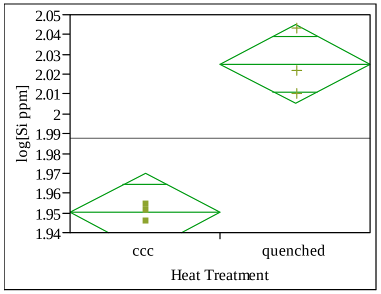
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.83357	0.00723	1.8135	1.8536
quenched	3	1.98804	0.00723	1.9680	2.0081

Std Error uses a pooled estimate of error variance

Exhibit B5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of Matrix 2 Non-Rad Glasses

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=FY09EM21-10



Oneway Anova
Summary of Fit

Rsquare	0.932165
Adj Rsquare	0.915207
Root Mean Square Error	0.012373
Mean of Response	1.987645
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.074899	t Ratio	7.413964
Std Err Dif	0.010102	DF	4
Upper CL Dif	0.102948	Prob > |t|	0.0018
Lower CL Dif	0.046850	Prob > t	0.0009
Confidence	0.95	Prob < t	0.9991

Analysis of Variance

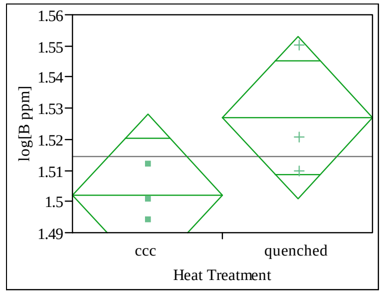
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00841479	0.008415	54.9669	0.0018
Error	4	0.00061235	0.000153		
C. Total	5	0.00902715			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.95020	0.00714	1.9304	1.9700
quenched	3	2.02509	0.00714	2.0053	2.0449

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=FY09EM21-11



Oneway Anova
Summary of Fit

Rsquare	0.468002
Adj Rsquare	0.335002
Root Mean Square Error	0.016193
Mean of Response	1.514468
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.02480	t Ratio	1.875852
Std Err Dif	0.01322	DF	4
Upper CL Dif	0.06151	Prob > |t|	0.1339
Lower CL Dif	-0.01191	Prob > t	0.0670
Confidence	0.95	Prob < t	0.9330

Analysis of Variance

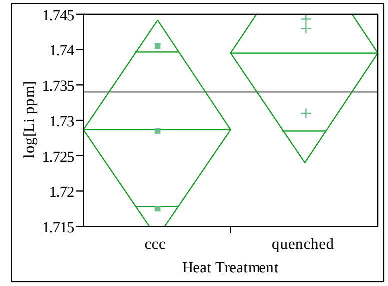
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00092267	0.000923	3.5188	0.1339
Error	4	0.00104884	0.000262		
C. Total	5	0.00197152			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.50207	0.00935	1.4761	1.5280
quenched	3	1.52687	0.00935	1.5009	1.5528

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=FY09EM21-11



Oneway Anova
Summary of Fit

Rsquare	0.318363
Adj Rsquare	0.147953
Root Mean Square Error	0.009624
Mean of Response	1.734082
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.01074	t Ratio	1.366829
Std Err Dif	0.00786	DF	4
Upper CL Dif	0.03256	Prob > |t|	0.2435
Lower CL Dif	-0.01108	Prob > t	0.1217
Confidence	0.95	Prob < t	0.8783

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00017304	0.000173	1.8682	0.2435
Error	4	0.00037049	0.000093		
C. Total	5	0.00054352			

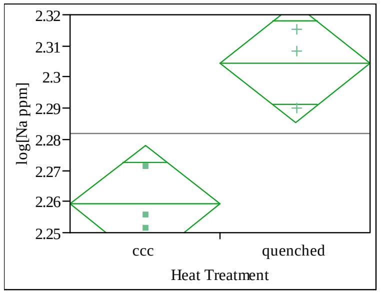
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.72871	0.00556	1.7133	1.7441
quenched	3	1.73945	0.00556	1.7240	1.7549

Std Error uses a pooled estimate of error variance

Exhibit B5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of Matrix 2 Non-Rad Glasses

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=FY09EM21-11



Oneway Anova
Summary of Fit

Rsquare	0.846451
Adj Rsquare	0.808063
Root Mean Square Error	0.011819
Mean of Response	2.281856
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.045314	t Ratio	4.69577
Std Err Dif	0.009650	DF	4
Upper CL Dif	0.072106	Prob > |t|	0.0093
Lower CL Dif	0.018521	Prob > t	0.0047
Confidence	0.95	Prob < t	0.9953

Analysis of Variance

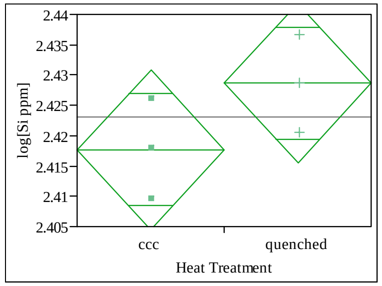
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00308003	0.003080	22.0503	0.0093
Error	4	0.00055873	0.000140		
C. Total	5	0.00363876			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.25920	0.00682	2.2403	2.2781
quenched	3	2.30451	0.00682	2.2856	2.3235

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=FY09EM21-11



Oneway Anova
Summary of Fit

Rsquare	0.399961
Adj Rsquare	0.249952
Root Mean Square Error	0.008197
Mean of Response	2.423169
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.01093	t Ratio	1.632861
Std Err Dif	0.00669	DF	4
Upper CL Dif	0.02951	Prob > |t|	0.1778
Lower CL Dif	-0.00765	Prob > t	0.0889
Confidence	0.95	Prob < t	0.9111

Analysis of Variance

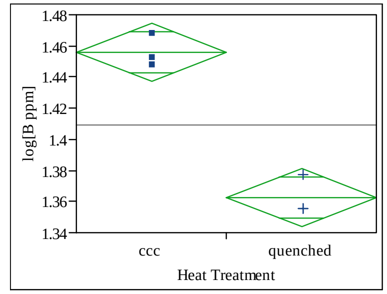
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00017916	0.000179	2.6662	0.1778
Error	4	0.00026878	0.000067		
C. Total	5	0.00044794			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.41770	0.00473	2.4046	2.4308
quenched	3	2.42863	0.00473	2.4155	2.4418

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=FY09EM21-12



Oneway Anova
Summary of Fit

Rsquare	0.960196
Adj Rsquare	0.950246
Root Mean Square Error	0.011589
Mean of Response	1.409138
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.09295	t Ratio	-9.82312
Std Err Dif	0.00946	DF	4
Upper CL Dif	-0.06668	Prob > |t|	0.0006
Lower CL Dif	-0.11922	Prob > t	0.9997
Confidence	0.95	Prob < t	0.0003

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.01296021	0.012960	96.4936	0.0006
Error	4	0.00053725	0.000134		
C. Total	5	0.01349745			

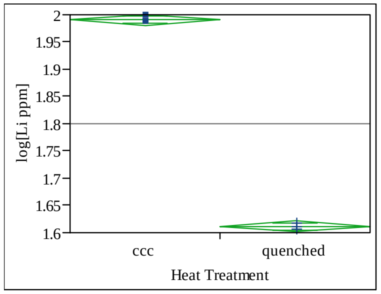
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.45561	0.00669	1.4370	1.4742
quenched	3	1.36266	0.00669	1.3441	1.3812

Std Error uses a pooled estimate of error variance

Exhibit B5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of Matrix 2 Non-Rad Glasses

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=FY09EM21-12



Oneway Anova
Summary of Fit

Rsquare	0.999334
Adj Rsquare	0.999168
Root Mean Square Error	0.005988
Mean of Response	1.801027
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.37889	t Ratio	-77.4907
Std Err Dif	0.00489	DF	4
Upper CL Dif	-0.36531	Prob > |t|	<.0001
Lower CL Dif	-0.39246	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

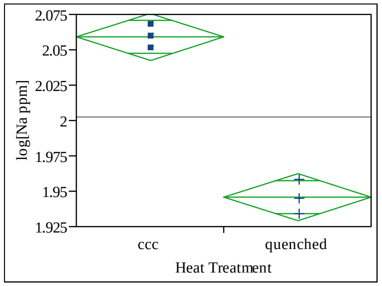
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.21533152	0.215332	6004.807	<.0001
Error	4	0.00014344	0.000036		
C. Total	5	0.21547496			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.99047	0.00346	1.9809	2.0001
quenched	3	1.61158	0.00346	1.6020	1.6212

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=FY09EM21-12



Oneway Anova
Summary of Fit

Rsquare	0.978186
Adj Rsquare	0.972732
Root Mean Square Error	0.010348
Mean of Response	2.002602
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.11315	t Ratio	-13.3927
Std Err Dif	0.00845	DF	4
Upper CL Dif	-0.08970	Prob > |t|	0.0002
Lower CL Dif	-0.13661	Prob > t	0.9999
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

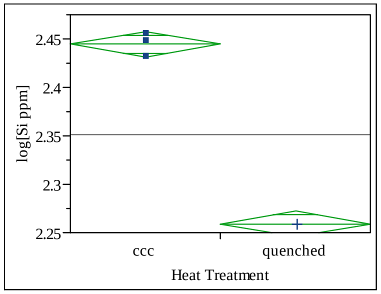
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.01920602	0.019206	179.3652	0.0002
Error	4	0.00042831	0.000107		
C. Total	5	0.01963433			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.05918	0.00597	2.0426	2.0758
quenched	3	1.94602	0.00597	1.9294	1.9626

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=FY09EM21-12



Oneway Anova
Summary of Fit

Rsquare	0.994458
Adj Rsquare	0.993073
Root Mean Square Error	0.008465
Mean of Response	2.351874
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.18518	t Ratio	-26.792
Std Err Dif	0.00691	DF	4
Upper CL Dif	-0.16599	Prob > |t|	<.0001
Lower CL Dif	-0.20437	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.05143762	0.051438	717.8109	<.0001
Error	4	0.00028664	0.000072		
C. Total	5	0.05172425			

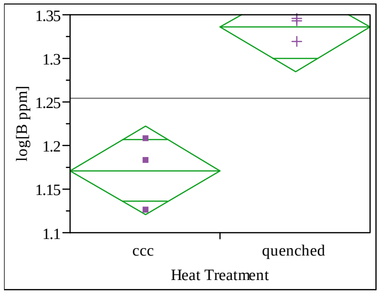
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.44446	0.00489	2.4309	2.4580
quenched	3	2.25928	0.00489	2.2457	2.2729

Std Error uses a pooled estimate of error variance

Exhibit B5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of Matrix 2 Non-Rad Glasses

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=FY09EM21-13



Oneway Anova
Summary of Fit

Rsquare	0.910338
Adj Rsquare	0.887922
Root Mean Square Error	0.031571
Mean of Response	1.253499
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.164275	t Ratio	6.372751
Std Err Dif	0.025778	DF	4
Upper CL Dif	0.235845	Prob > |t|	0.0031
Lower CL Dif	0.092704	Prob > t	0.0016
Confidence	0.95	Prob < t	0.9984

Analysis of Variance

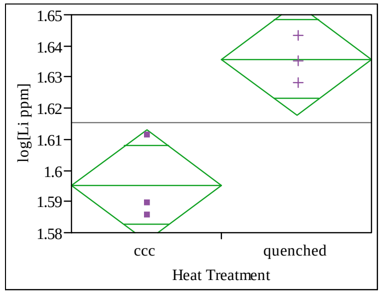
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.04047930	0.040479	40.6120	0.0031
Error	4	0.00398693	0.000997		
C. Total	5	0.04446623			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.17136	0.01823	1.1208	1.2220
quenched	3	1.33564	0.01823	1.2850	1.3862

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=FY09EM21-13



Oneway Anova
Summary of Fit

Rsquare	0.832139
Adj Rsquare	0.790174
Root Mean Square Error	0.011122
Mean of Response	1.615454
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.040437	t Ratio	4.453006
Std Err Dif	0.009081	DF	4
Upper CL Dif	0.065649	Prob > |t|	0.0112
Lower CL Dif	0.015224	Prob > t	0.0056
Confidence	0.95	Prob < t	0.9944

Analysis of Variance

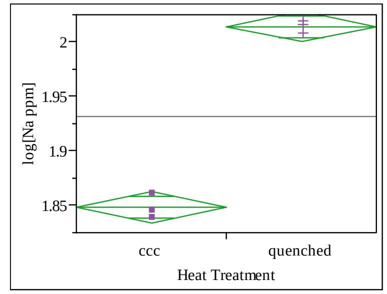
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00245268	0.002453	19.8293	0.0112
Error	4	0.00049476	0.000124		
C. Total	5	0.00294744			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.59524	0.00642	1.5774	1.6131
quenched	3	1.63567	0.00642	1.6178	1.6535

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=FY09EM21-13



Oneway Anova
Summary of Fit

Rsquare	0.992557
Adj Rsquare	0.990696
Root Mean Square Error	0.008809
Mean of Response	1.931164
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.166120	t Ratio	23.09538
Std Err Dif	0.007193	DF	4
Upper CL Dif	0.186090	Prob > |t|	<.0001
Lower CL Dif	0.146150	Prob > t	<.0001
Confidence	0.95	Prob < t	1.0000

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.04139382	0.041394	533.3968	<.0001
Error	4	0.00031042	0.000078		
C. Total	5	0.04170424			

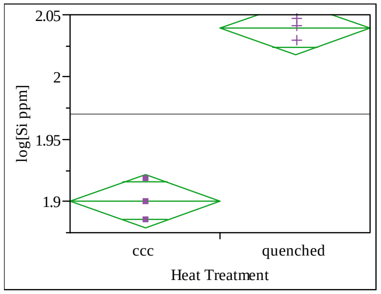
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.84810	0.00509	1.8340	1.8622
quenched	3	2.01422	0.00509	2.0001	2.0283

Std Error uses a pooled estimate of error variance

Exhibit B5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of Matrix 2 Non-Rad Glasses

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=FY09EM21-13



Oneway Anova
Summary of Fit

Rsquare	0.97653
Adj Rsquare	0.970662
Root Mean Square Error	0.013165
Mean of Response	1.969808
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.138670	t Ratio	12.90078
Std Err Dif	0.010749	DF	4
Upper CL Dif	0.168513	Prob > |t|	0.0002
Lower CL Dif	0.108826	Prob > t	0.0001
Confidence	0.95	Prob < t	0.9999

Analysis of Variance

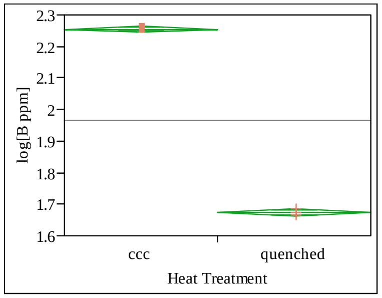
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.02884391	0.028844	166.4302	0.0002
Error	4	0.00069324	0.000173		
C. Total	5	0.02953715			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.90047	0.00760	1.8794	1.9216
quenched	3	2.03914	0.00760	2.0180	2.0602

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=FY09EM21-14



Oneway Anova
Summary of Fit

Rsquare	0.999639
Adj Rsquare	0.999548
Root Mean Square Error	0.006759
Mean of Response	1.964938
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.58066	t Ratio	-105.215
Std Err Dif	0.00552	DF	4
Upper CL Dif	-0.56534	Prob > |t|	<.0001
Lower CL Dif	-0.59598	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

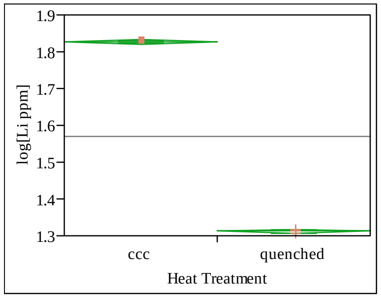
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.50575063	0.505751	11070.17	<.0001
Error	4	0.00018274	0.000046		
C. Total	5	0.50593338			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.25527	0.00390	2.2444	2.2661
quenched	3	1.67461	0.00390	1.6638	1.6854

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=FY09EM21-14



Oneway Anova
Summary of Fit

Rsquare	0.999868
Adj Rsquare	0.999835
Root Mean Square Error	0.003629
Mean of Response	1.569452
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.51540	t Ratio	-173.955
Std Err Dif	0.00296	DF	4
Upper CL Dif	-0.50717	Prob > |t|	<.0001
Lower CL Dif	-0.52362	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.39845395	0.398454	30260.21	<.0001
Error	4	0.00005267	0.000013		
C. Total	5	0.39850662			

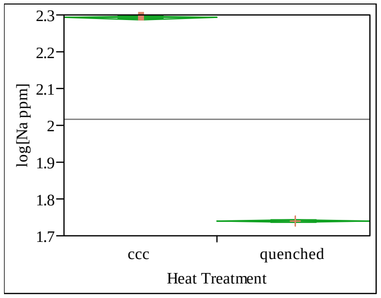
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.82715	0.00210	1.8213	1.8330
quenched	3	1.31175	0.00210	1.3059	1.3176

Std Error uses a pooled estimate of error variance

Exhibit B5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of Matrix 2 Non-Rad Glasses

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=FY09EM21-14



Oneway Anova
Summary of Fit

Rsquare	0.999919
Adj Rsquare	0.999898
Root Mean Square Error	0.003053
Mean of Response	2.016215
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.55256	t Ratio	-221.671
Std Err Dif	0.00249	DF	4
Upper CL Dif	-0.54564	Prob > |t|	<.0001
Lower CL Dif	-0.55949	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

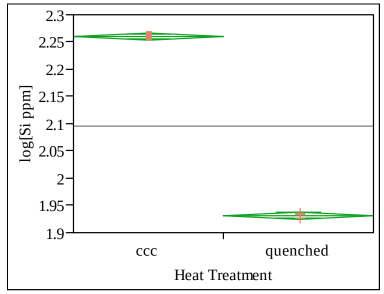
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.45799207	0.457992	49138.12	<.0001
Error	4	0.00003728	9.321e-6		
C. Total	5	0.45802935			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.29250	0.00176	2.2876	2.2974
quenched	3	1.73993	0.00176	1.7350	1.7448

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=FY09EM21-14



Oneway Anova
Summary of Fit

Rsquare	0.999552
Adj Rsquare	0.999439
Root Mean Square Error	0.004245
Mean of Response	2.095616
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.32731	t Ratio	-94.427
Std Err Dif	0.00347	DF	4
Upper CL Dif	-0.31769	Prob > |t|	<.0001
Lower CL Dif	-0.33694	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

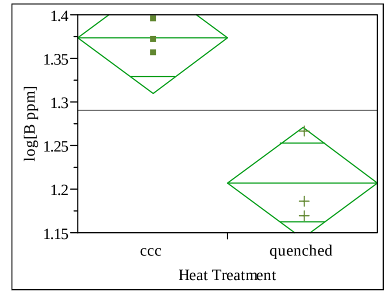
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.16070011	0.160700	8916.462	<.0001
Error	4	0.00007209	0.000018		
C. Total	5	0.16077220			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.25927	0.00245	2.2525	2.2661
quenched	3	1.93196	0.00245	1.9252	1.9388

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=FY09EM21-15



Oneway Anova
Summary of Fit

Rsquare	0.86799
Adj Rsquare	0.834988
Root Mean Square Error	0.039794
Mean of Response	1.290524
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.16663	t Ratio	-5.12843
Std Err Dif	0.03249	DF	4
Upper CL Dif	-0.07642	Prob > |t|	0.0068
Lower CL Dif	-0.25684	Prob > t	0.9966
Confidence	0.95	Prob < t	0.0034

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.04164837	0.041648	26.3008	0.0068
Error	4	0.00633416	0.001584		
C. Total	5	0.04798254			

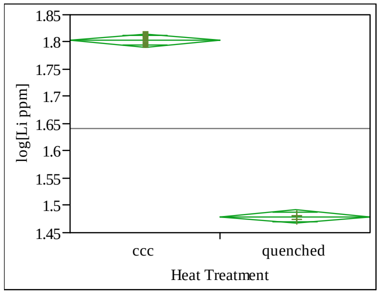
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.37384	0.02297	1.3101	1.4376
quenched	3	1.20721	0.02297	1.1434	1.2710

Std Error uses a pooled estimate of error variance

Exhibit B5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of Matrix 2 Non-Rad Glasses

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=FY09EM21-15



Oneway Anova
Summary of Fit

Rsquare	0.998437
Adj Rsquare	0.998046
Root Mean Square Error	0.007831
Mean of Response	1.641112
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.32318	t Ratio	-50.5424
Std Err Dif	0.00639	DF	4
Upper CL Dif	-0.30543	Prob > |t|	<.0001
Lower CL Dif	-0.34093	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

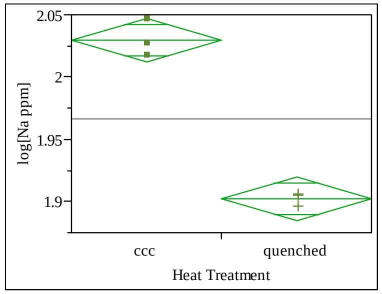
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.15666691	0.156667	2554.536	<.0001
Error	4	0.00024532	0.000061		
C. Total	5	0.15691222			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.80270	0.00452	1.7901	1.8153
quenched	3	1.47952	0.00452	1.4670	1.4921

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=FY09EM21-15



Oneway Anova
Summary of Fit

Rsquare	0.980495
Adj Rsquare	0.975619
Root Mean Square Error	0.011006
Mean of Response	1.966189
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.12743	t Ratio	-14.1802
Std Err Dif	0.00899	DF	4
Upper CL Dif	-0.10248	Prob > |t|	0.0001
Lower CL Dif	-0.15237	Prob > t	0.9999
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

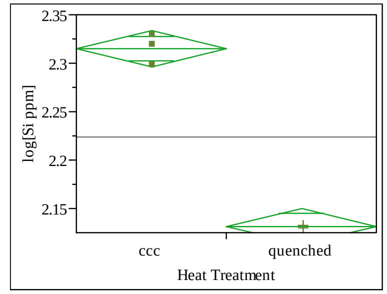
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.02435580	0.024356	201.0780	0.0001
Error	4	0.00048450	0.000121		
C. Total	5	0.02484030			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.02990	0.00635	2.0123	2.0475
quenched	3	1.90248	0.00635	1.8848	1.9201

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=FY09EM21-15



Oneway Anova
Summary of Fit

Rsquare	0.989728
Adj Rsquare	0.98716
Root Mean Square Error	0.011447
Mean of Response	2.223335
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.18349	t Ratio	-19.6317
Std Err Dif	0.00935	DF	4
Upper CL Dif	-0.15754	Prob > |t|	<.0001
Lower CL Dif	-0.20944	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.05050232	0.050502	385.4023	<.0001
Error	4	0.00052415	0.000131		
C. Total	5	0.05102647			

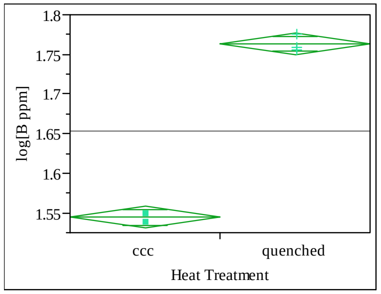
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.31508	0.00661	2.2967	2.3334
quenched	3	2.13159	0.00661	2.1132	2.1499

Std Error uses a pooled estimate of error variance

Exhibit B5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of Matrix 2 Non-Rad Glasses

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=FY09EM21-16



Oneway Anova
Summary of Fit

Rsquare	0.99576
Adj Rsquare	0.9947
Root Mean Square Error	0.008736
Mean of Response	1.654042
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.218609	t Ratio	30.64908
Std Err Dif	0.007133	DF	4
Upper CL Dif	0.238412	Prob > |t|	<.0001
Lower CL Dif	0.198805	Prob > t	<.0001
Confidence	0.95	Prob < t	1.0000

Analysis of Variance

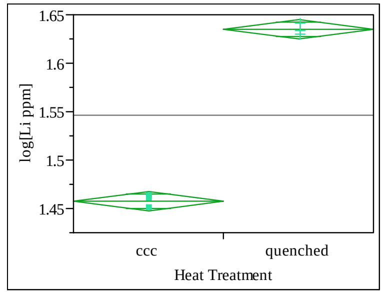
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.07168452	0.071685	939.3661	<.0001
Error	4	0.00030525	0.000076		
C. Total	5	0.07198976			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.54474	0.00504	1.5307	1.5587
quenched	3	1.76335	0.00504	1.7493	1.7773

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=FY09EM21-16



Oneway Anova
Summary of Fit

Rsquare	0.996581
Adj Rsquare	0.995726
Root Mean Square Error	0.006377
Mean of Response	1.54624
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.177778	t Ratio	34.14349
Std Err Dif	0.005207	DF	4
Upper CL Dif	0.192234	Prob > |t|	<.0001
Lower CL Dif	0.163321	Prob > t	<.0001
Confidence	0.95	Prob < t	1.0000

Analysis of Variance

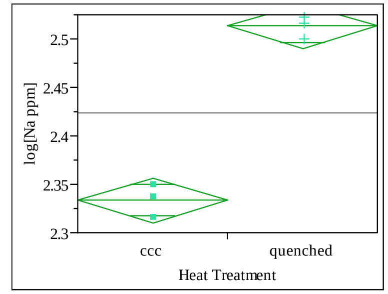
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.04740741	0.047407	1165.778	<.0001
Error	4	0.00016266	0.000041		
C. Total	5	0.04757008			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.45735	0.00368	1.4471	1.4676
quenched	3	1.63513	0.00368	1.6249	1.6454

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=FY09EM21-16



Oneway Anova
Summary of Fit

Rsquare	0.983028
Adj Rsquare	0.978786
Root Mean Square Error	0.014477
Mean of Response	2.423311
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.179927	t Ratio	15.22132
Std Err Dif	0.011821	DF	4
Upper CL Dif	0.212746	Prob > |t|	0.0001
Lower CL Dif	0.147107	Prob > t	<.0001
Confidence	0.95	Prob < t	0.9999

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.04856041	0.048560	231.6885	0.0001
Error	4	0.00083837	0.000210		
C. Total	5	0.04939878			

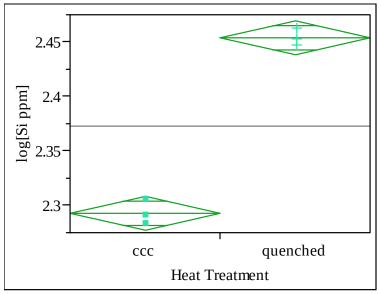
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.33335	0.00836	2.3101	2.3566
quenched	3	2.51327	0.00836	2.4901	2.5365

Std Error uses a pooled estimate of error variance

Exhibit B5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of Matrix 2 Non-Rad Glasses

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=FY09EM21-16



Oneway Anova
Summary of Fit

Rsquare	0.990572
Adj Rsquare	0.988215
Root Mean Square Error	0.009651
Mean of Response	2.373187
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.161546	t Ratio	20.50018
Std Err Dif	0.007880	DF	4
Upper CL Dif	0.183425	Prob > |t|	<.0001
Lower CL Dif	0.139667	Prob > t	<.0001
Confidence	0.95	Prob < t	1.0000

Analysis of Variance

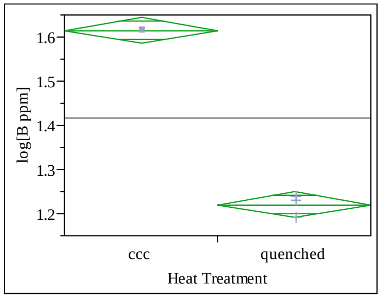
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.03914573	0.039146	420.2574	<.0001
Error	4	0.00037259	0.000093		
C. Total	5	0.03951831			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.29241	0.00557	2.2769	2.3079
quenched	3	2.45396	0.00557	2.4385	2.4694

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=FY09EM21-17



Oneway Anova
Summary of Fit

Rsquare	0.994495
Adj Rsquare	0.993118
Root Mean Square Error	0.017967
Mean of Response	1.417381
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.39435	t Ratio	-26.8806
Std Err Dif	0.01467	DF	4
Upper CL Dif	-0.35362	Prob > |t|	<.0001
Lower CL Dif	-0.43508	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

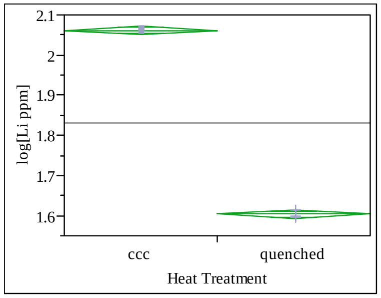
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.23326451	0.233265	722.5644	<.0001
Error	4	0.00129131	0.000323		
C. Total	5	0.23455582			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.61455	0.01037	1.5858	1.6434
quenched	3	1.22021	0.01037	1.1914	1.2490

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=FY09EM21-17



Oneway Anova
Summary of Fit

Rsquare	0.999383
Adj Rsquare	0.999229
Root Mean Square Error	0.006959
Mean of Response	1.832463
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.45732	t Ratio	-80.4828
Std Err Dif	0.00568	DF	4
Upper CL Dif	-0.44154	Prob > |t|	<.0001
Lower CL Dif	-0.47309	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.31370619	0.313706	6477.476	<.0001
Error	4	0.00019372	0.000048		
C. Total	5	0.31389991			

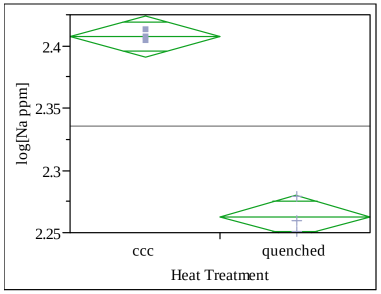
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.06112	0.00402	2.0500	2.0723
quenched	3	1.60381	0.00402	1.5926	1.6150

Std Error uses a pooled estimate of error variance

Exhibit B5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of Matrix 2 Non-Rad Glasses

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=FY09EM21-17



Oneway Anova
Summary of Fit

Rsquare	0.986192
Adj Rsquare	0.98274
Root Mean Square Error	0.010462
Mean of Response	2.335288
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.14438	t Ratio	-16.9022
Std Err Dif	0.00854	DF	4
Upper CL Dif	-0.12067	Prob > |t|	<.0001
Lower CL Dif	-0.16810	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

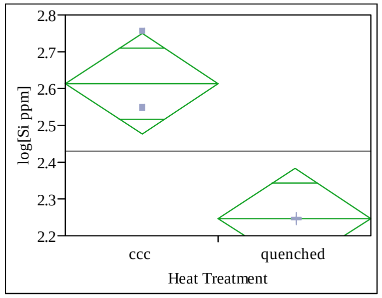
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.03127005	0.031270	285.6860	<.0001
Error	4	0.00043782	0.000109		
C. Total	5	0.03170787			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.40748	0.00604	2.3907	2.4243
quenched	3	2.26310	0.00604	2.2463	2.2799

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=FY09EM21-17



Oneway Anova
Summary of Fit

Rsquare	0.873388
Adj Rsquare	0.841734
Root Mean Square Error	0.085494
Mean of Response	2.430489
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.36668	t Ratio	-5.25285
Std Err Dif	0.06981	DF	4
Upper CL Dif	-0.17287	Prob > |t|	0.0063
Lower CL Dif	-0.56049	Prob > t	0.9969
Confidence	0.95	Prob < t	0.0031

Analysis of Variance

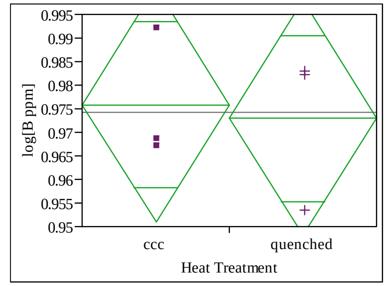
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.20167720	0.201677	27.5925	0.0063
Error	4	0.02923656	0.007309		
C. Total	5	0.23091376			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.61383	0.04936	2.4768	2.7509
quenched	3	2.24715	0.04936	2.1101	2.3842

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=FY09EM21-18



Oneway Anova
Summary of Fit

Rsquare	0.01275
Adj Rsquare	-0.23406
Root Mean Square Error	0.015514
Mean of Response	0.974359
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.00288	t Ratio	-0.22729
Std Err Dif	0.01267	DF	4
Upper CL Dif	0.03229	Prob > |t|	0.8313
Lower CL Dif	-0.03805	Prob > t	0.5843
Confidence	0.95	Prob < t	0.4157

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00001243	0.000012	0.0517	0.8313
Error	4	0.00096272	0.000241		
C. Total	5	0.00097516			

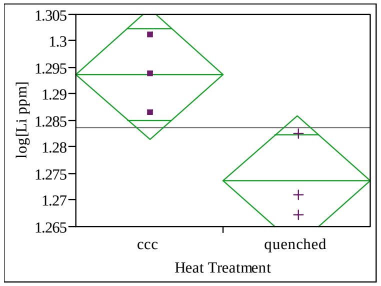
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	0.975799	0.00896	0.95093	1.0007
quenched	3	0.972920	0.00896	0.94805	0.9978

Std Error uses a pooled estimate of error variance

Exhibit B5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of Matrix 2 Non-Rad Glasses

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=FY09EM21-18



Oneway Anova
Summary of Fit

Rsquare	0.719456
Adj Rsquare	0.64932
Root Mean Square Error	0.007684
Mean of Response	1.283651
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.02009	t Ratio	-3.20281
Std Err Dif	0.00627	DF	4
Upper CL Dif	-0.00267	Prob > |t|	0.0328
Lower CL Dif	-0.03751	Prob > t	0.9836
Confidence	0.95	Prob < t	0.0164

Analysis of Variance

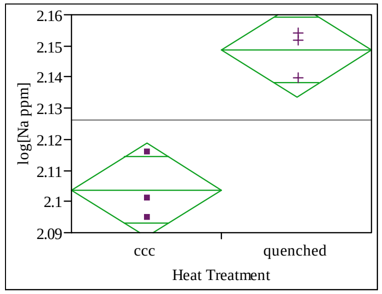
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00060566	0.000606	10.2580	0.0328
Error	4	0.00023617	0.000059		
C. Total	5	0.00084183			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.29370	0.00444	1.2814	1.3060
quenched	3	1.27360	0.00444	1.2613	1.2859

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=FY09EM21-18



Oneway Anova
Summary of Fit

Rsquare	0.896089
Adj Rsquare	0.870112
Root Mean Square Error	0.009373
Mean of Response	2.126196
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.044946	t Ratio	5.873207
Std Err Dif	0.007653	DF	4
Upper CL Dif	0.066193	Prob > |t|	0.0042
Lower CL Dif	0.023699	Prob > t	0.0021
Confidence	0.95	Prob < t	0.9979

Analysis of Variance

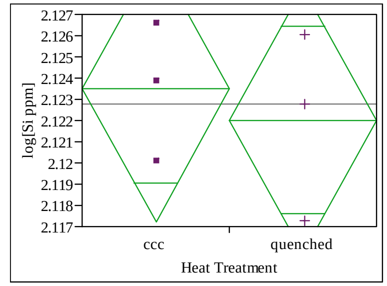
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00303018	0.003030	34.4946	0.0042
Error	4	0.00035138	0.000088		
C. Total	5	0.00338156			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.10372	0.00541	2.0887	2.1187
quenched	3	2.14867	0.00541	2.1336	2.1637

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=FY09EM21-18



Oneway Anova
Summary of Fit

Rsquare	0.050138
Adj Rsquare	-0.18733
Root Mean Square Error	0.003896
Mean of Response	2.122758
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.00146	t Ratio	-0.4595
Std Err Dif	0.00318	DF	4
Upper CL Dif	0.00737	Prob > |t|	0.6697
Lower CL Dif	-0.01029	Prob > t	0.6651
Confidence	0.95	Prob < t	0.3349

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00000320	3.205e-6	0.2111	0.6697
Error	4	0.00006071	0.000015		
C. Total	5	0.00006392			

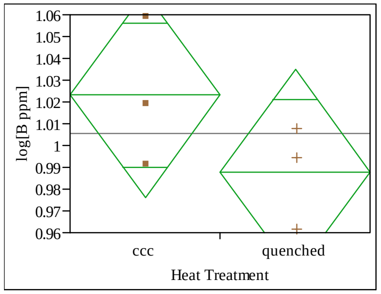
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.12349	0.00225	2.1172	2.1297
quenched	3	2.12203	0.00225	2.1158	2.1283

Std Error uses a pooled estimate of error variance

Exhibit B5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of Matrix 2 Non-Rad Glasses

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=FY09EM21-19



Oneway Anova
Summary of Fit

Rsquare	0.350608
Adj Rsquare	0.18826
Root Mean Square Error	0.029354
Mean of Response	1.005447
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.03522	t Ratio	-1.46956
Std Err Dif	0.02397	DF	4
Upper CL Dif	0.03132	Prob > |t|	0.2156
Lower CL Dif	-0.10177	Prob > t	0.8922
Confidence	0.95	Prob < t	0.1078

Analysis of Variance

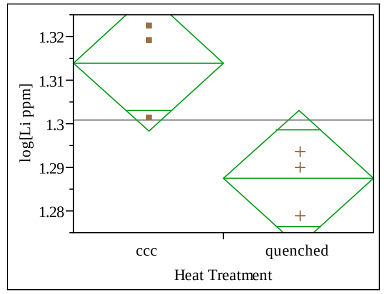
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00186090	0.001861	2.1596	0.2156
Error	4	0.00344672	0.000862		
C. Total	5	0.00530762			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.02306	0.01695	0.97600	1.0701
quenched	3	0.98784	0.01695	0.94078	1.0349

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=FY09EM21-19



Oneway Anova
Summary of Fit

Rsquare	0.734751
Adj Rsquare	0.668439
Root Mean Square Error	0.009749
Mean of Response	1.300763
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.02650	t Ratio	-3.32869
Std Err Dif	0.00796	DF	4
Upper CL Dif	-0.00440	Prob > |t|	0.0291
Lower CL Dif	-0.04860	Prob > t	0.9854
Confidence	0.95	Prob < t	0.0146

Analysis of Variance

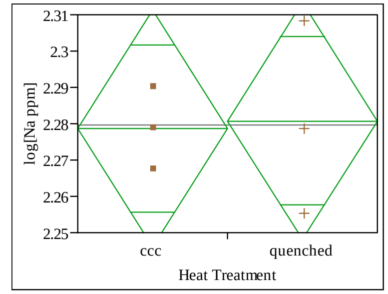
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00105309	0.001053	11.0802	0.0291
Error	4	0.00038017	0.000095		
C. Total	5	0.00143326			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.31401	0.00563	1.2984	1.3296
quenched	3	1.28752	0.00563	1.2719	1.3031

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=FY09EM21-19



Oneway Anova
Summary of Fit

Rsquare	0.003918
Adj Rsquare	-0.2451
Root Mean Square Error	0.020423
Mean of Response	2.279708
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.00209	t Ratio	0.125428
Std Err Dif	0.01668	DF	4
Upper CL Dif	0.04839	Prob > |t|	0.9062
Lower CL Dif	-0.04421	Prob > t	0.4531
Confidence	0.95	Prob < t	0.5469

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00000656	6.562e-6	0.0157	0.9062
Error	4	0.00166843	0.000417		
C. Total	5	0.00167499			

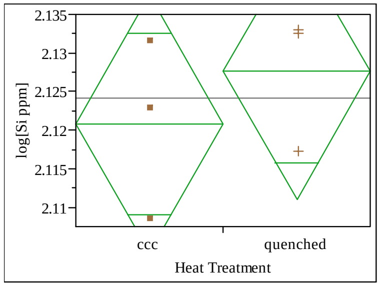
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.27866	0.01179	2.2459	2.3114
quenched	3	2.28075	0.01179	2.2480	2.3135

Std Error uses a pooled estimate of error variance

Exhibit B5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of Matrix 2 Non-Rad Glasses

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=FY09EM21-19



Oneway Anova
Summary of Fit

Rsquare	0.136743
Adj Rsquare	-0.07907
Root Mean Square Error	0.010383
Mean of Response	2.124218
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.00675	t Ratio	0.795999
Std Err Dif	0.00848	DF	4
Upper CL Dif	0.03029	Prob > |t|	0.4706
Lower CL Dif	-0.01679	Prob > t	0.2353
Confidence	0.95	Prob < t	0.7647

Analysis of Variance

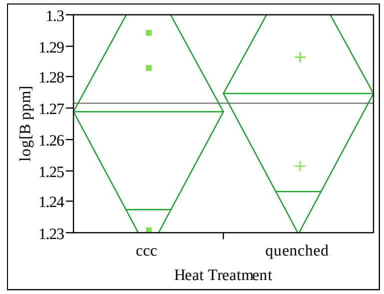
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00006831	0.000068	0.6336	0.4706
Error	4	0.00043123	0.000108		
C. Total	5	0.00049954			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.12084	0.00599	2.1042	2.1375
quenched	3	2.12759	0.00599	2.1109	2.1442

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=FY09EM21-20



Oneway Anova
Summary of Fit

Rsquare	0.015506
Adj Rsquare	-0.23062
Root Mean Square Error	0.027845
Mean of Response	1.271771
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.00571	t Ratio	0.250999
Std Err Dif	0.02274	DF	4
Upper CL Dif	0.06883	Prob > |t|	0.8142
Lower CL Dif	-0.05742	Prob > t	0.4071
Confidence	0.95	Prob < t	0.5929

Analysis of Variance

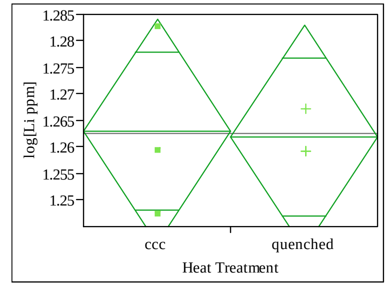
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00004885	0.000049	0.0630	0.8142
Error	4	0.00310141	0.000775		
C. Total	5	0.00315026			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.26892	0.01608	1.2243	1.3136
quenched	3	1.27462	0.01608	1.2300	1.3193

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=FY09EM21-20



Oneway Anova
Summary of Fit

Rsquare	0.002557
Adj Rsquare	-0.2468
Root Mean Square Error	0.01312
Mean of Response	1.262458
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.00108	t Ratio	-0.10126
Std Err Dif	0.01071	DF	4
Upper CL Dif	0.02866	Prob > |t|	0.9242
Lower CL Dif	-0.03083	Prob > t	0.5379
Confidence	0.95	Prob < t	0.4621

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00000177	1.765e-6	0.0103	0.9242
Error	4	0.00068859	0.000172		
C. Total	5	0.00069035			

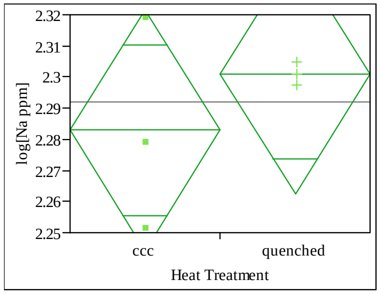
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.26300	0.00758	1.2420	1.2840
quenched	3	1.26192	0.00758	1.2409	1.2829

Std Error uses a pooled estimate of error variance

Exhibit B5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of Matrix 2 Non-Rad Glasses

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=FY09EM21-20



Oneway Anova
Summary of Fit

Rsquare	0.174125
Adj Rsquare	-0.03234
Root Mean Square Error	0.024146
Mean of Response	2.291976
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.01810	t Ratio	0.918339
Std Err Dif	0.01971	DF	4
Upper CL Dif	0.07284	Prob > |t|	0.4104
Lower CL Dif	-0.03663	Prob > t	0.2052
Confidence	0.95	Prob < t	0.7948

Analysis of Variance

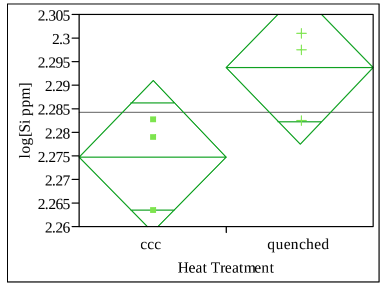
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00049169	0.000492	0.8433	0.4104
Error	4	0.00233207	0.000583		
C. Total	5	0.00282375			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.28292	0.01394	2.2442	2.3216
quenched	3	2.30103	0.01394	2.2623	2.3397

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=FY09EM21-20



Oneway Anova
Summary of Fit

Rsquare	0.569612
Adj Rsquare	0.462015
Root Mean Square Error	0.010013
Mean of Response	2.284261
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.01881	t Ratio	2.300856
Std Err Dif	0.00818	DF	4
Upper CL Dif	0.04151	Prob > |t|	0.0829
Lower CL Dif	-0.00389	Prob > t	0.0414
Confidence	0.95	Prob < t	0.9586

Analysis of Variance

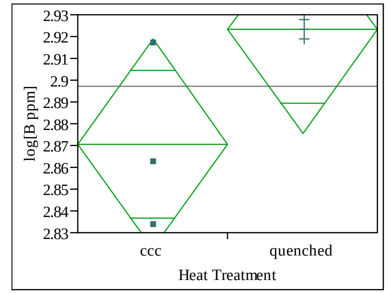
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00053074	0.000531	5.2939	0.0829
Error	4	0.00040101	0.000100		
C. Total	5	0.00093175			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.27486	0.00578	2.2588	2.2909
quenched	3	2.29367	0.00578	2.2776	2.3097

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=FY09EM21-21



Oneway Anova
Summary of Fit

Rsquare	0.537093
Adj Rsquare	0.421366
Root Mean Square Error	0.029913
Mean of Response	2.897103
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.05262	t Ratio	2.154309
Std Err Dif	0.02442	DF	4
Upper CL Dif	0.12043	Prob > |t|	0.0975
Lower CL Dif	-0.01520	Prob > t	0.0488
Confidence	0.95	Prob < t	0.9512

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00415283	0.004153	4.6410	0.0975
Error	4	0.00357922	0.000895		
C. Total	5	0.00773204			

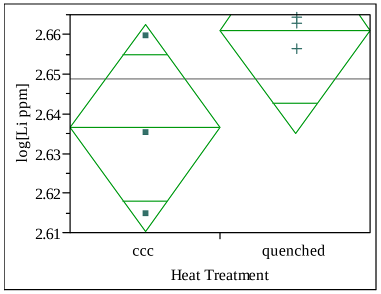
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.87079	0.01727	2.8228	2.9187
quenched	3	2.92341	0.01727	2.8755	2.9714

Std Error uses a pooled estimate of error variance

Exhibit B5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of Matrix 2 Non-Rad Glasses

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=FY09EM21-21



Oneway Anova
Summary of Fit

Rsquare	0.465844
Adj Rsquare	0.332305
Root Mean Square Error	0.016221
Mean of Response	2.648808
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.02474	t Ratio	1.867738
Std Err Dif	0.01324	DF	4
Upper CL Dif	0.06151	Prob > |t|	0.1352
Lower CL Dif	-0.01204	Prob > t	0.0676
Confidence	0.95	Prob < t	0.9324

Analysis of Variance

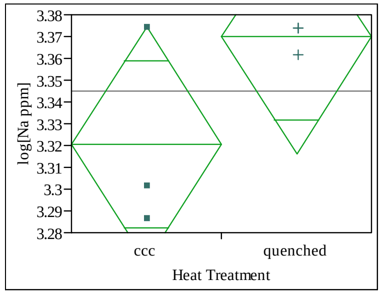
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00091787	0.000918	3.4884	0.1352
Error	4	0.00105246	0.000263		
C. Total	5	0.00197033			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.63644	0.00937	2.6104	2.6624
quenched	3	2.66118	0.00937	2.6352	2.6872

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=FY09EM21-21



Oneway Anova
Summary of Fit

Rsquare	0.448134
Adj Rsquare	0.310167
Root Mean Square Error	0.033645
Mean of Response	3.345255
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.04951	t Ratio	1.802258
Std Err Dif	0.02747	DF	4
Upper CL Dif	0.12578	Prob > |t|	0.1459
Lower CL Dif	-0.02676	Prob > t	0.0729
Confidence	0.95	Prob < t	0.9271

Analysis of Variance

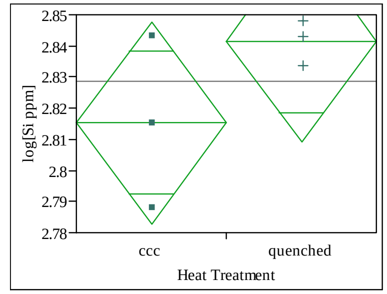
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00367677	0.003677	3.2481	0.1459
Error	4	0.00452786	0.001132		
C. Total	5	0.00820463			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	3.32050	0.01942	3.2666	3.3744
quenched	3	3.37001	0.01942	3.3161	3.4239

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=FY09EM21-21



Oneway Anova
Summary of Fit

Rsquare	0.387596
Adj Rsquare	0.234495
Root Mean Square Error	0.020252
Mean of Response	2.828449
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.02631	t Ratio	1.591112
Std Err Dif	0.01654	DF	4
Upper CL Dif	0.07222	Prob > |t|	0.1868
Lower CL Dif	-0.01960	Prob > t	0.0934
Confidence	0.95	Prob < t	0.9066

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00103832	0.001038	2.5316	0.1868
Error	4	0.00164055	0.000410		
C. Total	5	0.00267887			

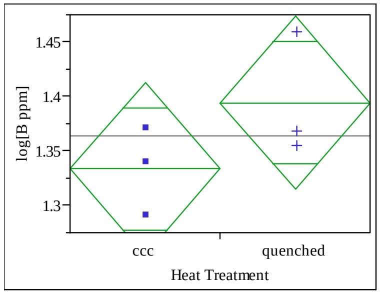
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.81529	0.01169	2.7828	2.8478
quenched	3	2.84160	0.01169	2.8091	2.8741

Std Error uses a pooled estimate of error variance

Exhibit B5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of Matrix 2 Non-Rad Glasses

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=FY09EM21-22



Oneway Anova
Summary of Fit

Rsquare	0.361979
Adj Rsquare	0.202473
Root Mean Square Error	0.049603
Mean of Response	1.363922
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.06101	t Ratio	1.506447
Std Err Dif	0.04050	DF	4
Upper CL Dif	0.17346	Prob > |t|	0.2064
Lower CL Dif	-0.05144	Prob > t	0.1032
Confidence	0.95	Prob < t	0.8968

Analysis of Variance

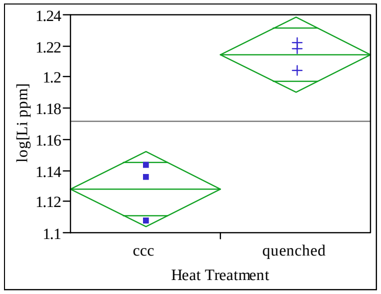
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00558374	0.005584	2.2694	0.2064
Error	4	0.00984187	0.002460		
C. Total	5	0.01542561			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.33342	0.02864	1.2539	1.4129
quenched	3	1.39443	0.02864	1.3149	1.4739

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=FY09EM21-22



Oneway Anova
Summary of Fit

Rsquare	0.925123
Adj Rsquare	0.906403
Root Mean Square Error	0.015047
Mean of Response	1.171456
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.086367	t Ratio	7.029981
Std Err Dif	0.012285	DF	4
Upper CL Dif	0.120476	Prob > |t|	0.0022
Lower CL Dif	0.052257	Prob > t	0.0011
Confidence	0.95	Prob < t	0.9989

Analysis of Variance

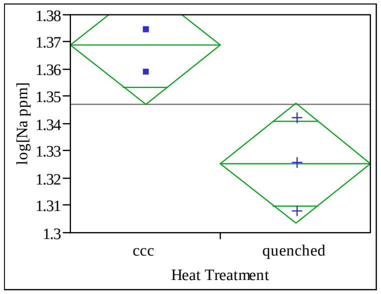
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.01118876	0.011189	49.4206	0.0022
Error	4	0.00090559	0.000226		
C. Total	5	0.01209436			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.12827	0.00869	1.1042	1.1524
quenched	3	1.21464	0.00869	1.1905	1.2388

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=FY09EM21-22



Oneway Anova
Summary of Fit

Rsquare	0.791816
Adj Rsquare	0.73977
Root Mean Square Error	0.013665
Mean of Response	1.347197
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.04352	t Ratio	-3.90048
Std Err Dif	0.01116	DF	4
Upper CL Dif	-0.01254	Prob > |t|	0.0175
Lower CL Dif	-0.07450	Prob > t	0.9912
Confidence	0.95	Prob < t	0.0088

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00284098	0.002841	15.2138	0.0175
Error	4	0.00074695	0.000187		
C. Total	5	0.00358792			

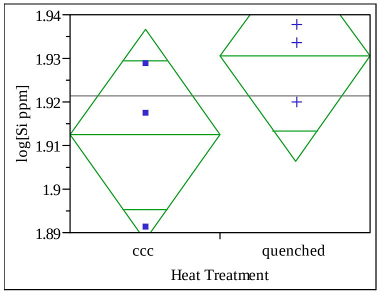
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.36896	0.00789	1.3471	1.3909
quenched	3	1.32544	0.00789	1.3035	1.3473

Std Error uses a pooled estimate of error variance

Exhibit B5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of Matrix 2 Non-Rad Glasses

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=FY09EM21-22



Oneway Anova

Summary of Fit

Rsquare	0.350979
Adj Rsquare	0.188723
Root Mean Square Error	0.015099
Mean of Response	1.921429
Observations (or Sum Wgts)	6

t Test

quenched-ccc

Assuming equal variances

Difference	0.01813	t Ratio	1.470756
Std Err Dif	0.01233	DF	4
Upper CL Dif	0.05236	Prob > |t|	0.2153
Lower CL Dif	-0.01610	Prob > t	0.1077
Confidence	0.95	Prob < t	0.8923

Analysis of Variance

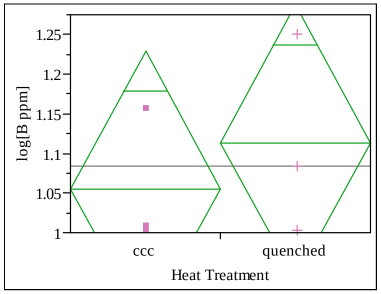
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00049313	0.000493	2.1631	0.2153
Error	4	0.00091189	0.000228		
C. Total	5	0.00140502			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.91236	0.00872	1.8882	1.9366
quenched	3	1.93049	0.00872	1.9063	1.9547

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=FY09EM21-23



Oneway Anova

Summary of Fit

Rsquare	0.095075
Adj Rsquare	-0.13116
Root Mean Square Error	0.108499
Mean of Response	1.084431
Observations (or Sum Wgts)	6

t Test

quenched-ccc

Assuming equal variances

Difference	0.05743	t Ratio	0.648272
Std Err Dif	0.08859	DF	4
Upper CL Dif	0.30339	Prob > |t|	0.5521
Lower CL Dif	-0.18853	Prob > t	0.2761
Confidence	0.95	Prob < t	0.7239

Analysis of Variance

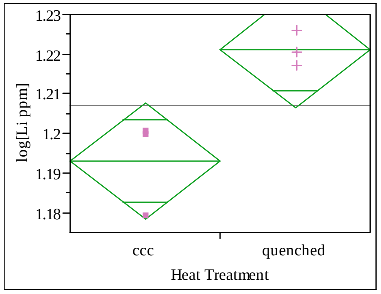
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00494731	0.004947	0.4203	0.5521
Error	4	0.04708855	0.011772		
C. Total	5	0.05203586			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.05572	0.06264	0.88179	1.2296
quenched	3	1.11315	0.06264	0.93922	1.2871

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=FY09EM21-23



Oneway Anova

Summary of Fit

Rsquare	0.779578
Adj Rsquare	0.724473
Root Mean Square Error	0.009196
Mean of Response	1.207141
Observations (or Sum Wgts)	6

t Test

quenched-ccc

Assuming equal variances

Difference	0.028241	t Ratio	3.761254
Std Err Dif	0.007508	DF	4
Upper CL Dif	0.049088	Prob > |t|	0.0198
Lower CL Dif	0.007394	Prob > t	0.0099
Confidence	0.95	Prob < t	0.9901

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00119636	0.001196	14.1470	0.0198
Error	4	0.00033826	0.000085		
C. Total	5	0.00153463			

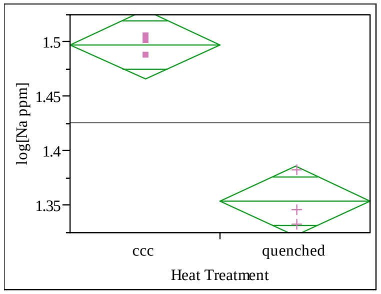
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.19302	0.00531	1.1783	1.2078
quenched	3	1.22126	0.00531	1.2065	1.2360

Std Error uses a pooled estimate of error variance

Exhibit B5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of Matrix 2 Non-Rad Glasses

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=FY09EM21-23



Oneway Anova
Summary of Fit

Rsquare	0.95167
Adj Rsquare	0.939587
Root Mean Square Error	0.019829
Mean of Response	1.425638
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.14369	t Ratio	-8.87488
Std Err Dif	0.01619	DF	4
Upper CL Dif	-0.09874	Prob > |t|	0.0009
Lower CL Dif	-0.18864	Prob > t	0.9996
Confidence	0.95	Prob < t	0.0004

Analysis of Variance

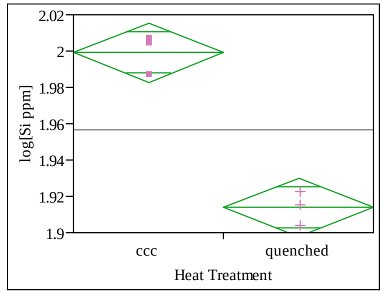
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.03096926	0.030969	78.7635	0.0009
Error	4	0.00157277	0.000393		
C. Total	5	0.03254203			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.49748	0.01145	1.4657	1.5293
quenched	3	1.35379	0.01145	1.3220	1.3856

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=FY09EM21-23



Oneway Anova
Summary of Fit

Rsquare	0.963733
Adj Rsquare	0.954667
Root Mean Square Error	0.010115
Mean of Response	1.956622
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.08515	t Ratio	-10.3099
Std Err Dif	0.00826	DF	4
Upper CL Dif	-0.06222	Prob > |t|	0.0005
Lower CL Dif	-0.10808	Prob > t	0.9998
Confidence	0.95	Prob < t	0.0002

Analysis of Variance

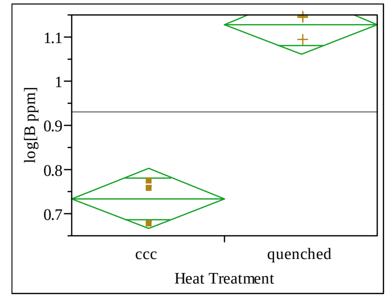
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.01087469	0.010875	106.2939	0.0005
Error	4	0.00040923	0.000102		
C. Total	5	0.01128392			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.99920	0.00584	1.9830	2.0154
quenched	3	1.91405	0.00584	1.8978	1.9303

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=FY09EM21-24



Oneway Anova
Summary of Fit

Rsquare	0.970511
Adj Rsquare	0.963138
Root Mean Square Error	0.042164
Mean of Response	0.931456
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.394997	t Ratio	11.47353
Std Err Dif	0.034427	DF	4
Upper CL Dif	0.490581	Prob > |t|	0.0003
Lower CL Dif	0.299413	Prob > t	0.0002
Confidence	0.95	Prob < t	0.9998

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.23403386	0.234034	131.6419	0.0003
Error	4	0.00711123	0.001778		
C. Total	5	0.24114509			

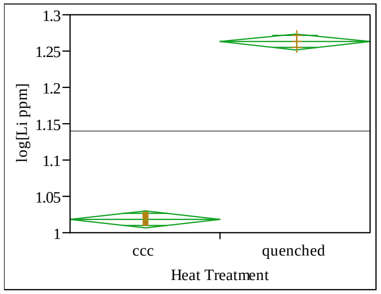
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	0.73396	0.02434	0.6664	0.8015
quenched	3	1.12895	0.02434	1.0614	1.1965

Std Error uses a pooled estimate of error variance

Exhibit B5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of Matrix 2 Non-Rad Glasses

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=FY09EM21-24



Oneway Anova
Summary of Fit

Rsquare	0.997938
Adj Rsquare	0.997422
Root Mean Square Error	0.006815
Mean of Response	1.140805
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.244794	t Ratio	43.99487
Std Err Dif	0.005564	DF	4
Upper CL Dif	0.260242	Prob > |t|	<.0001
Lower CL Dif	0.229345	Prob > t	<.0001
Confidence	0.95	Prob < t	1.0000

Analysis of Variance

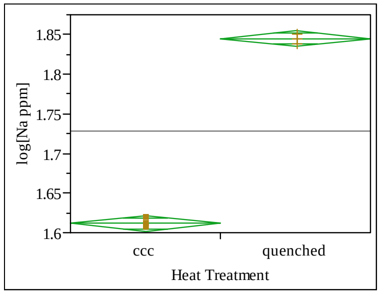
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.08988605	0.089886	1935.549	<.0001
Error	4	0.00018576	0.000046		
C. Total	5	0.09007181			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.01841	0.00393	1.0075	1.0293
quenched	3	1.26320	0.00393	1.2523	1.2741

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=FY09EM21-24



Oneway Anova
Summary of Fit

Rsquare	0.998105
Adj Rsquare	0.997631
Root Mean Square Error	0.006221
Mean of Response	1.728158
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.233148	t Ratio	45.9005
Std Err Dif	0.005079	DF	4
Upper CL Dif	0.247250	Prob > |t|	<.0001
Lower CL Dif	0.219045	Prob > t	<.0001
Confidence	0.95	Prob < t	1.0000

Analysis of Variance

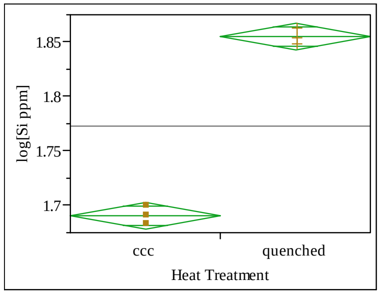
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.08153679	0.081537	2106.856	<.0001
Error	4	0.00015480	0.000039		
C. Total	5	0.08169159			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.61158	0.00359	1.6016	1.6216
quenched	3	1.84473	0.00359	1.8348	1.8547

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=FY09EM21-24



Oneway Anova
Summary of Fit

Rsquare	0.994292
Adj Rsquare	0.992864
Root Mean Square Error	0.007624
Mean of Response	1.772798
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.164304	t Ratio	26.39543
Std Err Dif	0.006225	DF	4
Upper CL Dif	0.181587	Prob > |t|	<.0001
Lower CL Dif	0.147022	Prob > t	<.0001
Confidence	0.95	Prob < t	1.0000

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.04049382	0.040494	696.7185	<.0001
Error	4	0.00023248	0.000058		
C. Total	5	0.04072630			

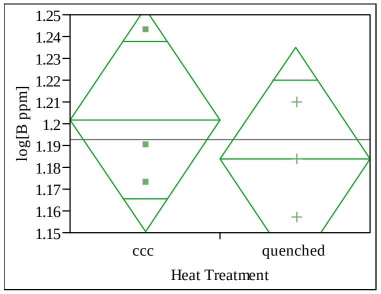
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.69065	0.00440	1.6784	1.7029
quenched	3	1.85495	0.00440	1.8427	1.8672

Std Error uses a pooled estimate of error variance

Exhibit B5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of Matrix 2 Non-Rad Glasses

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=FY09EM21-25



Oneway Anova
Summary of Fit

Rsquare	0.108504
Adj Rsquare	-0.11437
Root Mean Square Error	0.031912
Mean of Response	1.192786
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.01818	t Ratio	-0.69774
Std Err Dif	0.02606	DF	4
Upper CL Dif	0.05416	Prob > |t|	0.5238
Lower CL Dif	-0.09052	Prob > t	0.7381
Confidence	0.95	Prob < t	0.2619

Analysis of Variance

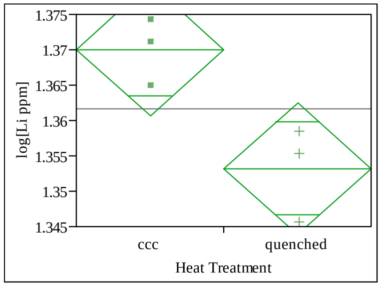
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00049578	0.000496	0.4868	0.5238
Error	4	0.00407350	0.001018		
C. Total	5	0.00456928			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.20188	0.01842	1.1507	1.2530
quenched	3	1.18370	0.01842	1.1325	1.2349

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=FY09EM21-25



Oneway Anova
Summary of Fit

Rsquare	0.758987
Adj Rsquare	0.698733
Root Mean Square Error	0.005799
Mean of Response	1.36163
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.01680	t Ratio	-3.54917
Std Err Dif	0.00473	DF	4
Upper CL Dif	-0.00366	Prob > |t|	0.0238
Lower CL Dif	-0.02995	Prob > t	0.9881
Confidence	0.95	Prob < t	0.0119

Analysis of Variance

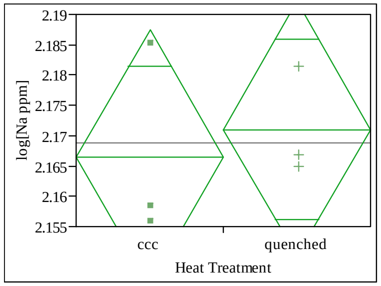
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00042355	0.000424	12.5966	0.0238
Error	4	0.00013450	0.000034		
C. Total	5	0.00055804			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.37003	0.00335	1.3607	1.3793
quenched	3	1.35323	0.00335	1.3439	1.3625

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=FY09EM21-25



Oneway Anova
Summary of Fit

Rsquare	0.043142
Adj Rsquare	-0.19607
Root Mean Square Error	0.013143
Mean of Response	2.168743
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.00456	t Ratio	0.424675
Std Err Dif	0.01073	DF	4
Upper CL Dif	0.03435	Prob > |t|	0.6929
Lower CL Dif	-0.02524	Prob > t	0.3465
Confidence	0.95	Prob < t	0.6535

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00003115	0.000031	0.1803	0.6929
Error	4	0.00069092	0.000173		
C. Total	5	0.00072207			

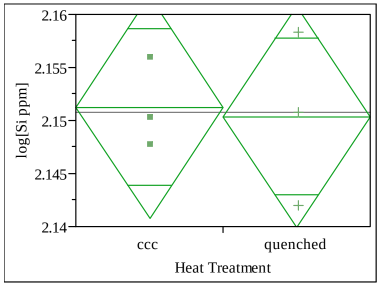
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.16646	0.00759	2.1454	2.1875
quenched	3	2.17102	0.00759	2.1500	2.1921

Std Error uses a pooled estimate of error variance

Exhibit B5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of Matrix 2 Non-Rad Glasses

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=FY09EM21-25



Oneway Anova
Summary of Fit

Rsquare	0.006974
Adj Rsquare	-0.24128
Root Mean Square Error	0.006508
Mean of Response	2.150818
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.00089	t Ratio	-0.1676
Std Err Dif	0.00531	DF	4
Upper CL Dif	0.01386	Prob > |t|	0.8750
Lower CL Dif	-0.01564	Prob > t	0.5625
Confidence	0.95	Prob < t	0.4375

Analysis of Variance

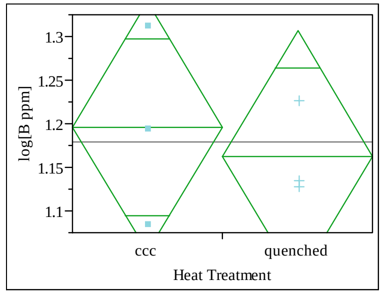
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00000119	1.19e-6	0.0281	0.8750
Error	4	0.00016942	0.000042		
C. Total	5	0.00017061			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.15126	0.00376	2.1408	2.1617
quenched	3	2.15037	0.00376	2.1399	2.1608

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=FY09EM21-26



Oneway Anova
Summary of Fit

Rsquare	0.04871
Adj Rsquare	-0.18911
Root Mean Square Error	0.089581
Mean of Response	1.179545
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.03310	t Ratio	-0.45257
Std Err Dif	0.07314	DF	4
Upper CL Dif	0.16997	Prob > |t|	0.6743
Lower CL Dif	-0.23618	Prob > t	0.6628
Confidence	0.95	Prob < t	0.3372

Analysis of Variance

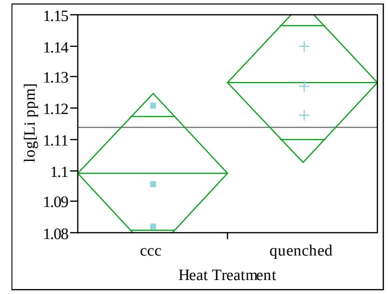
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00164360	0.001644	0.2048	0.6743
Error	4	0.03209883	0.008025		
C. Total	5	0.03374243			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.19610	0.05172	1.0525	1.3397
quenched	3	1.16299	0.05172	1.0194	1.3066

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=FY09EM21-26



Oneway Anova
Summary of Fit

Rsquare	0.553568
Adj Rsquare	0.441961
Root Mean Square Error	0.016035
Mean of Response	1.113698
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.02916	t Ratio	2.227092
Std Err Dif	0.01309	DF	4
Upper CL Dif	0.06551	Prob > |t|	0.0899
Lower CL Dif	-0.00719	Prob > t	0.0450
Confidence	0.95	Prob < t	0.9550

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00127536	0.001275	4.9599	0.0899
Error	4	0.00102853	0.000257		
C. Total	5	0.00230390			

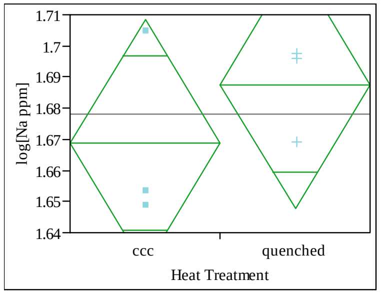
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.09912	0.00926	1.0734	1.1248
quenched	3	1.12828	0.00926	1.1026	1.1540

Std Error uses a pooled estimate of error variance

Exhibit B5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of Matrix 2 Non-Rad Glasses

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=FY09EM21-26



Oneway Anova
Summary of Fit

Rsquare	0.176359
Adj Rsquare	-0.02955
Root Mean Square Error	0.024834
Mean of Response	1.678156
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.01877	t Ratio	0.925466
Std Err Dif	0.02028	DF	4
Upper CL Dif	0.07506	Prob > |t|	0.4071
Lower CL Dif	-0.03753	Prob > t	0.2036
Confidence	0.95	Prob < t	0.7964

Analysis of Variance

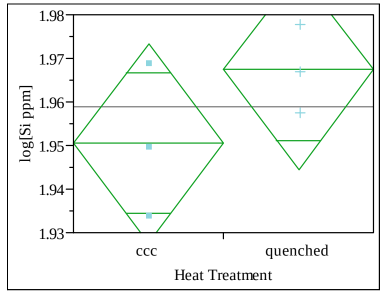
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00052822	0.000528	0.8565	0.4071
Error	4	0.00246693	0.000617		
C. Total	5	0.00299515			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.66877	0.01434	1.6290	1.7086
quenched	3	1.68754	0.01434	1.6477	1.7273

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=FY09EM21-26



Oneway Anova
Summary of Fit

Rsquare	0.343576
Adj Rsquare	0.17947
Root Mean Square Error	0.014267
Mean of Response	1.958946
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.01686	t Ratio	1.446936
Std Err Dif	0.01165	DF	4
Upper CL Dif	0.04920	Prob > |t|	0.2215
Lower CL Dif	-0.01549	Prob > t	0.1107
Confidence	0.95	Prob < t	0.8893

Analysis of Variance

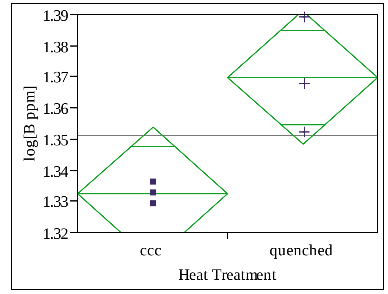
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00042615	0.000426	2.0936	0.2215
Error	4	0.00081419	0.000204		
C. Total	5	0.00124034			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.95052	0.00824	1.9276	1.9734
quenched	3	1.96737	0.00824	1.9445	1.9902

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=FY09EM21-27



Oneway Anova
Summary of Fit

Rsquare	0.746235
Adj Rsquare	0.682793
Root Mean Square Error	0.013336
Mean of Response	1.351111
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.037345	t Ratio	3.429665
Std Err Dif	0.010889	DF	4
Upper CL Dif	0.067578	Prob > |t|	0.0265
Lower CL Dif	0.007113	Prob > t	0.0133
Confidence	0.95	Prob < t	0.9867

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00209201	0.002092	11.7626	0.0265
Error	4	0.00071141	0.000178		
C. Total	5	0.00280343			

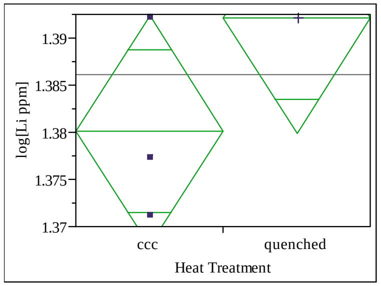
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.33244	0.00770	1.3111	1.3538
quenched	3	1.36978	0.00770	1.3484	1.3912

Std Error uses a pooled estimate of error variance

Exhibit B5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of Matrix 2 Non-Rad Glasses

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=FY09EM21-27



Oneway Anova
Summary of Fit

Rsquare	0.47921
Adj Rsquare	0.349013
Root Mean Square Error	0.007654
Mean of Response	1.386124
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.01199	t Ratio	1.918501
Std Err Dif	0.00625	DF	4
Upper CL Dif	0.02934	Prob > |t|	0.1275
Lower CL Dif	-0.00536	Prob > t	0.0637
Confidence	0.95	Prob < t	0.9363

Analysis of Variance

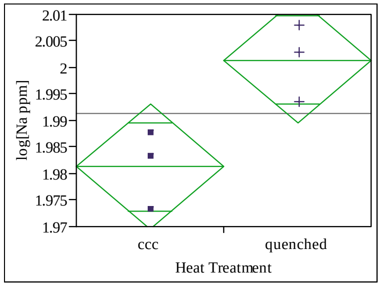
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00021562	0.000216	3.6806	0.1275
Error	4	0.00023433	0.000059		
C. Total	5	0.00044995			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.38013	0.00442	1.3679	1.3924
quenched	3	1.39212	0.00442	1.3799	1.4044

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=FY09EM21-27



Oneway Anova
Summary of Fit

Rsquare	0.738653
Adj Rsquare	0.673316
Root Mean Square Error	0.007351
Mean of Response	1.991322
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.020181	t Ratio	3.362335
Std Err Dif	0.006002	DF	4
Upper CL Dif	0.036845	Prob > |t|	0.0282
Lower CL Dif	0.003517	Prob > t	0.0141
Confidence	0.95	Prob < t	0.9859

Analysis of Variance

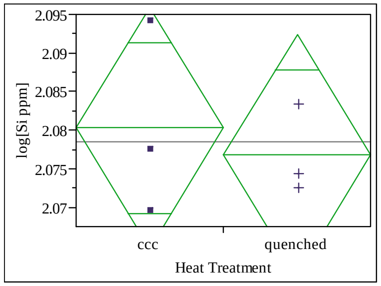
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00061089	0.000611	11.3053	0.0282
Error	4	0.00021614	0.000054		
C. Total	5	0.00082704			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.98123	0.00424	1.9694	1.9930
quenched	3	2.00141	0.00424	1.9896	2.0132

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=FY09EM21-27



Oneway Anova
Summary of Fit

Rsquare	0.046541
Adj Rsquare	-0.19182
Root Mean Square Error	0.009782
Mean of Response	2.078509
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.00353	t Ratio	-0.44187
Std Err Dif	0.00799	DF	4
Upper CL Dif	0.01865	Prob > |t|	0.6814
Lower CL Dif	-0.02570	Prob > t	0.6593
Confidence	0.95	Prob < t	0.3407

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00001868	0.000019	0.1953	0.6814
Error	4	0.00038273	0.000096		
C. Total	5	0.00040141			

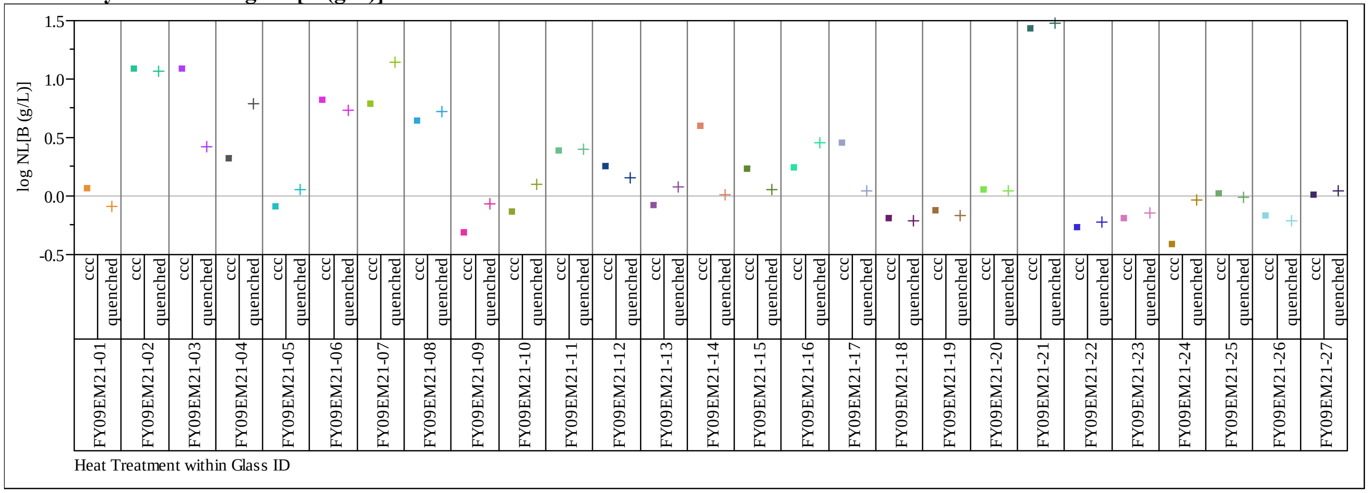
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.08027	0.00565	2.0646	2.0960
quenched	3	2.07674	0.00565	2.0611	2.0924

Std Error uses a pooled estimate of error variance

Exhibit B6. Effects of Heat Treatment for the Matrix 2 Non-Rad Glasses by Compositional View

Comp View=Measured
Variability Chart for log NL[B (g/L)]



Comp View=Measured
Variability Chart for log NL[Li(g/L)]

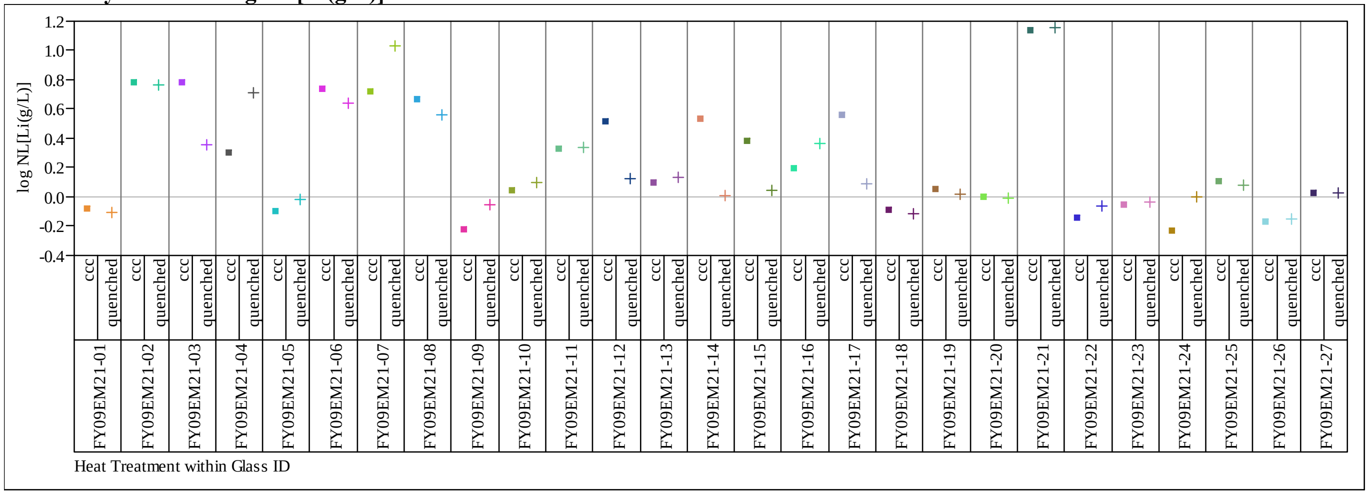
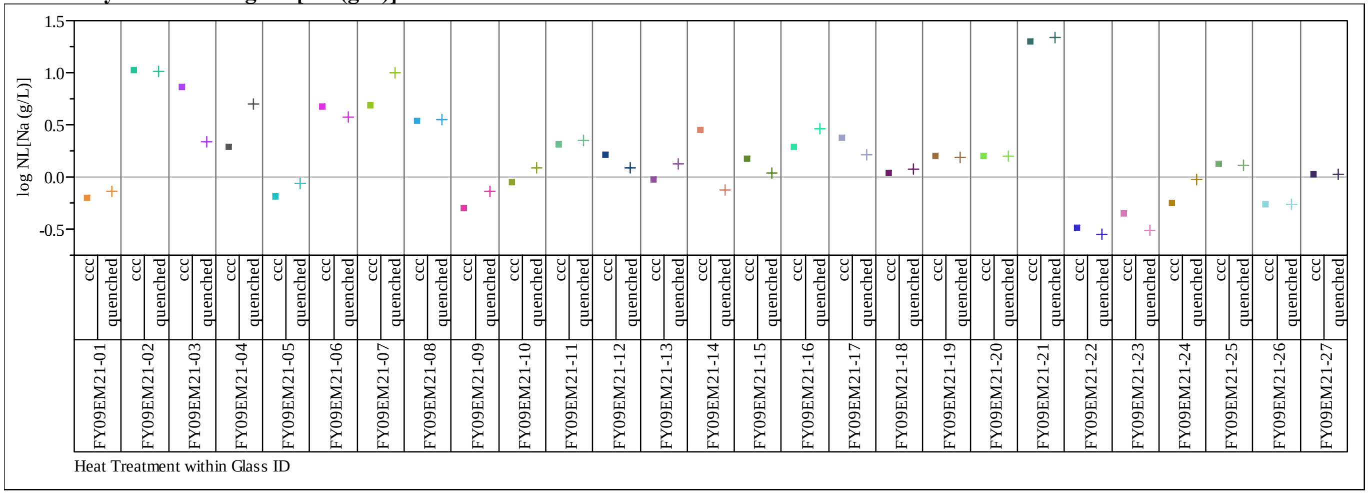


Exhibit B6. Effects of Heat Treatment for the Matrix 2 Non-Rad Glasses by Compositional View

Comp View=Measured
Variability Chart for log NL[Na (g/L)]



Comp View=Measured
Variability Chart for log NL[Si (g/L)]

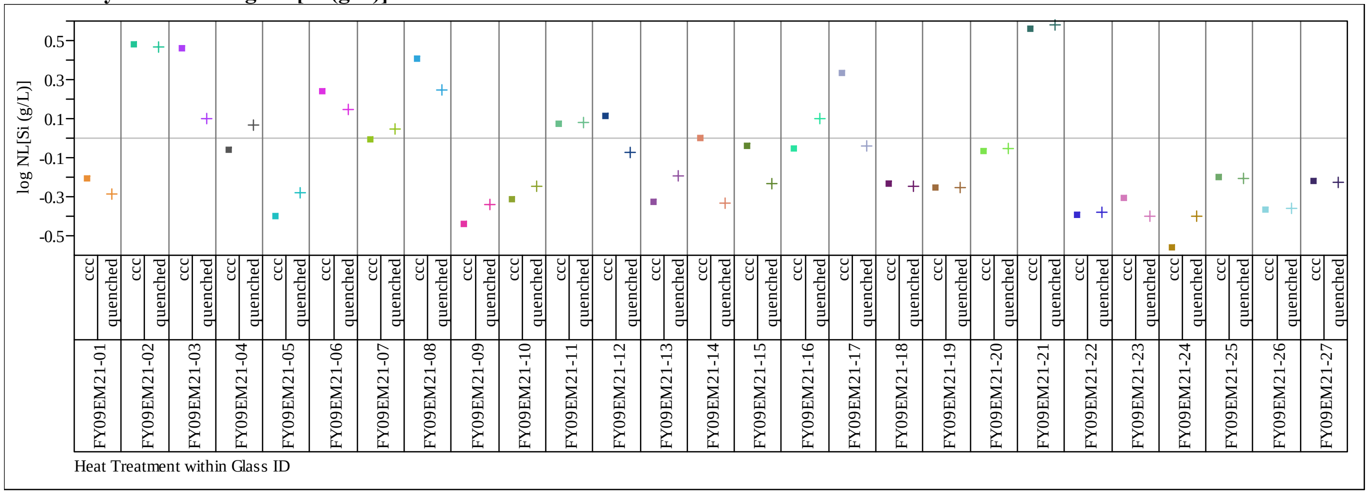
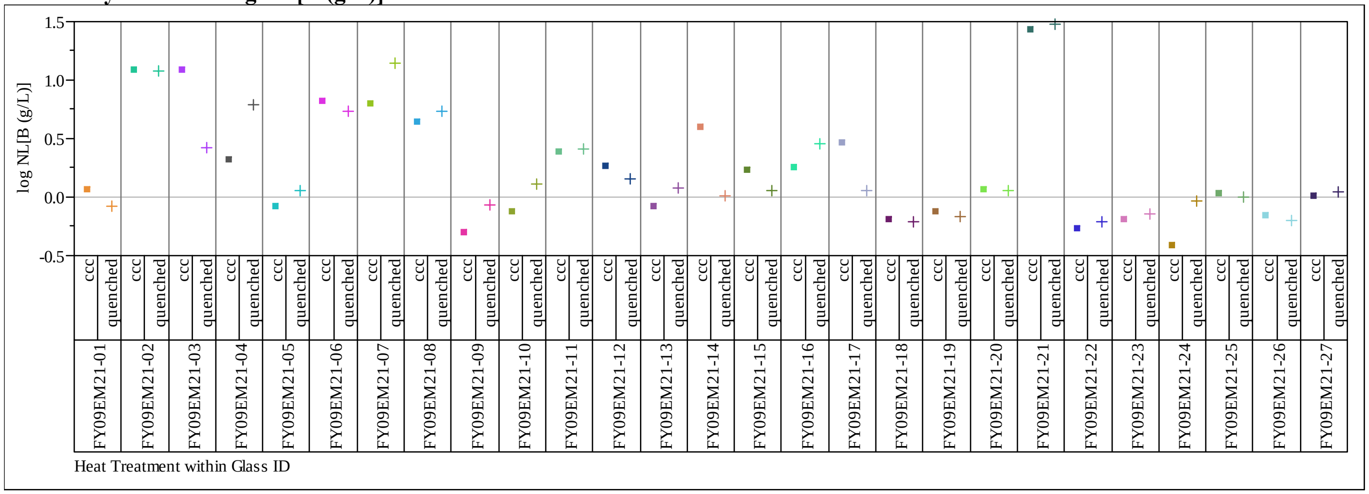


Exhibit B6. Effects of Heat Treatment for the Matrix 2 Non-Rad Glasses by Compositional View

Comp View=Measured bc
Variability Chart for log NL[B (g/L)]



Comp View=Measured bc
Variability Chart for log NL[Li(g/L)]

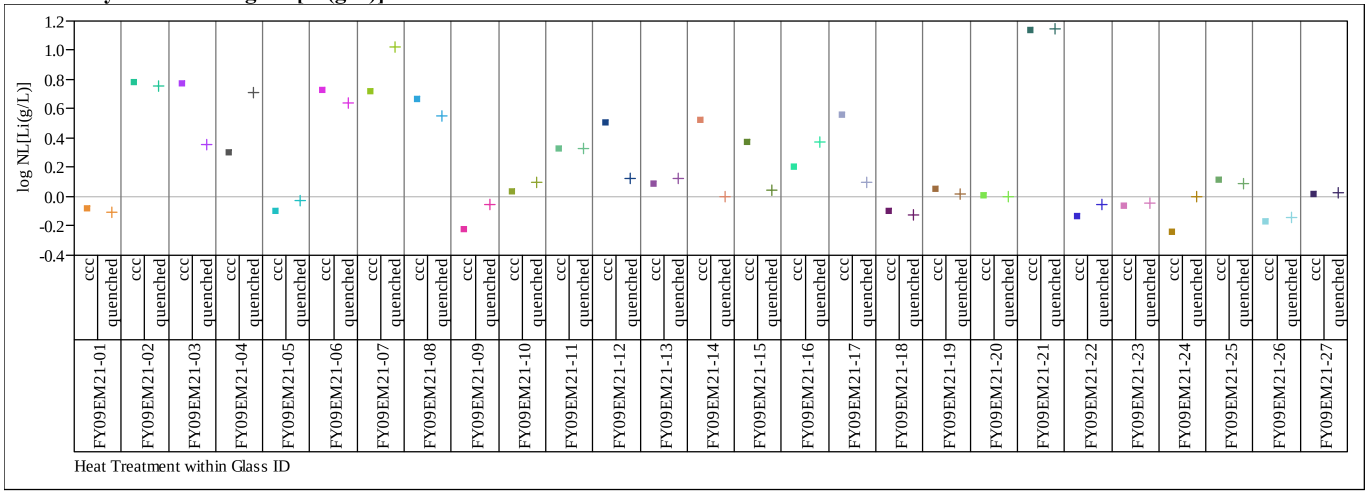
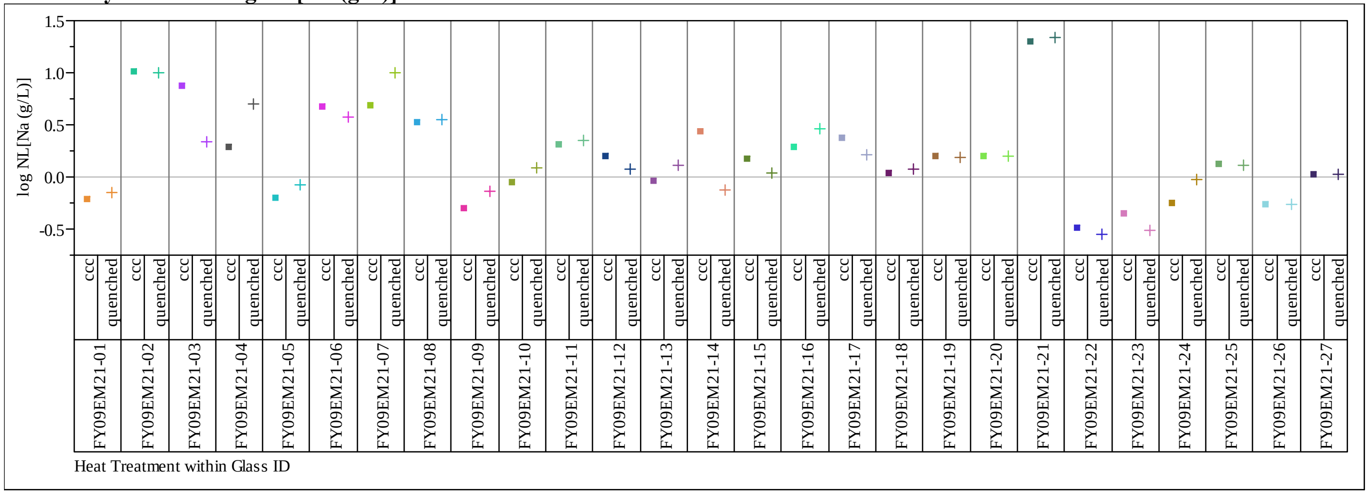


Exhibit B6. Effects of Heat Treatment for the Matrix 2 Non-Rad Glasses by Compositional View

Comp View=Measured bc
Variability Chart for log NL[Na (g/L)]



Comp View=Measured bc
Variability Chart for log NL[Si (g/L)]

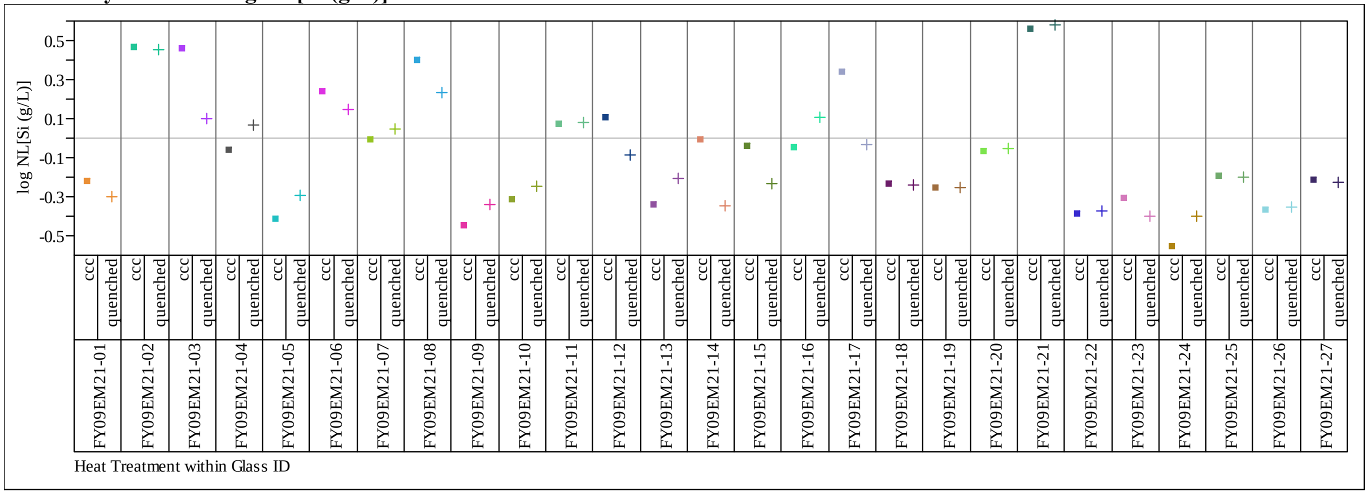
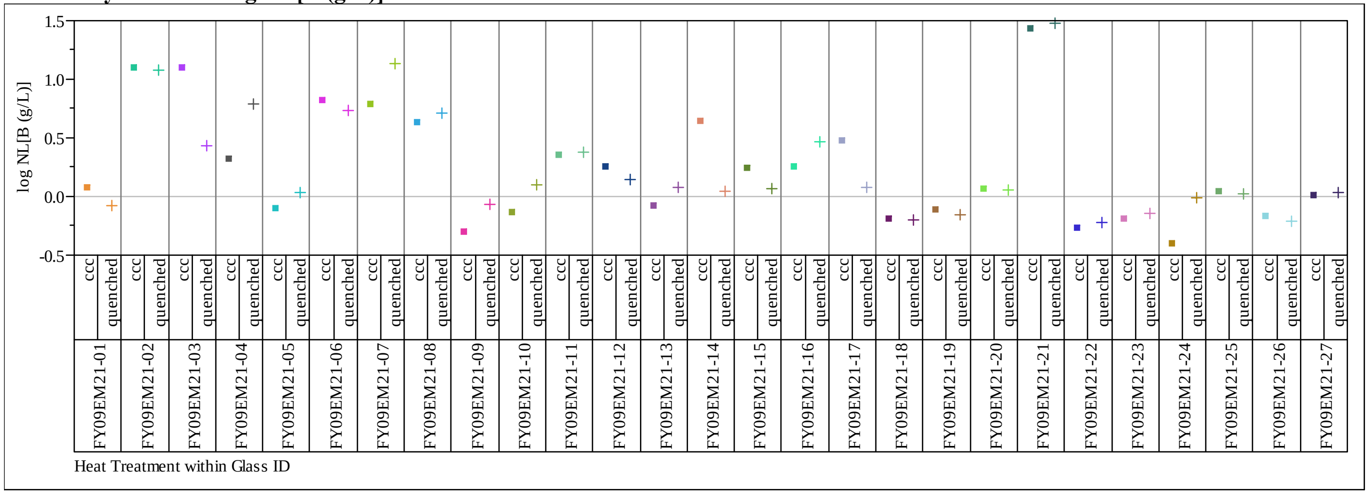


Exhibit B6. Effects of Heat Treatment for the Matrix 2 Non-Rad Glasses by Compositional View

Comp View=Targeted
Variability Chart for log NL[B (g/L)]



Comp View=Targeted
Variability Chart for log NL[Li(g/L)]

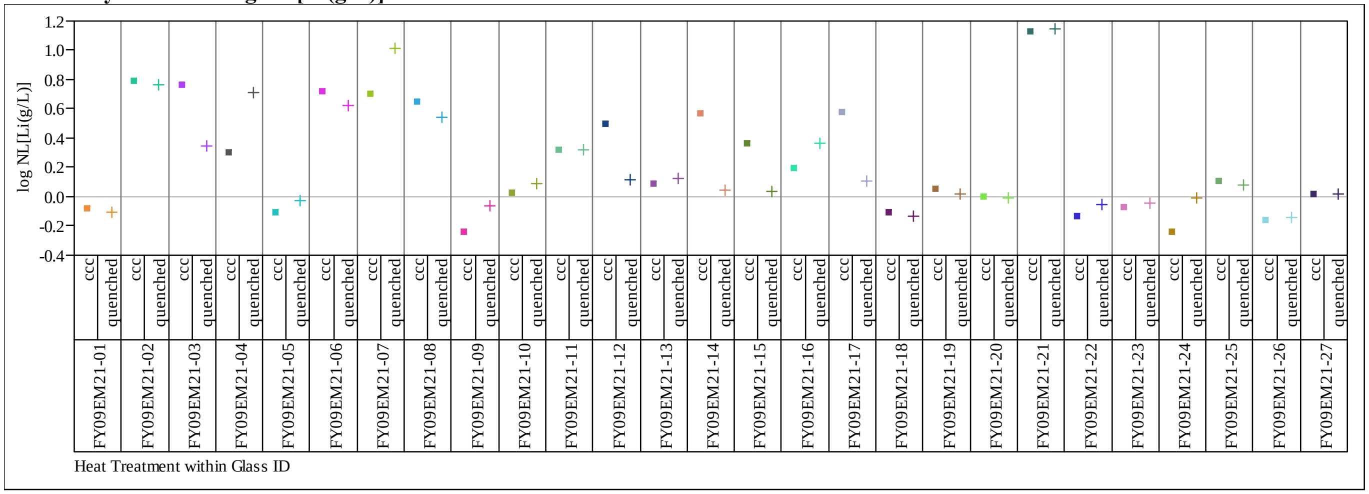
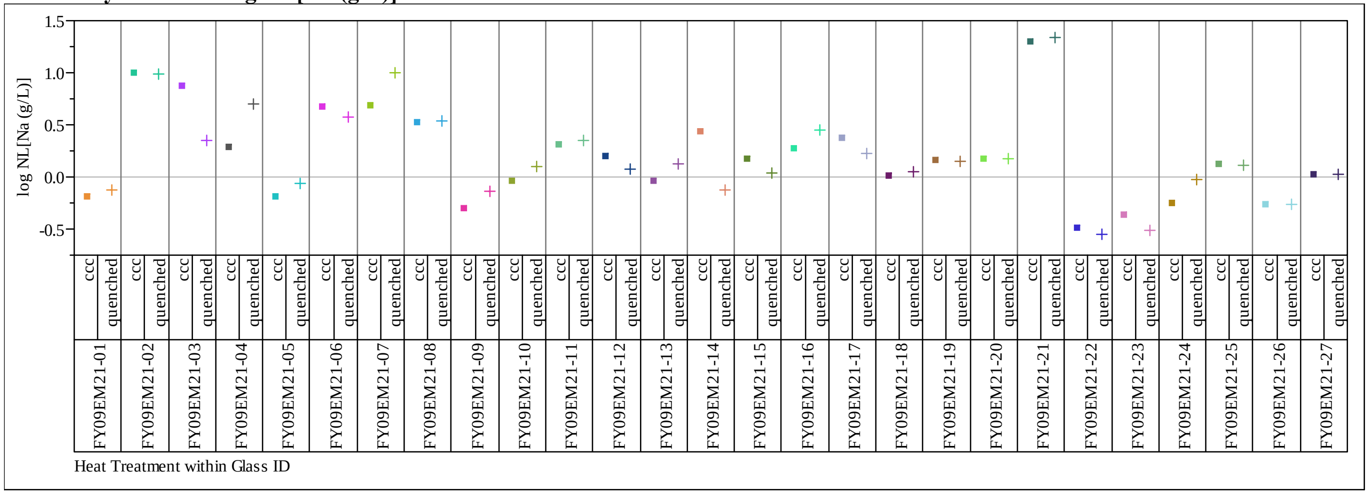


Exhibit B6. Effects of Heat Treatment for the Matrix 2 Non-Rad Glasses by Compositional View

Comp View=Targeted
Variability Chart for log NL[Na (g/L)]



Comp View=Targeted
Variability Chart for log NL[Si (g/L)]

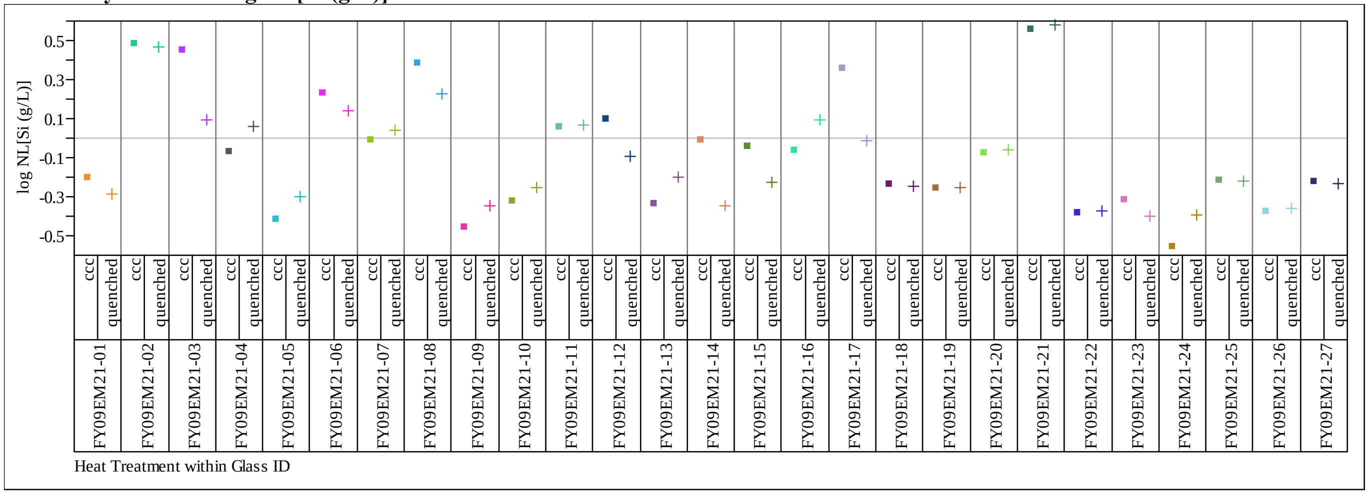


Exhibit B7. del Gp (ΔG_p) Predictions versus Common Logarithm Normalized Leachate (log NL[.]) for B over All Compositional Views and Heat Treatments for the Non-Rad Glasses from the Matrix 2 Study

Legend

Symbol	Standard/ Comp View-Heat Treatment
z	EA
◊	ARM
□	Measured-ccc
□	Measured bc -ccc
□	Targeted-ccc
•	Measured-quenched
•	Measured bc - quenched
•	Targeted- quenched

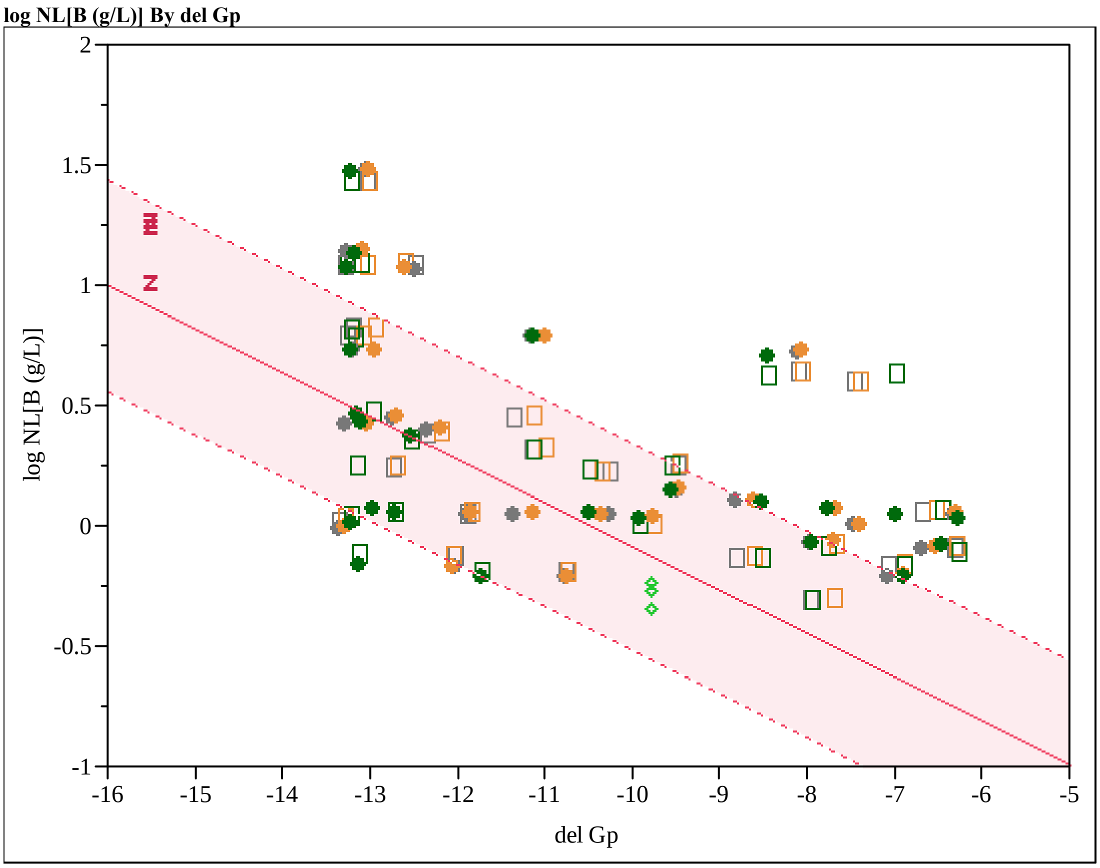


Exhibit B8. del Gp (ΔG_p) Predictions versus Common Logarithm Normalized Leachate (log NL[.]) for Li over All Compositional Views and Heat Treatments for the Non-Rad Glasses from the Matrix 2 Study

Legend

Symbol	Standard/ Comp View-Heat Treatment
z	EA
◊	ARM
□	Measured-ccc
□	Measured bc -ccc
□	Targeted-ccc
●	Measured-quenched
●	Measured bc - quenched
●	Targeted- quenched

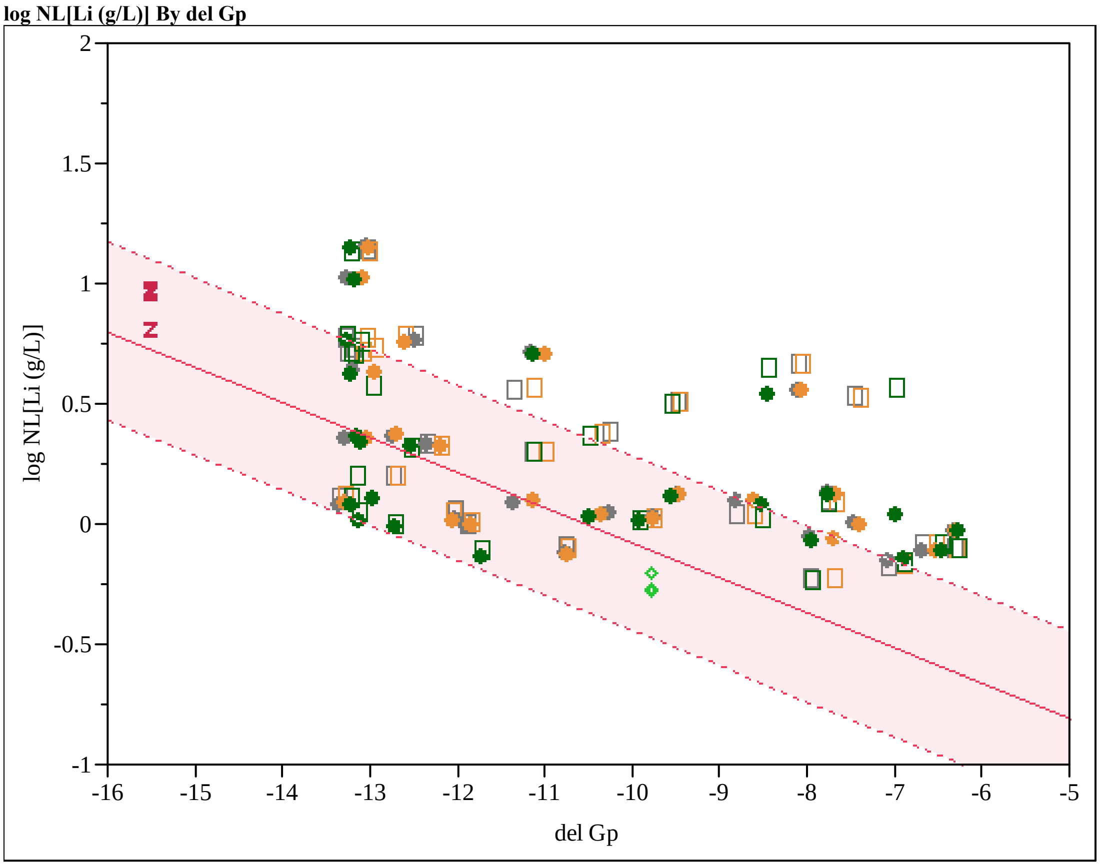


Exhibit B9. del Gp (ΔG_p) Predictions versus Common Logarithm Normalized Leachate (log NL[.]) for Na over All Compositional Views and Heat Treatments for the Non-Rad Glasses from the Matrix 2 Study

Legend

Symbol	Standard/ Comp View-Heat Treatment
z	EA
◊	ARM
□	Measured-ccc
□	Measured bc -ccc
□	Targeted-ccc
●	Measured-quenched
●	Measured bc - quenched
●	Targeted- quenched

log NL[Na (g/L)] By del Gp

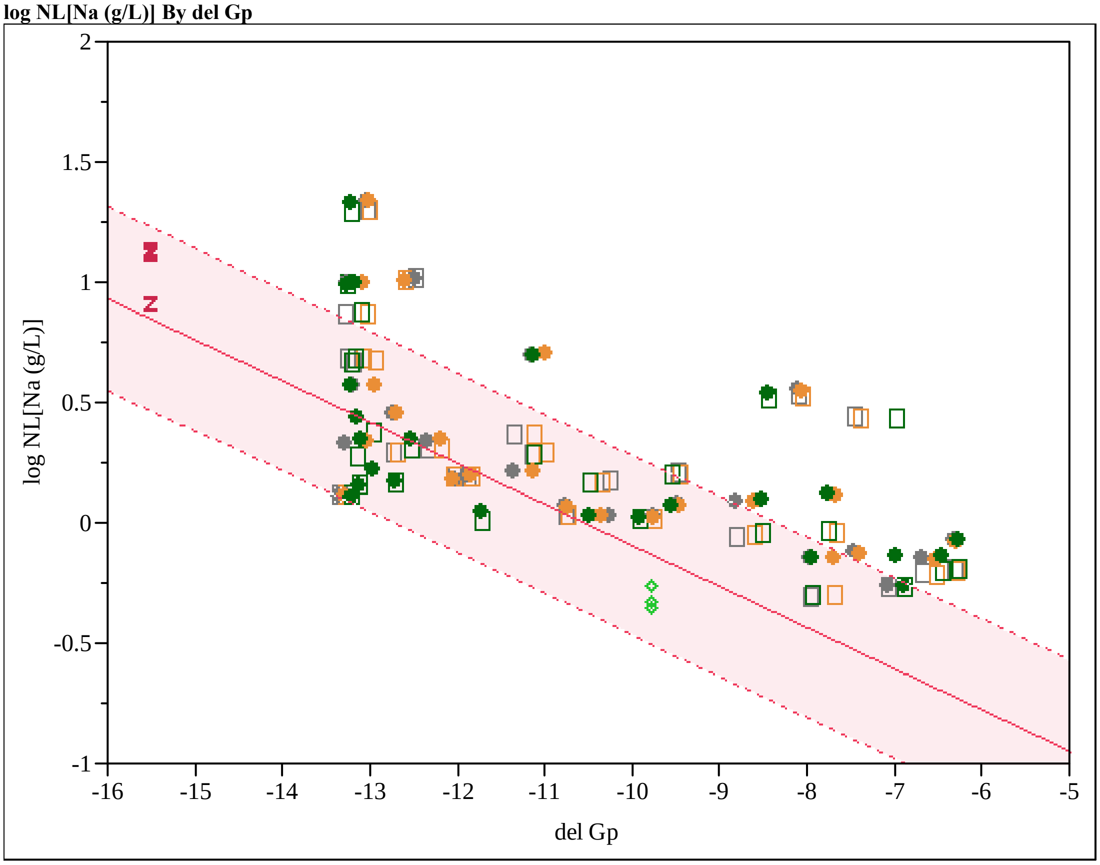


Exhibit B10. del Gp (ΔG_p) Predictions versus Common Logarithm Normalized Leachate (log NL[.]) for Si over All Compositional Views and Heat Treatments for the Non-Rad Glasses from the Matrix 2 Study

Legend

Symbol	Standard/ Comp View-Heat Treatment
z	EA
◊	ARM
□	Measured-ccc
□	Measured bc -ccc
□	Targeted-ccc
●	Measured-quenched
●	Measured bc - quenched
●	Targeted- quenched

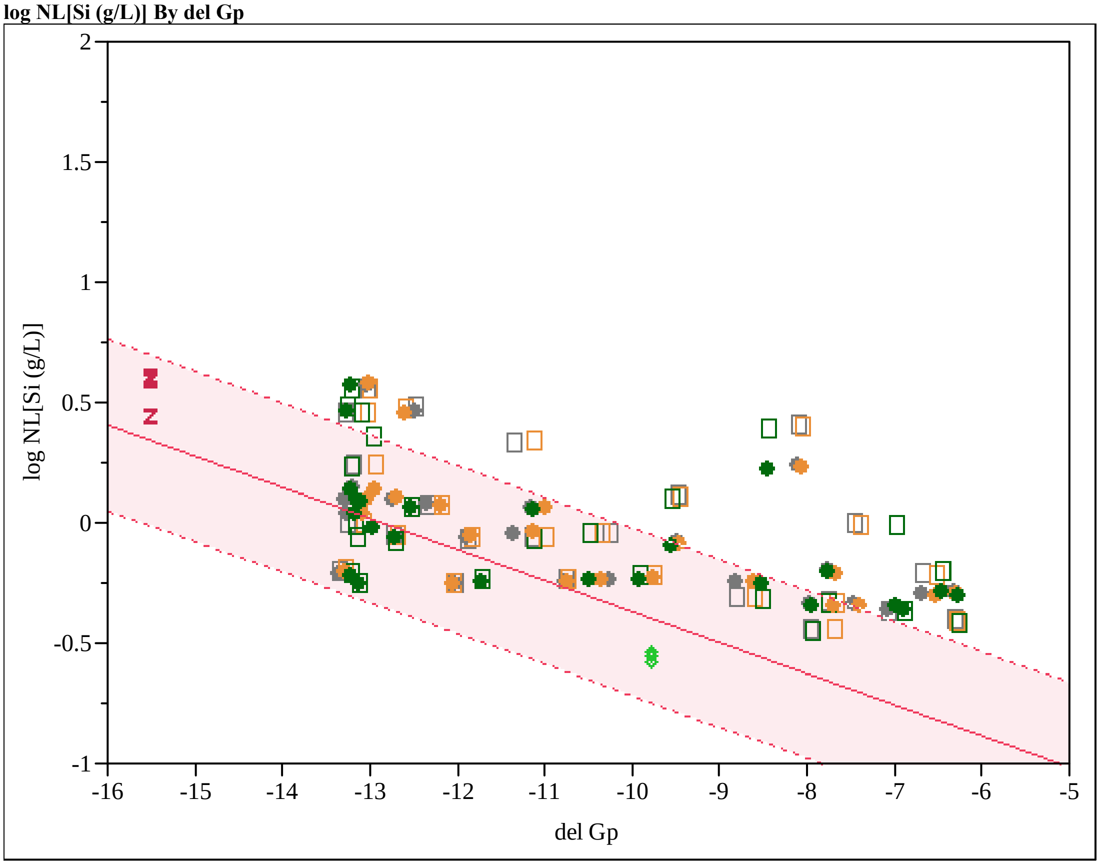
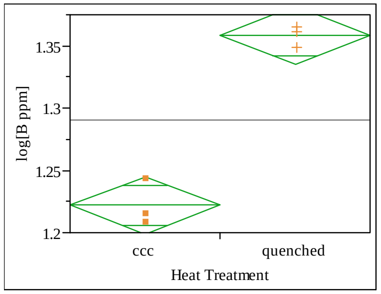


Exhibit B11. Effects of Heat Treatment for the Matrix 2 Rad Glasses

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=FY09EM21-28



Oneway Anova
Summary of Fit

Rsquare	0.970895
Adj Rsquare	0.963619
Root Mean Square Error	0.014488
Mean of Response	1.290201
Observations (or Sum Wgts)	6

t Test
quenched-ccc
Assuming equal variances

Difference	0.136646	t Ratio	11.55142
Std Err Dif	0.011829	DF	4
Upper CL Dif	0.169490	Prob > |t|	0.0003
Lower CL Dif	0.103803	Prob > t	0.0002
Confidence	0.95	Prob < t	0.9998

Analysis of Variance

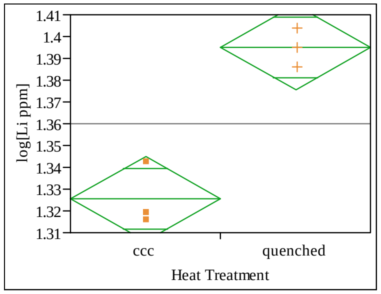
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.02800832	0.028008	133.4354	0.0003
Error	4	0.00083961	0.000210		
C. Total	5	0.02884793			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.22188	0.00836	1.1987	1.2451
quenched	3	1.35852	0.00836	1.3353	1.3817

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=FY09EM21-28



Oneway Anova
Summary of Fit

Rsquare	0.924752
Adj Rsquare	0.90594
Root Mean Square Error	0.012139
Mean of Response	1.360239
Observations (or Sum Wgts)	6

t Test
quenched-ccc
Assuming equal variances

Difference	0.069492	t Ratio	7.011252
Std Err Dif	0.009912	DF	4
Upper CL Dif	0.097011	Prob > |t|	0.0022
Lower CL Dif	0.041973	Prob > t	0.0011
Confidence	0.95	Prob < t	0.9989

Analysis of Variance

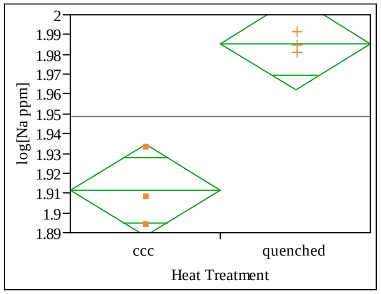
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00724378	0.007244	49.1577	0.0022
Error	4	0.00058943	0.000147		
C. Total	5	0.00783322			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.32549	0.00701	1.3060	1.3450
quenched	3	1.39499	0.00701	1.3755	1.4144

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=FY09EM21-28



Oneway Anova
Summary of Fit

Rsquare	0.90797
Adj Rsquare	0.884963
Root Mean Square Error	0.014438
Mean of Response	1.948486
Observations (or Sum Wgts)	6

t Test
quenched-ccc
Assuming equal variances

Difference	0.074055	t Ratio	6.282058
Std Err Dif	0.011788	DF	4
Upper CL Dif	0.106785	Prob > |t|	0.0033
Lower CL Dif	0.041325	Prob > t	0.0016
Confidence	0.95	Prob < t	0.9984

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00822622	0.008226	39.4642	0.0033
Error	4	0.00083379	0.000208		
C. Total	5	0.00906001			

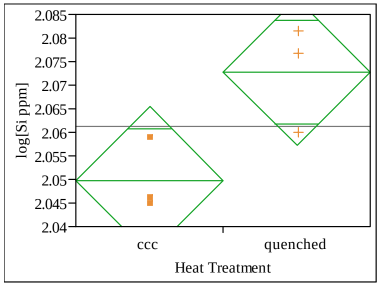
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.91146	0.00834	1.8883	1.9346
quenched	3	1.98551	0.00834	1.9624	2.0087

Std Error uses a pooled estimate of error variance

Exhibit B11. Effects of Heat Treatment for the Matrix 2 Rad Glasses

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=FY09EM21-28



Oneway Anova
Summary of Fit

Rsquare	0.677668
Adj Rsquare	0.597085
Root Mean Square Error	0.009709
Mean of Response	2.06132
Observations (or Sum Wgts)	6

t Test
quenched-ccc
Assuming equal variances

Difference	0.022989	t Ratio	2.899927
Std Err Dif	0.007927	DF	4
Upper CL Dif	0.044999	Prob > |t|	0.0441
Lower CL Dif	0.000979	Prob > t	0.0221
Confidence	0.95	Prob < t	0.9779

Analysis of Variance

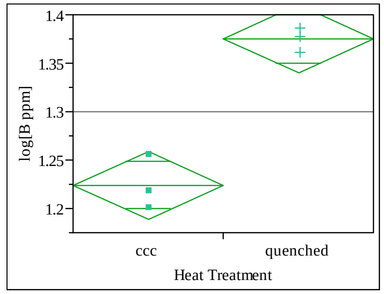
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00079273	0.000793	8.4096	0.0441
Error	4	0.00037706	0.000094		
C. Total	5	0.00116979			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.04983	0.00561	2.0343	2.0654
quenched	3	2.07281	0.00561	2.0573	2.0884

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=FY09EM21-29



Oneway Anova
Summary of Fit

Rsquare	0.946758
Adj Rsquare	0.933448
Root Mean Square Error	0.021896
Mean of Response	1.299656
Observations (or Sum Wgts)	6

t Test
quenched-ccc
Assuming equal variances

Difference	0.150782	t Ratio	8.433787
Std Err Dif	0.017878	DF	4
Upper CL Dif	0.200421	Prob > |t|	0.0011
Lower CL Dif	0.101144	Prob > t	0.0005
Confidence	0.95	Prob < t	0.9995

Analysis of Variance

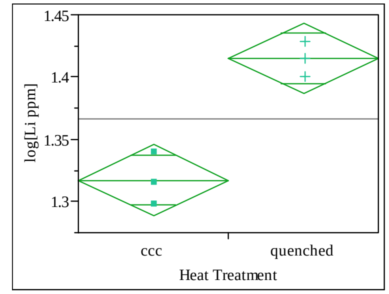
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.03410296	0.034103	71.1288	0.0011
Error	4	0.00191782	0.000479		
C. Total	5	0.03602078			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.22426	0.01264	1.1892	1.2594
quenched	3	1.37505	0.01264	1.3399	1.4101

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=FY09EM21-29



Oneway Anova
Summary of Fit

Rsquare	0.918657
Adj Rsquare	0.898321
Root Mean Square Error	0.017778
Mean of Response	1.366052
Observations (or Sum Wgts)	6

t Test
quenched-ccc
Assuming equal variances

Difference	0.097562	t Ratio	6.721194
Std Err Dif	0.014516	DF	4
Upper CL Dif	0.137864	Prob > |t|	0.0026
Lower CL Dif	0.057261	Prob > t	0.0013
Confidence	0.95	Prob < t	0.9987

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.01427766	0.014278	45.1744	0.0026
Error	4	0.00126422	0.000316		
C. Total	5	0.01554188			

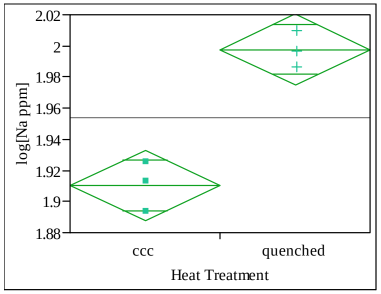
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.31727	0.01026	1.2888	1.3458
quenched	3	1.41483	0.01026	1.3863	1.4433

Std Error uses a pooled estimate of error variance

Exhibit B11. Effects of Heat Treatment for the Matrix 2 Rad Glasses

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=FY09EM21-29



Oneway Anova
Summary of Fit

Rsquare	0.93478
Adj Rsquare	0.918476
Root Mean Square Error	0.01413
Mean of Response	1.95405
Observations (or Sum Wgts)	6

t Test
quenched-ccc
Assuming equal variances

Difference	0.087354	t Ratio	7.571741
Std Err Dif	0.011537	DF	4
Upper CL Dif	0.119386	Prob > |t|	0.0016
Lower CL Dif	0.055323	Prob > t	0.0008
Confidence	0.95	Prob < t	0.9992

Analysis of Variance

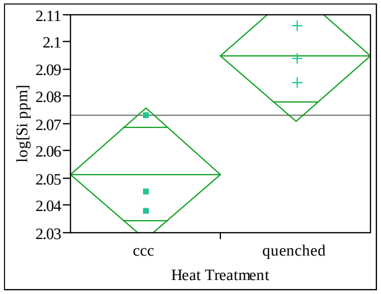
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.01144614	0.011446	57.3313	0.0016
Error	4	0.00079860	0.000200		
C. Total	5	0.01224473			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.91037	0.00816	1.8877	1.9330
quenched	3	1.99773	0.00816	1.9751	2.0204

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=FY09EM21-29



Oneway Anova
Summary of Fit

Rsquare	0.758539
Adj Rsquare	0.698174
Root Mean Square Error	0.015048
Mean of Response	2.073316
Observations (or Sum Wgts)	6

t Test
quenched-ccc
Assuming equal variances

Difference	0.043554	t Ratio	3.54483
Std Err Dif	0.012287	DF	4
Upper CL Dif	0.077667	Prob > |t|	0.0239
Lower CL Dif	0.009441	Prob > t	0.0120
Confidence	0.95	Prob < t	0.9880

Analysis of Variance

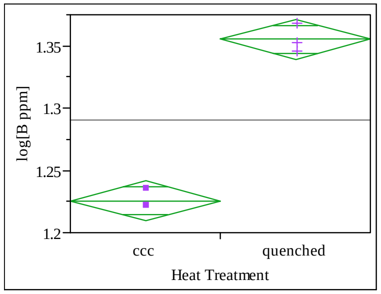
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00284544	0.002845	12.5658	0.0239
Error	4	0.00090577	0.000226		
C. Total	5	0.00375121			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.05154	0.00869	2.0274	2.0757
quenched	3	2.09509	0.00869	2.0710	2.1192

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=FY09EM21-30



Oneway Anova
Summary of Fit

Rsquare	0.984872
Adj Rsquare	0.98109
Root Mean Square Error	0.009847
Mean of Response	1.290426
Observations (or Sum Wgts)	6

t Test
quenched-ccc
Assuming equal variances

Difference	0.129738	t Ratio	16.13722
Std Err Dif	0.008040	DF	4
Upper CL Dif	0.152060	Prob > |t|	<.0001
Lower CL Dif	0.107417	Prob > t	<.0001
Confidence	0.95	Prob < t	1.0000

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.02524807	0.025248	260.4100	<.0001
Error	4	0.00038782	0.000097		
C. Total	5	0.02563589			

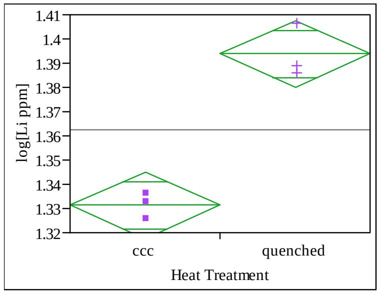
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.22556	0.00568	1.2098	1.2413
quenched	3	1.35530	0.00568	1.3395	1.3711

Std Error uses a pooled estimate of error variance

Exhibit B11. Effects of Heat Treatment for the Matrix 2 Rad Glasses

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=FY09EM21-30



Oneway Anova
Summary of Fit

Rsquare	0.952351
Adj Rsquare	0.940439
Root Mean Square Error	0.008585
Mean of Response	1.362641
Observations (or Sum Wgts)	6

t Test
quenched-ccc
Assuming equal variances

Difference	0.062675	t Ratio	8.941338
Std Err Dif	0.007010	DF	4
Upper CL Dif	0.082137	Prob > |t|	0.0009
Lower CL Dif	0.043213	Prob > t	0.0004
Confidence	0.95	Prob < t	0.9996

Analysis of Variance

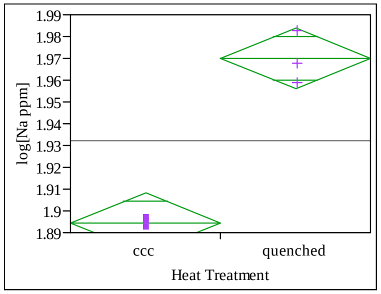
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00589222	0.005892	79.9475	0.0009
Error	4	0.00029480	0.000074		
C. Total	5	0.00618703			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.33130	0.00496	1.3175	1.3451
quenched	3	1.39398	0.00496	1.3802	1.4077

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=FY09EM21-30



Oneway Anova
Summary of Fit

Rsquare	0.965353
Adj Rsquare	0.956692
Root Mean Square Error	0.008743
Mean of Response	1.932249
Observations (or Sum Wgts)	6

t Test
quenched-ccc
Assuming equal variances

Difference	0.075365	t Ratio	10.55703
Std Err Dif	0.007139	DF	4
Upper CL Dif	0.095186	Prob > |t|	0.0005
Lower CL Dif	0.055545	Prob > t	0.0002
Confidence	0.95	Prob < t	0.9998

Analysis of Variance

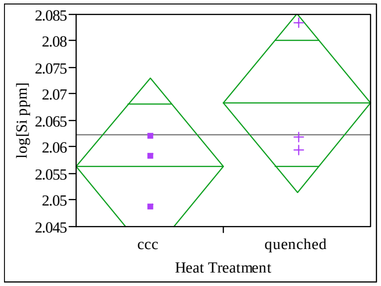
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00851988	0.008520	111.4509	0.0005
Error	4	0.00030578	0.000076		
C. Total	5	0.00882566			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.89457	0.00505	1.8806	1.9086
quenched	3	1.96993	0.00505	1.9559	1.9839

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=FY09EM21-30



Oneway Anova
Summary of Fit

Rsquare	0.329445
Adj Rsquare	0.161806
Root Mean Square Error	0.010506
Mean of Response	2.062254
Observations (or Sum Wgts)	6

t Test
quenched-ccc
Assuming equal variances

Difference	0.01203	t Ratio	1.401859
Std Err Dif	0.00858	DF	4
Upper CL Dif	0.03584	Prob > |t|	0.2336
Lower CL Dif	-0.01179	Prob > t	0.1168
Confidence	0.95	Prob < t	0.8832

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00021692	0.000217	1.9652	0.2336
Error	4	0.00044151	0.000110		
C. Total	5	0.00065843			

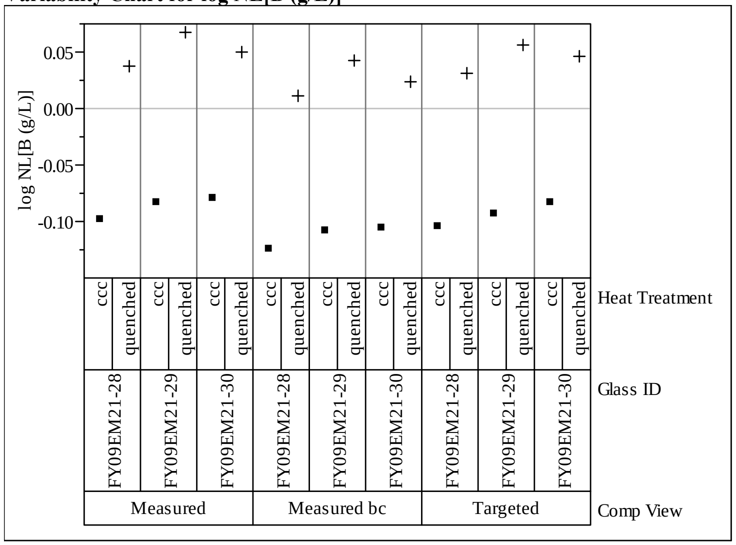
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.05624	0.00607	2.0394	2.0731
quenched	3	2.06827	0.00607	2.0514	2.0851

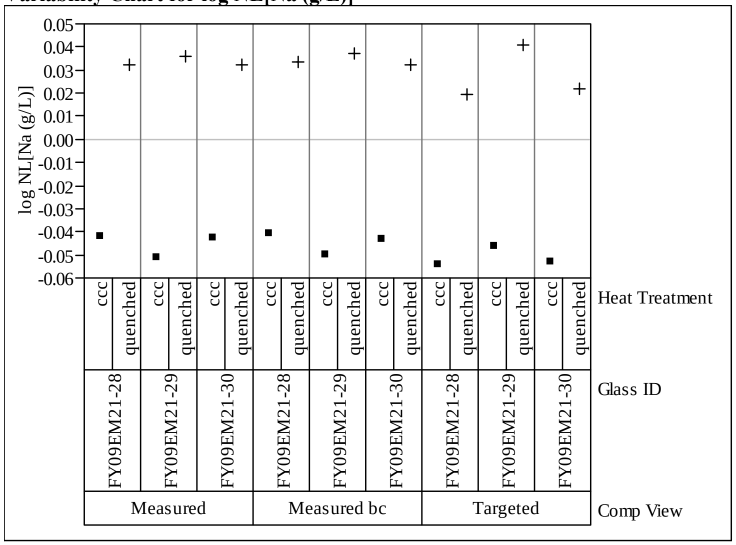
Std Error uses a pooled estimate of error variance

Exhibit B12. Effects of Heat Treatment for the Matrix 2 Rad Glasses by Compositional View

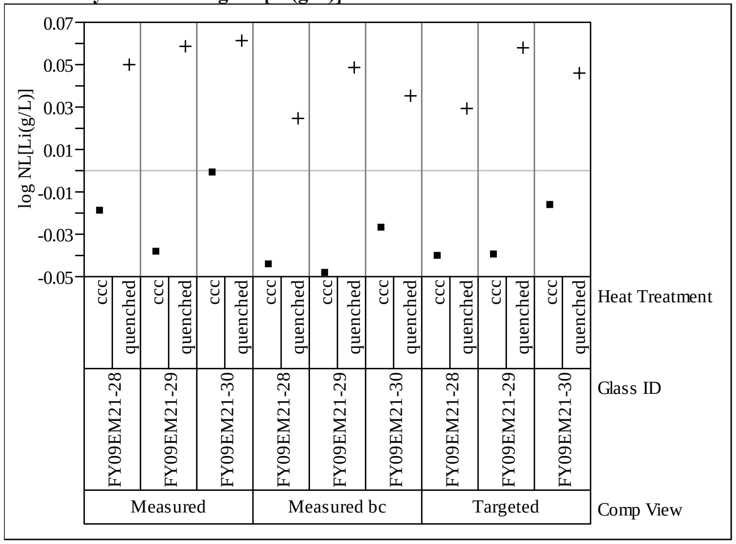
Variability Chart for log NL[B (g/L)]



Variability Chart for log NL[Na (g/L)]



Variability Chart for log NL[Li(g/L)]



Variability Chart for log NL[Si (g/L)]

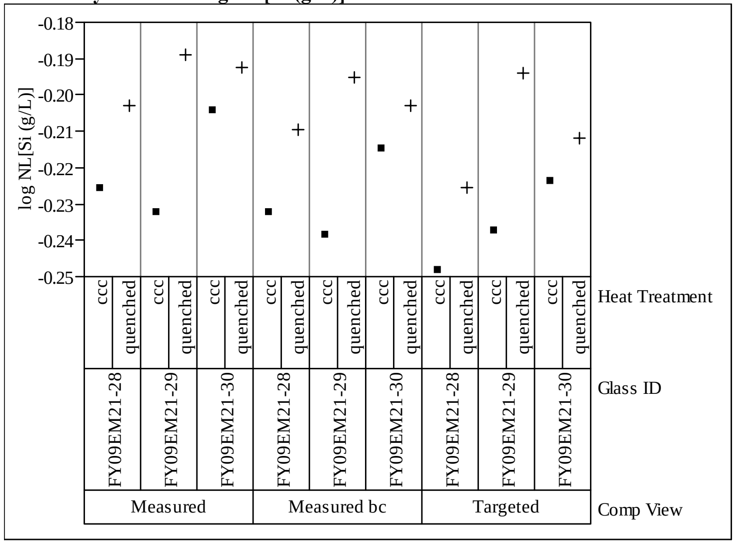
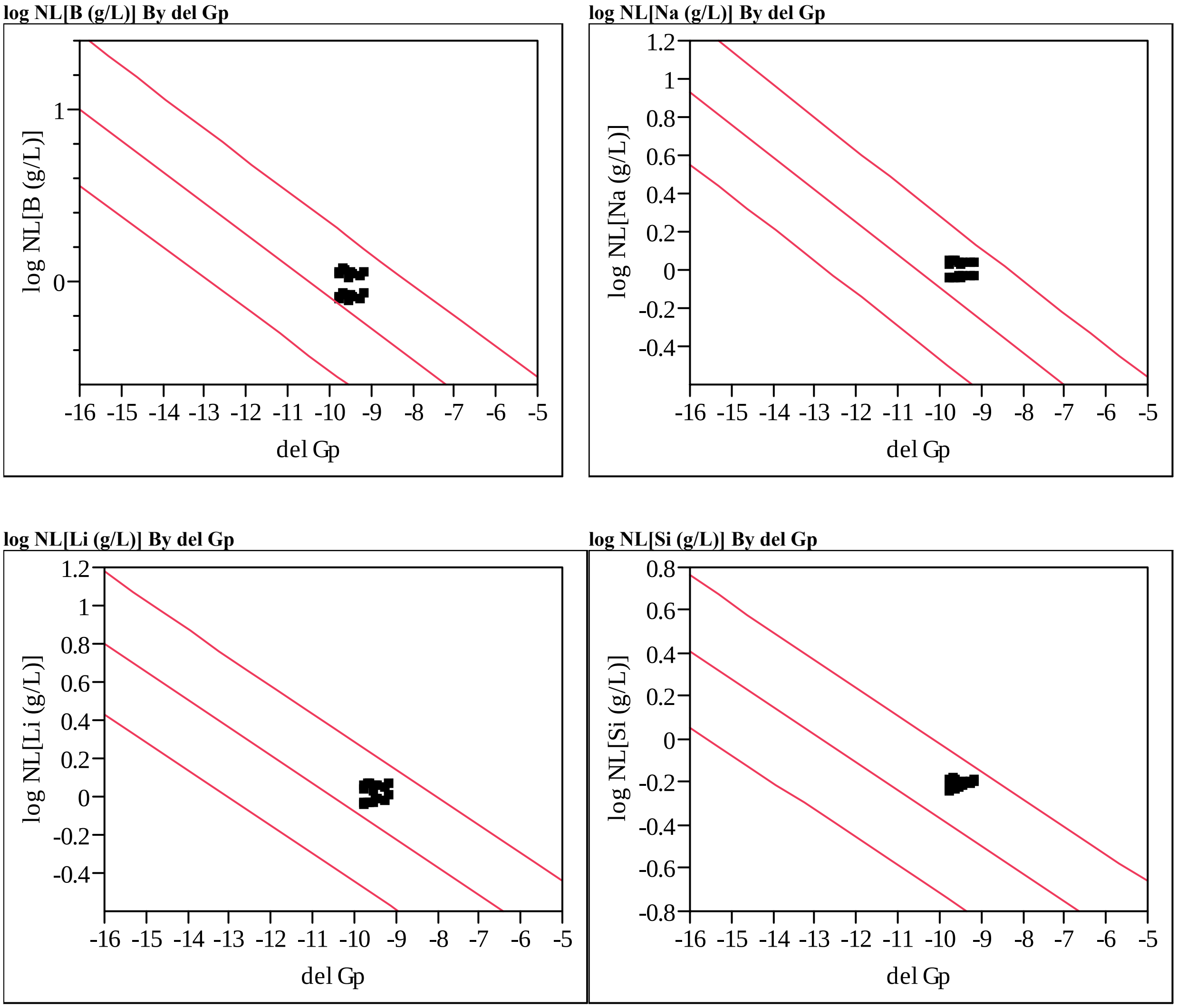


Exhibit B13. del Gp (ΔG_p) Predictions versus Common Logarithm Normalized Leachate Concentrations over All Compositional Views and Heat Treatments for the Rad Glasses from the Matrix 2 Study



Appendix C:

Exhibits Supporting the Analysis of the Viscosity Measurements of the Matrix 2 Study Glasses

Exhibit C1. VFT fit of FY09EM21-02.

Nonlinear Fit Glass ID=FY09EM21-02
Response: ln(n; poise), Predictor: ln(n; VTF)

Control Panel

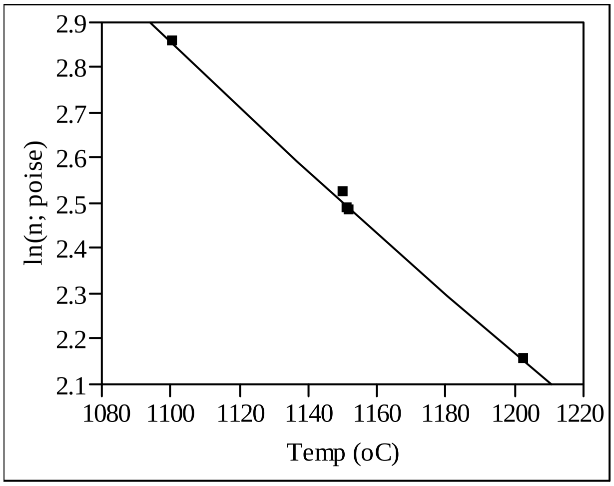
Converged in Gradient

Criterion	Current	Stop Limit
Iteration	2	60
Obj Change	7.2903937e-8	1e-15
Relative Gradient	0.0001045404	0.000001
Gradient	5.7536147e-8	0.000001

Parameter	Current Value
C	-553.0362445
B	19954.017859
A	-9.213600734

SSE
0.000613249
N
5

Edit Alpha
0.050Convergence Criterion
0.00001Goal SSE for CL
.
Plot



Parameter	Estimate	Low	High
C	-553.0362445	64.1049	192.315
B	19954.017859	3212.47	9637.41
A	-9.213600734	-5.8424	-1.9475

Solution

SSE	DFE	MSE	RMSE
0.000613249	2	0.0003066	0.0175107

Parameter	Estimate	ApproxStdErr
C	-553.0362445	2623.41905
B	19954.017859	61490.0895
A	-9.213600734	18.053176

Solved By:
Analytic NR

Exhibit C2. VFT fit of FY09EM21-05.

Nonlinear Fit Glass ID=FY09EM21-05
Response: ln(n; poise), Predictor: ln(n; VTF)

Control Panel

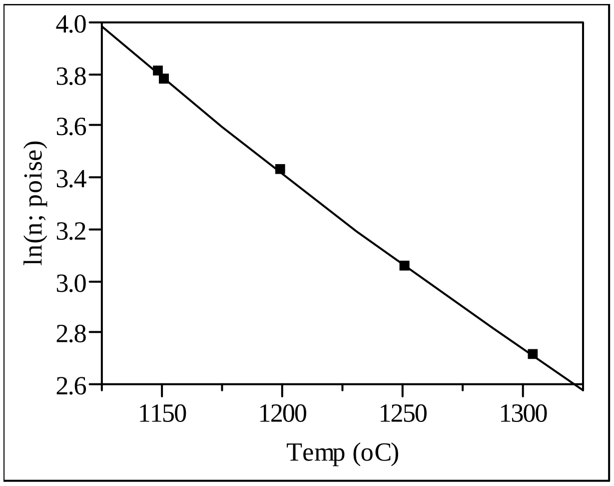
Converged in Gradient

Criterion	Current	Stop Limit
Iteration	4	60
Obj Change	2.6523406e-7	1e-15
Relative Gradient	9.9809815e-8	0.000001
Gradient	9.6159454e-8	0.000001

Parameter	Current Value
C	-364.1576961
B	17684.147514
A	-7.891421959

SSE
0.0001830874
N
5

Edit Alpha
0.050Convergence Criterion
0.00001Goal SSE for CL
.
Plot



Parameter	Estimate	Low	High
C	-364.1576961	64.1049	192.315
B	17684.147514	3212.47	9637.41
A	-7.891421959	-5.8424	-1.9475

Solution

SSE	DFE	MSE	RMSE
0.0001830874	2	9.1544e-5	0.0095678

Parameter	Estimate	ApproxStdErr
C	-364.1576961	609.18502
B	17684.147514	13616.1591
A	-7.891421959	4.29690698

Solved By:
Analytic NR

Exhibit C3. VFT fit of FY09EM21-06.

Nonlinear Fit Glass ID=FY09EM21-06
Response: ln(n; poise), Predictor: ln(n; VTF)

Control Panel

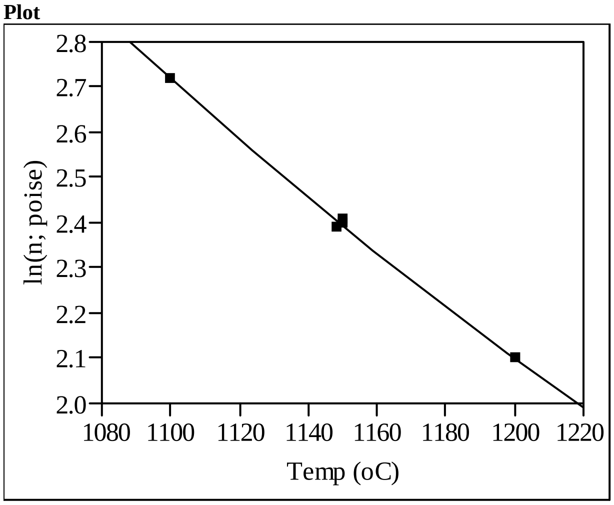
Converged in Gradient

Criterion	Current	Stop Limit
Iteration	0	60
Obj Change	.	1e-15
Relative Gradient	3.102121e-7	0.000001
Gradient	3.0995937e-7	0.000001

Parameter	Current Value
C	128.20980796
B	6424.9401356
A	-3.894957375

SSE
0.0002981023
N
5

Edit Alpha
0.050Convergence Criterion
0.00001Goal SSE for CL
.
Plot



Parameter	Estimate	Low	High
C	128.20980796	64.1049	192.315
B	6424.9401356	3212.47	9637.41
A	-3.894957375	-5.8424	-1.9475

Solution

SSE	DFE	MSE	RMSE
0.0002981023	2	0.0001491	0.0122087

Parameter	Estimate	ApproxStdErr
C	128.20980796	750.772494
B	6424.9401356	9469.99104
A	-3.894957375	4.64513029

Solved By:
Analytic NR

Exhibit C4. VFT fit of FY09EM21-07.

Nonlinear Fit Glass ID=FY09EM21-07
Response: ln(n; poise), Predictor: ln(n; VTF)

Control Panel

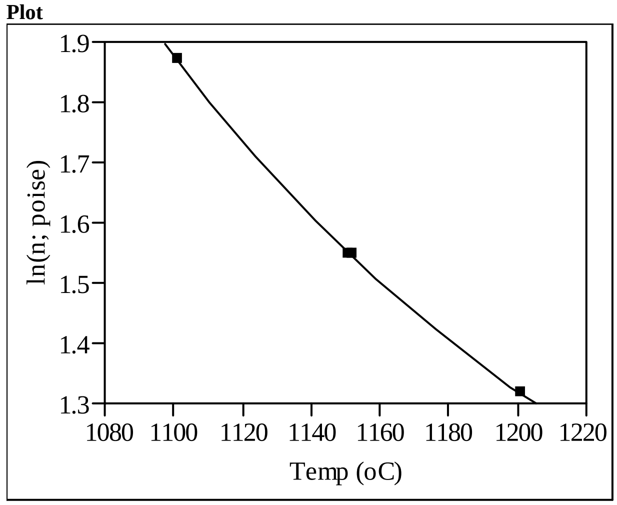
Converged in Gradient

Criterion	Current	Stop Limit
Iteration	11	60
Obj Change	9.0587534e-7	1e-15
Relative Gradient	6.085017e-7	0.000001
Gradient	5.9022959e-7	0.000001

Parameter	Current Value
C	842.64527497
B	512.70471375
A	-0.114261429

SSE
0.0000193872
N
5

Edit Alpha
0.050Convergence Criterion
0.00001Goal SSE for CL
.
Plot



Parameter	Estimate	Low	High
C	842.64527497	64.1049	192.315
B	512.70471375	3212.47	9637.41
A	-0.114261429	-5.8424	-1.9475

Solution

SSE	DFE	MSE	RMSE
0.0000193872	2	9.6936e-6	0.0031135

Parameter	Estimate	ApproxStdErr
C	842.64527497	19.7020121
B	512.70471375	67.9247838
A	-0.114261429	0.11330754

Solved By:
Analytic NR

Exhibit C5. VFT fit of FY09EM21-08.

Nonlinear Fit Glass ID=FY09EM21-08

Response: ln(n; poise), Predictor: ln(n; VTF)

Control Panel

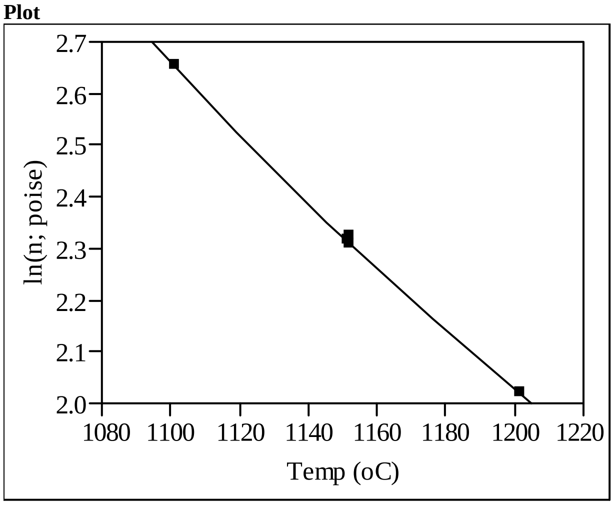
Converged in Gradient

Criterion	Current	Stop Limit
Iteration	22	60
Obj Change	1.580292e-11	1e-15
Relative Gradient	4.500047e-12	0.000001
Gradient	4.417614e-12	0.000001

Parameter	Current Value
C	425.17134708
B	3310.4774856
A	-2.24536641

SSE
0.0001316768
N
5

Edit Alpha
0.050Convergence Criterion
0.00001Goal SSE for CL
.
Plot



Parameter	Estimate	Low	High
C	425.17134708	64.1049	192.315
B	3310.4774856	3212.47	9637.41
A	-2.24536641	-5.8424	-1.9475

Solution

SSE	DFE	MSE	RMSE
0.0001316768	2	6.5838e-5	0.0081141

Parameter	Estimate	ApproxStdErr
C	425.17134708	246.384961
B	3310.4774856	2261.24789
A	-2.24536641	1.56529602

Solved By:
Analytic NR

Exhibit C6. VFT fit of FY09EM21-09.

Nonlinear Fit Glass ID=FY09EM21-09

Response: ln(n; poise), Predictor: ln(n; VTF)

Control Panel

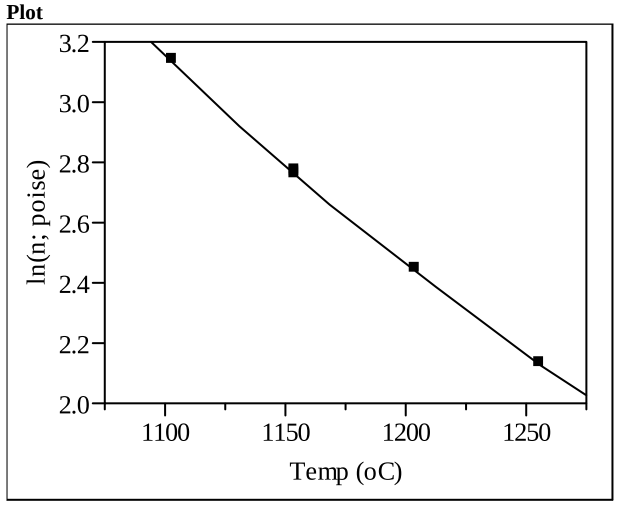
Converged in Gradient

Criterion	Current	Stop Limit
Iteration	4	60
Obj Change	4.394676e-11	1e-15
Relative Gradient	6.1727369e-9	0.000001
Gradient	2.5730692e-9	0.000001

Parameter	Current Value
C	225.00199851
B	5922.1755566
A	-3.613128561

SSE
0.0000916958
N
6

Edit Alpha
0.050Convergence Criterion
0.00001Goal SSE for CL
.
Plot



Parameter	Estimate	Low	High
C	225.00199851	64.1049	192.315
B	5922.1755566	3212.47	9637.41
A	-3.613128561	-5.8424	-1.9475

Solution

SSE	DFE	MSE	RMSE
0.0000916958	3	3.0565e-5	0.0055286

Parameter	Estimate	ApproxStdErr
C	225.00199851	125.673394
B	5922.1755566	1567.21647
A	-3.613128561	0.82357526

Solved By:
Analytic NR

Exhibit C7. VFT fit of FY09EM21-11.

Nonlinear Fit Glass ID=FY09EM21-11

Response: ln(n; poise), Predictor: ln(n; VTF)

Control Panel

Converged in Gradient

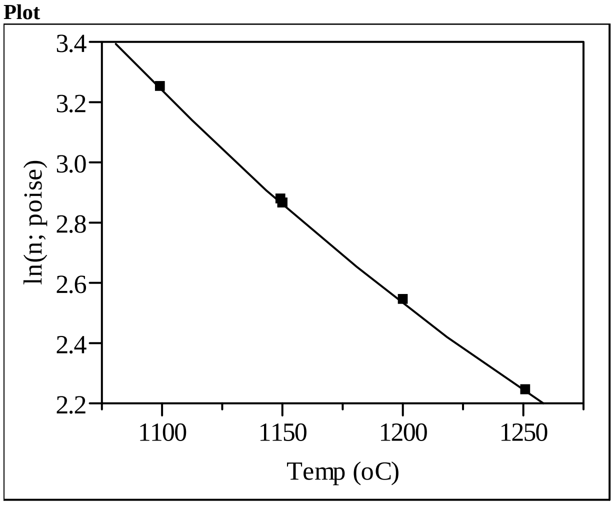
Criterion	Current	Stop Limit
Iteration	5	60
Obj Change	3.3428941e-8	1e-15
Relative Gradient	6.2582353e-9	0.000001
Gradient	5.954877e-9	0.000001

Parameter	Current Value
C	383.36806533
B	4123.5245323
A	-2.514214664

SSE
0.0000376747
N
6

Edit Alpha
0.050Convergence Criterion
0.00001Goal SSE for CL
.

Plot



Parameter	Estimate	Low	High
C	383.36806533	64.1049	192.315
B	4123.5245323	3212.47	9637.41
A	-2.514214664	-5.8424	-1.9475

Solution

SSE	DFE	MSE	RMSE
0.0000376747	3	1.2558e-5	0.0035438

Parameter	Estimate	ApproxStdErr
C	383.36806533	54.4648039
B	4123.5245323	571.200069
A	-2.514214664	0.36227335

Solved By:
Analytic NR

Exhibit C8. VFT fit of FY09EM21-12.

Nonlinear Fit Glass ID=FY09EM21-12

Response: ln(n; poise), Predictor: ln(n; VTF)

Control Panel

Converged in Gradient

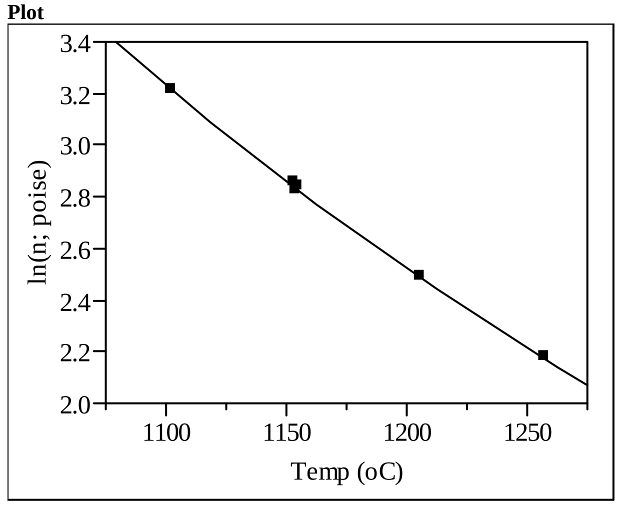
Criterion	Current	Stop Limit
Iteration	2	60
Obj Change	2.1149404e-6	1e-15
Relative Gradient	5.9636071e-7	0.000001
Gradient	5.8520192e-7	0.000001

Parameter	Current Value
C	126.96478956
B	7411.5770129
A	-4.383504331

SSE
0.0005201352
N
6

Edit Alpha
0.050Convergence Criterion
0.00001Goal SSE for CL
.

Plot



Parameter	Estimate	Low	High
C	126.96478956	64.1049	192.315
B	7411.5770129	3212.47	9637.41
A	-4.383504331	-5.8424	-1.9475

Solution

SSE	DFE	MSE	RMSE
0.0005201352	3	0.0001734	0.0131673

Parameter	Estimate	ApproxStdErr
C	126.96478956	343.809415
B	7411.5770129	4857.24716
A	-4.383504331	2.31115036

Solved By:
Analytic NR

Exhibit C9. VFT fit of FY09EM21-14.

Nonlinear Fit Glass ID=FY09EM21-14
Response: ln(n; poise), Predictor: ln(n; VTF)

Control Panel

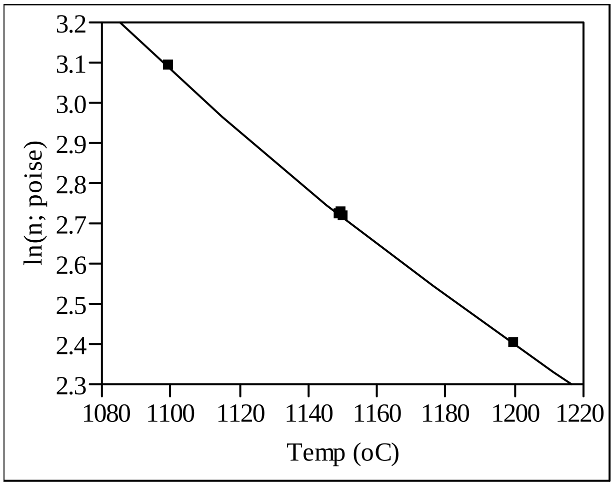
Converged in Gradient

Criterion	Current	Stop Limit
Iteration	5	60
Obj Change	4.3500506e-9	1e-15
Relative Gradient	6.417153e-10	0.000001
Gradient	6.390685e-10	0.000001

Parameter	Current Value
C	354.83240014
B	4309.4394088
A	-2.702202371

SSE
0.0000504192
N
5

Edit Alpha
0.050Convergence Criterion
0.00001Goal SSE for CL
.
Plot



Parameter	Estimate	Low	High
C	354.83240014	64.1049	192.315
B	4309.4394088	3212.47	9637.41
A	-2.702202371	-5.8424	-1.9475

Solution

SSE	DFE	MSE	RMSE
0.0000504192	2	0.0000252	0.0050209

Parameter	Estimate	ApproxStdErr
C	354.83240014	167.383678
B	4309.4394088	1826.09644
A	-2.702202371	1.1545323

Solved By:
Analytic NR

Exhibit C10. VFT fit of FY09EM21-15.

Nonlinear Fit Glass ID=FY09EM21-15
Response: ln(n; poise), Predictor: ln(n; VTF)

Control Panel

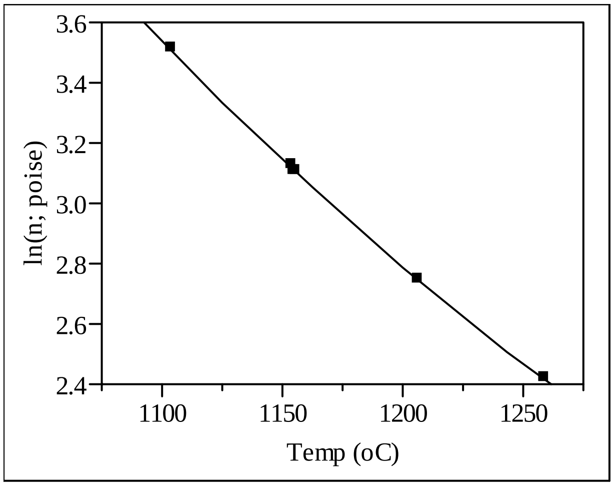
Converged in Gradient

Criterion	Current	Stop Limit
Iteration	4	60
Obj Change	5.7405127e-9	1e-15
Relative Gradient	1.531954e-9	0.000001
Gradient	9.362284e-10	0.000001

Parameter	Current Value
C	249.64447364
B	6062.7150125
A	-3.591171912

SSE
0.0000884628
N
6

Edit Alpha
0.050Convergence Criterion
0.00001Goal SSE for CL
.
Plot



Parameter	Estimate	Low	High
C	249.64447364	64.1049	192.315
B	6062.7150125	3212.47	9637.41
A	-3.591171912	-5.8424	-1.9475

Solution

SSE	DFE	MSE	RMSE
0.0000884628	3	2.9488e-5	0.0054302

Parameter	Estimate	ApproxStdErr
C	249.64447364	105.666927
B	6062.7150125	1382.56024
A	-3.591171912	0.74448329

Solved By:
Analytic NR

Exhibit C11. VFT fit of FY09EM21-16.

Nonlinear Fit Glass ID=FY09EM21-16

Response: ln(n; poise), Predictor: ln(n; VTF)

Control Panel

Converged in Gradient

Criterion	Current	Stop Limit
Iteration	4	60
Obj Change	2.064385e-11	1e-15
Relative Gradient	1.2678757e-8	0.000001
Gradient	4.5803466e-9	0.000001

Parameter	Current Value
C	207.16202256
B	6363.7022981
A	-3.677116231

SSE

0.0002337324

N

6

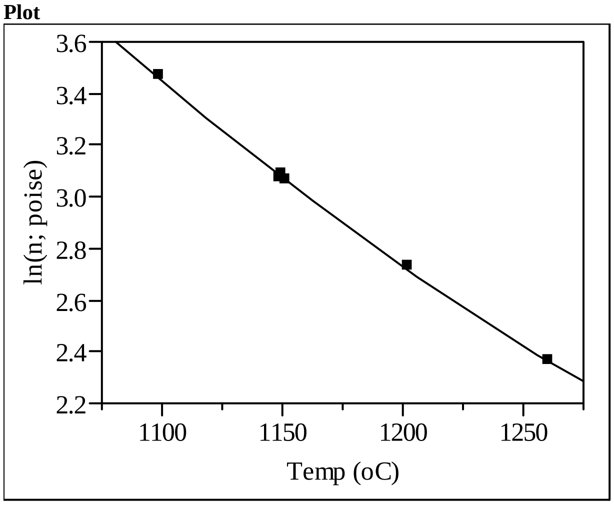
Edit Alpha

0.050Convergence Criterion

0.00001Goal SSE for CL

.

Plot



Parameter	Estimate	Low	High
C	207.16202256	64.1049	192.315
B	6363.7022981	3212.47	9637.41
A	-3.677116231	-5.8424	-1.9475

Solution

SSE	DFE	MSE	RMSE
0.0002337324	3	7.7911e-5	0.0088267

Parameter	Estimate	ApproxStdErr
C	207.16202256	180.809689
B	6363.7022981	2377.80928
A	-3.677116231	1.2260369

Solved By:

Analytic NR

Exhibit C12. VFT fit of FY09EM21-17.

Nonlinear Fit Glass ID=FY09EM21-17

Response: ln(n; poise), Predictor: ln(n; VTF)

Control Panel

Converged in Gradient

Criterion	Current	Stop Limit
Iteration	4	60
Obj Change	1.0127935e-9	1e-15
Relative Gradient	0.0032910295	0.000001
Gradient	7.5859816e-7	0.000001

Parameter	Current Value
C	-792.755299
B	24270.188402
A	-10.18757065

SSE

0.0001158608

N

5

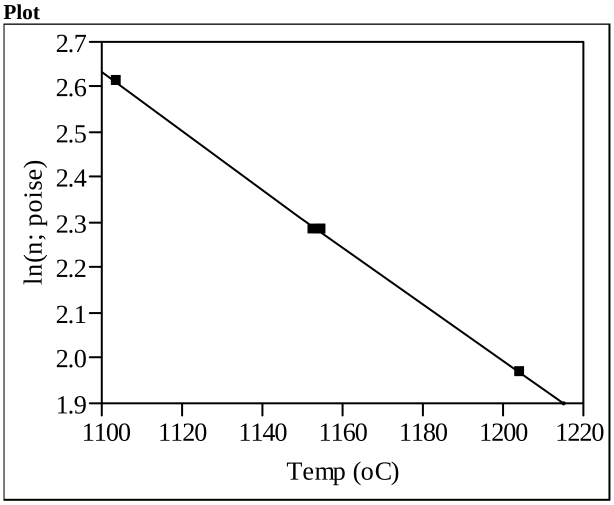
Edit Alpha

0.050Convergence Criterion

0.00001Goal SSE for CL

.

Plot



Parameter	Estimate	ApproxStdErr
C	-792.755299	2302.32145
B	24270.188402	57468.1933
A	-10.18757065	14.7727398

Solution

SSE	DFE	MSE	RMSE
0.0001158608	2	5.793e-5	0.0076112

Parameter	Estimate	Low	High
C	-792.755299	-14607	13021.2
B	24270.188402	-320539	369079
A	-10.18757065	-98.824	78.4489

Solved By:

Analytic NR

Exhibit C13. VFT fit of FY09EM21-18.

Nonlinear Fit Glass ID=FY09EM21-18
Response: ln(n; poise), Predictor: ln(n; VTF)

Control Panel

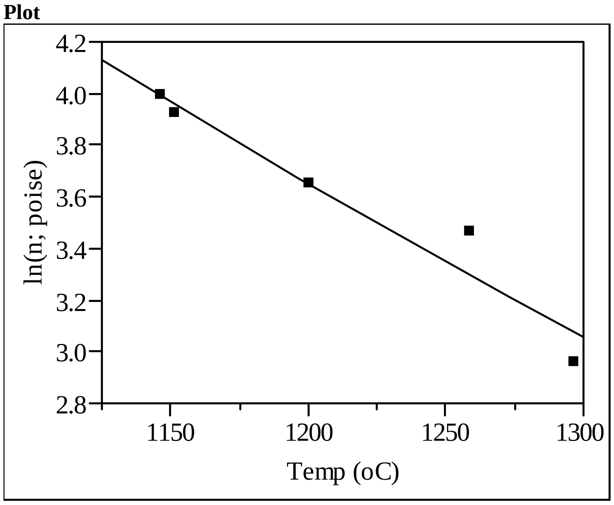
Converged in Gradient

Criterion	Current	Stop Limit
Iteration	15	60
Obj Change	6.164005e-10	1e-15
Relative Gradient	.	0.000001
Gradient	3.2366588e-7	0.000001

Parameter	Current Value
C	-1079.690952
B	32182.060002
A	-10.46855138

SSE
0.042426804
N
5

Edit Alpha
0.050Convergence Criterion
0.00001Goal SSE for CL
.
Plot



Parameter	Estimate	Low	High
C	-1079.690952	64.1049	192.315
B	32182.060002	3212.47	9637.41
A	-10.46855138	-5.8424	-1.9475

Solution

SSE	DFE	MSE	RMSE
0.042426804	2	0.0212134	0.1456482

Parameter	Estimate	ApproxStdErr
C	-1079.690952	4243.08542
B	32182.060002	118122.459
A	-10.46855138	25.587628

Solved By:
Analytic NR

Exhibit C14. VFT fit of FY09EM21-19.

Nonlinear Fit Glass ID=FY09EM21-19
Response: ln(n; poise), Predictor: ln(n; VTF)

Control Panel

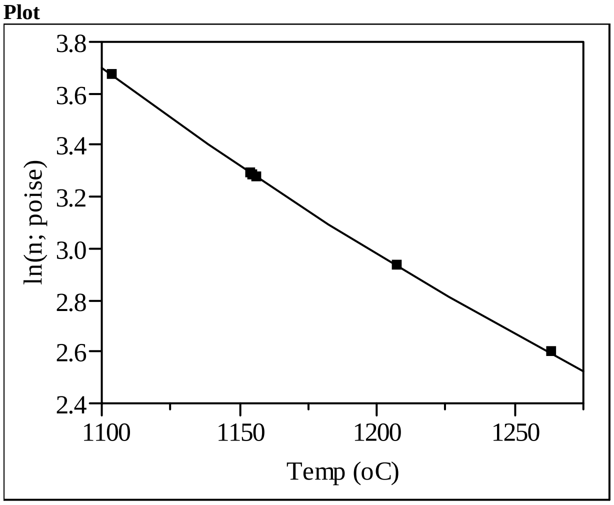
Converged in Gradient

Criterion	Current	Stop Limit
Iteration	4	60
Obj Change	1.5437009e-8	1e-15
Relative Gradient	2.0544559e-9	0.000001
Gradient	1.8962762e-9	0.000001

Parameter	Current Value
C	270.9412507
B	5563.7321938
A	-3.014681047

SSE
0.0000460635
N
6

Edit Alpha
0.050Convergence Criterion
0.00001Goal SSE for CL
.
Plot



Parameter	Estimate	Low	High
C	270.9412507	64.1049	192.315
B	5563.7321938	3212.47	9637.41
A	-3.014681047	-5.8424	-1.9475

Solution

SSE	DFE	MSE	RMSE
0.0000460635	3	1.5354e-5	0.0039185

Parameter	Estimate	ApproxStdErr
C	270.9412507	71.9476068
B	5563.7321938	881.867268
A	-3.014681047	0.48464695

Solved By:
Analytic NR

Exhibit C15. VFT fit of FY09EM21-20.

Nonlinear Fit Glass ID=FY09EM21-20
Response: ln(n; poise), Predictor: ln(n; VTF)

Control Panel

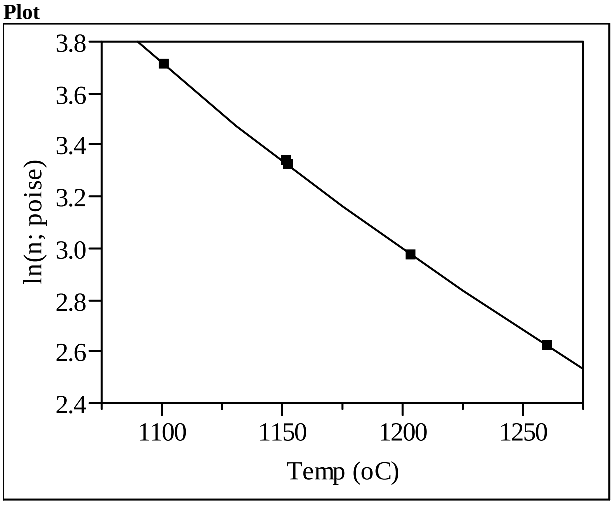
Converged in Gradient

Criterion	Current	Stop Limit
Iteration	3	60
Obj Change	1.3081083e-6	1e-15
Relative Gradient	2.8569496e-7	0.000001
Gradient	2.7224125e-7	0.000001

Parameter	Current Value
C	54.212644118
B	8661.4175821
A	-4.565140805

SSE
0.0000761407
N
6

Edit Alpha
0.050Convergence Criterion
0.00001Goal SSE for CL
.
Plot



Parameter	Estimate	Low	High
C	54.212644118	64.1049	192.315
B	8661.4175821	3212.47	9637.41
A	-4.565140805	-5.8424	-1.9475

Solution

SSE	DFE	MSE	RMSE
0.0000761407	3	2.538e-5	0.0050379

Parameter	Estimate	ApproxStdErr
C	54.212644118	141.025648
B	8661.4175821	2174.72464
A	-4.565140805	0.96659439

Solved By:
Analytic NR

Exhibit C16. VFT fit of FY09EM21-21.

Nonlinear Fit Glass ID=FY09EM21-21
Response: ln(n; poise), Predictor: ln(n; VTF)

Control Panel

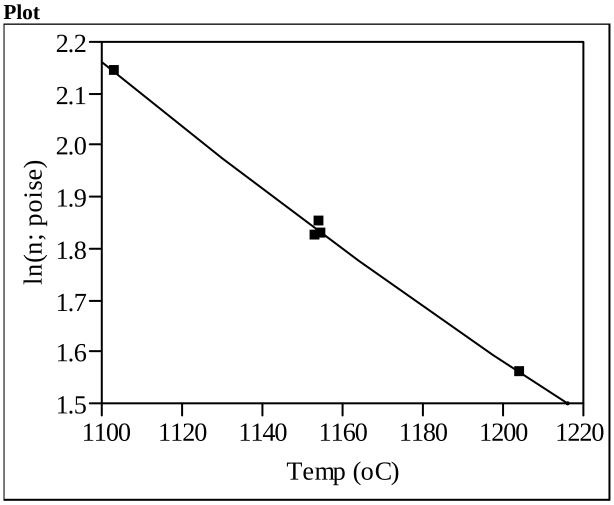
Converged in Gradient

Criterion	Current	Stop Limit
Iteration	3	60
Obj Change	2.3640854e-6	1e-15
Relative Gradient	7.0755497e-7	0.000001
Gradient	7.0472487e-7	0.000001

Parameter	Current Value
C	239.5386168
B	4797.7500663
A	-3.414128589

SSE
0.0004897508
N
5

Edit Alpha
0.050Convergence Criterion
0.00001Goal SSE for CL
.
Plot



Parameter	Estimate	Low	High
C	239.5386168	64.1049	192.315
B	4797.7500663	3212.47	9637.41
A	-3.414128589	-5.8424	-1.9475

Solution

SSE	DFE	MSE	RMSE
0.0004897508	2	0.0002449	0.0156485

Parameter	Estimate	ApproxStdErr
C	239.5386168	814.014125
B	4797.7500663	8583.15162
A	-3.414128589	4.71219599

Solved By:
Analytic NR

Exhibit C17. VFT fit of FY09EM21-25.

Nonlinear Fit Glass ID=FY09EM21-25
Response: ln(n; poise), Predictor: ln(n; VTF)

Control Panel

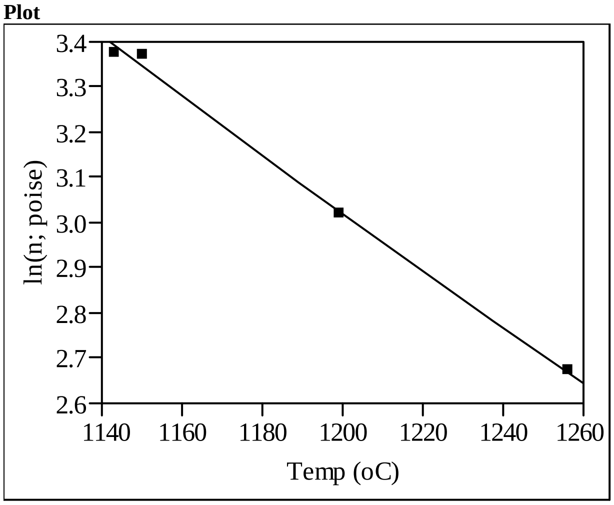
Converged in Gradient

Criterion	Current	Stop Limit
Iteration	5	60
Obj Change	9.0092777e-7	1e-15
Relative Gradient	1.1468472e-7	0.000001
Gradient	8.1041489e-8	0.000001

Parameter	Current Value
C	-545.4128966
B	19547.958968
A	-8.18359794

SSE
0.0010014471
N
4

Edit Alpha
0.050Convergence Criterion
0.00001Goal SSE for CL
.
Plot



Parameter	Estimate	Low	High
C	-545.4128966	64.1049	192.315
B	19547.958968	3212.47	9637.41
A	-8.18359794	-5.8424	-1.9475

Solution

SSE	DFE	MSE	RMSE
0.0010014471	1	0.0010014	0.0316456

Parameter	Estimate	ApproxStdErr
C	-545.4128966	5733.28843
B	19547.958968	128656.272
A	-8.18359794	36.8991529

Solved By:
Analytic NR

Exhibit C18. VFT fit of FY09EM21-27.

Nonlinear Fit Glass ID=FY09EM21-27
Response: ln(n; poise), Predictor: ln(n; VTF)

Control Panel

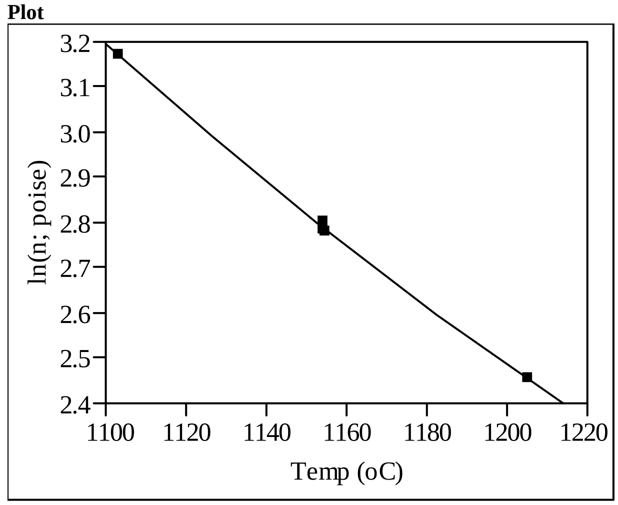
Converged in Gradient

Criterion	Current	Stop Limit
Iteration	5	60
Obj Change	2.8163382e-7	1e-15
Relative Gradient	5.2615069e-8	0.000001
Gradient	5.2348983e-8	0.000001

Parameter	Current Value
C	418.63075019
B	3785.1845033
A	-2.359939853

SSE
0.0002613861
N
5

Edit Alpha
0.050Convergence Criterion
0.00001Goal SSE for CL
.
Plot



Parameter	Estimate	Low	High
C	418.63075019	64.1049	192.315
B	3785.1845033	3212.47	9637.41
A	-2.359939853	-5.8424	-1.9475

Solution

SSE	DFE	MSE	RMSE
0.0002613861	2	0.0001307	0.0114321

Parameter	Estimate	ApproxStdErr
C	418.63075019	309.057127
B	3785.1845033	3202.86276
A	-2.359939853	2.18952781

Solved By:
Analytic NR

Appendix D:

Tables and Exhibits Supporting the Analysis of the Chemical Composition Measurements of the Matrix 2A Study Glasses

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Table D1. Measured Elemental Concentrations (wt%) for the Matrix 2A Study Glasses Prepared Using Lithium Metaborate (part 1)

Set	Glass ID	Block	Sub-Block	Sequence	Lab ID	Al (wt%)	Ba (wt%)	Ca (wt%)	Cd (wt%)	Ce (wt%)	Cr (wt%)	Cu (wt%)	Fe (wt%)	La (wt%)
1	Batch 1	1	1	1	BCHLM1111	2.48	0.123	0.864	<0.010	<0.010	0.072	0.308	8.82	<0.010
1	EM-15	1	1	2	r10LM21	7.69	0.062	3.26	<0.010	0.198	0.056	0.036	7.93	0.059
1	EM-13	1	1	3	r02LM21	7.54	0.057	1.74	<0.010	0.197	0.064	0.040	8.04	0.057
1	EM-04	1	1	4	r07LM11	3.51	0.062	0.939	<0.010	0.193	0.082	0.045	9.98	0.055
1	EM-15	1	1	5	r10LM11	7.49	0.063	3.14	<0.010	0.202	0.058	0.036	7.95	0.060
1	EM-05	1	1	6	r11LM11	3.44	0.063	0.927	<0.010	0.200	0.072	0.035	11.3	0.060
1	EM-11	1	1	7	r15LM21	5.98	0.063	0.929	<0.010	0.204	0.064	0.038	9.48	0.060
1	EM-07	1	1	8	r09LM21	3.45	0.062	2.36	<0.010	0.201	0.065	0.045	12.5	0.059
1	EM-04	1	1	9	r07LM21	3.40	0.062	0.920	<0.010	0.195	0.081	0.042	9.87	0.055
1	Batch 1	1	1	10	BCHLM1112	2.48	0.119	0.842	<0.010	<0.010	0.070	0.308	8.65	<0.010
1	EM-05	1	1	11	r11LM21	3.56	0.063	0.989	<0.010	0.200	0.074	0.035	11.0	0.060
1	EM-03	1	1	12	r04LM21	4.78	0.063	0.974	<0.010	0.196	0.080	0.048	9.69	0.059
1	EM-11	1	1	13	r15LM11	6.10	0.064	0.943	<0.010	0.203	0.064	0.037	9.34	0.061
1	EM-13	1	1	14	r02LM11	7.61	0.055	1.77	<0.010	0.191	0.063	0.041	8.07	0.055
1	EM-03	1	1	15	r04LM11	4.85	0.062	0.992	<0.010	0.196	0.079	0.040	9.66	0.059
1	EM-14	1	1	16	r08LM11	7.63	0.063	2.50	<0.010	0.194	0.063	0.042	8.02	0.059
1	EM-07	1	1	17	r09LM11	3.59	0.060	2.49	<0.010	0.196	0.063	0.059	12.1	0.057
1	EM-14	1	1	18	r08LM21	7.55	0.060	2.95	<0.010	0.190	0.060	0.043	8.08	0.057
1	Batch 1	1	1	19	BCHLM1113	2.52	0.119	0.871	<0.010	<0.010	0.070	0.302	8.62	<0.010
1	Batch 1	1	2	1	BCHLM1121	2.50	0.119	0.857	<0.010	<0.010	0.072	0.308	8.91	<0.010
1	EM-07	1	2	2	r09LM22	3.48	0.063	2.42	<0.010	0.203	0.067	0.043	12.7	0.060
1	EM-15	1	2	3	r10LM12	7.60	0.063	3.21	<0.010	0.204	0.059	0.035	8.04	0.059
1	EM-11	1	2	4	r15LM12	6.16	0.062	0.969	<0.010	0.206	0.064	0.037	9.48	0.061
1	EM-07	1	2	5	r09LM12	3.59	0.060	2.50	<0.010	0.200	0.063	0.058	12.6	0.058
1	EM-04	1	2	6	r07LM22	3.48	0.062	0.955	<0.010	0.198	0.082	0.041	9.98	0.055
1	EM-14	1	2	7	r08LM12	7.56	0.062	2.47	<0.010	0.196	0.063	0.041	8.41	0.059
1	EM-03	1	2	8	r04LM12	4.86	0.063	0.984	<0.010	0.200	0.081	0.039	10.1	0.059
1	EM-05	1	2	9	r11LM12	3.48	0.063	0.944	<0.010	0.202	0.072	0.034	11.5	0.059
1	Batch 1	1	2	10	BCHLM1122	2.53	0.118	0.876	<0.010	<0.010	0.071	0.324	8.77	<0.010
1	EM-15	1	2	11	r10LM22	7.51	0.061	3.17	<0.010	0.202	0.057	0.035	7.95	0.058
1	EM-03	1	2	12	r04LM22	4.75	0.061	0.965	<0.010	0.200	0.078	0.048	9.96	0.059
1	EM-14	1	2	13	r08LM22	7.43	0.063	2.87	<0.010	0.198	0.064	0.043	8.49	0.059
1	EM-05	1	2	14	r11LM22	3.47	0.062	0.946	<0.010	0.203	0.073	0.034	11.7	0.060
1	EM-11	1	2	15	r15LM22	6.09	0.062	0.966	<0.010	0.206	0.064	0.037	9.44	0.060
1	EM-04	1	2	16	r07LM12	3.53	0.061	0.953	<0.010	0.194	0.080	0.044	9.93	0.054
1	EM-13	1	2	17	r02LM12	7.59	0.055	1.77	<0.010	0.194	0.063	0.040	8.14	0.055
1	EM-13	1	2	18	r02LM22	7.53	0.057	1.74	<0.010	0.197	0.064	0.039	8.10	0.057
1	Batch 1	1	2	19	BCHLM1123	2.52	0.118	0.881	<0.010	<0.010	0.071	0.319	8.88	<0.010
1	Batch 1	2	1	1	BCHLM1211	2.53	0.121	0.864	<0.010	<0.010	0.072	0.309	8.86	<0.010
1	EM-02	2	1	2	r05LM11	7.68	0.060	0.997	<0.010	0.194	0.076	0.039	9.75	0.060
1	EM-06	2	1	3	r13LM21	3.58	0.061	0.976	<0.010	0.198	0.071	0.037	12.6	0.058
1	EM-09	2	1	4	r06LM11	6.22	0.059	0.976	<0.010	0.195	0.063	0.048	11.2	0.057
1	EM-12	2	1	5	r14LM11	6.09	0.063	0.938	<0.010	0.198	0.084	0.039	10.0	0.061
1	EM-10	2	1	6	r01LM21	6.12	0.058	0.962	<0.010	0.191	0.068	0.045	8.27	0.058
1	EM-12	2	1	7	r14LM21	6.12	0.063	0.997	<0.010	0.196	0.077	0.037	9.42	0.060
1	EM-08	2	1	8	r03LM11	3.52	0.054	3.24	<0.010	0.197	0.059	0.033	12.6	0.058
1	Batch 1	2	1	9	BCHLM1212	2.52	0.121	0.868	<0.010	<0.010	0.072	0.309	8.68	<0.010
1	EM-10	2	1	10	r01LM11	6.06	0.059	0.954	<0.010	0.189	0.069	0.048	8.28	0.058
1	EM-02	2	1	11	r05LM21	7.45	0.060	0.956	<0.010	0.193	0.074	0.039	9.74	0.060
1	EM-08	2	1	12	r03LM21	3.56	0.054	3.25	<0.010	0.197	0.059	0.033	12.7	0.058
1	EM-01	2	1	13	r12LM21	6.12	0.060	0.964	<0.010	0.192	0.069	0.037	9.72	0.058
1	EM-06	2	1	14	r13LM11	3.59	0.063	0.999	<0.010	0.202	0.072	0.035	12.6	0.059
1	EM-09	2	1	15	r06LM21	6.26	0.060	1.01	<0.010	0.195	0.065	0.041	10.9	0.057
1	EM-01	2	1	16	r12LM11	6.17	0.061	0.997	<0.010	0.195	0.070	0.036	9.65	0.059
1	Batch 1	2	1	17	BCHLM1213	2.52	0.119	0.870	<0.010	<0.010	0.070	0.305	8.65	<0.010
1	Batch 1	2	2	1	BCHLM1221	2.50	0.122	0.841	<0.010	<0.010	0.072	0.308	8.96	<0.010
1	EM-01	2	2	2	r12LM22	6.04	0.062	0.925	<0.010	0.191	0.071	0.035	10.1	0.059
1	EM-10	2	2	3	r01LM22	6.09	0.061	0.944	<0.010	0.188	0.071	0.043	8.43	0.059
1	EM-08	2	2	4	r03LM12	3.51	0.056	3.21	<0.010	0.194	0.060	0.032	12.8	0.057
1	EM-10	2	2	5	r01LM12	6.09	0.061	0.954	<0.010	0.186	0.071	0.046	8.35	0.058
1	EM-08	2	2	6	r03LM22	3.47	0.055	3.14	<0.010	0.195	0.060	0.032	12.9	0.058
1	EM-02	2	2	7	r05LM12	7.43	0.061	0.934	<0.010	0.190	0.075	0.037	9.93	0.059
1	EM-02	2	2	8	r05LM22	7.37	0.063	0.926	<0.010	0.193	0.078	0.037	9.97	0.061
1	Batch 1	2	2	9	BCHLM1222	2.48	0.123	0.855	<0.010	<0.010	0.073	0.302	8.95	<0.010
1	EM-12	2	2	10	r14LM22	6.06	0.065	0.977	<0.010	0.194	0.078	0.036	9.52	0.061
1	EM-09	2	2	11	r06LM22	6.18	0.061	0.976	<0.010	0.192	0.066	0.039	11.2	0.058
1	EM-06	2	2	12	r13LM12	3.50	0.063	0.951	<0.010	0.200	0.072	0.034	12.9	0.059
1	EM-09	2	2	13	r06LM12	6.05	0.061	0.923	<0.010	0.192	0.064	0.046	11.4	0.057
1	EM-01	2	2	14	r12LM12	5.99	0.062	0.931	<0.010	0.195	0.071	0.035	10.1	0.060
1	EM-12	2	2	15	r14LM12	6.05	0.065	0.926	<0.010	0.195	0.087	0.037	9.98	0.061
1	EM-06	2	2	16	r13LM22	3.53	0.062	0.950	<0.010	0.196	0.073	0.035	12.7	0.058

Table D1. Measured Elemental Concentrations (wt%) for the Matrix 2A Study Glasses Prepared Using Lithium Metaborate (part 1)

Set	Glass ID	Block	Sub-Block	Sequence	Lab ID	Al (wt%)	Ba (wt%)	Ca (wt%)	Cd (wt%)	Ce (wt%)	Cr (wt%)	Cu (wt%)	Fe (wt%)	La (wt%)
1	Batch 1	2	2	17	BCHLM1223	2.51	0.120	0.854	<0.010	<0.010	0.072	0.304	8.70	<0.010
2	Batch 1	1	1	1	BCHLM2111	2.46	0.119	0.836	<0.010	<0.010	0.070	0.305	8.79	<0.010
2	EM-21	1	1	2	s03LM11	3.55	0.061	0.987	<0.010	0.194	0.075	0.038	12.9	0.058
2	EM-30	1	1	3	s13LM11	7.44	0.058	3.18	<0.010	0.186	0.060	0.036	8.28	0.059
2	EM-22	1	1	4	s02LM21	3.44	0.065	2.44	<0.010	0.202	0.074	0.041	12.8	0.073
2	EM-25	1	1	5	s14LM11	6.08	0.058	0.968	<0.010	0.190	0.071	0.036	8.26	0.060
2	EM-18	1	1	6	s08LM21	4.72	0.059	0.947	<0.010	0.190	0.070	0.035	9.52	0.060
2	EM-25	1	1	7	s14LM21	6.08	0.060	0.975	<0.010	0.194	0.072	0.036	8.02	0.060
2	EM-30	1	1	8	s13LM21	7.49	0.057	3.23	<0.010	0.183	0.061	0.034	8.12	0.058
2	EM-24	1	1	9	s05LM21	6.30	0.059	0.982	<0.010	0.191	0.062	0.040	11.0	0.060
2	Batch 1	1	1	10	BCHLM2112	2.50	0.119	0.886	<0.010	<0.010	0.071	0.302	8.51	<0.010
2	EM-21	1	1	11	s03LM21	3.82	0.060	1.00	<0.010	0.196	0.075	0.036	13.2	0.058
2	EM-18	1	1	12	s08LM11	4.78	0.061	0.977	<0.010	0.198	0.072	0.037	9.82	0.061
2	EM-20	1	1	13	s04LM11	3.51	0.066	0.973	<0.010	0.196	0.077	0.042	11.2	0.069
2	EM-20	1	1	14	s04LM21	3.45	0.066	0.914	<0.010	0.190	0.076	0.032	11.2	0.066
2	EM-24	1	1	15	s05LM11	6.11	0.062	0.945	<0.010	0.196	0.062	0.032	10.9	0.059
2	EM-28	1	1	16	s01LM21	7.43	0.059	1.72	<0.010	0.187	0.070	0.040	8.22	0.061
2	EM-22	1	1	17	s02LM11	3.48	0.062	2.47	<0.010	0.190	0.070	0.036	12.9	0.067
2	EM-28	1	1	18	s01LM11	7.36	0.058	1.71	<0.010	0.185	0.062	0.040	7.83	0.059
2	Batch 1	1	1	19	BCHLM2113	2.47	0.118	0.863	<0.010	<0.010	0.071	0.303	8.37	<0.010
2	Batch 1	1	2	1	BCHLM2121	2.44	0.121	0.848	<0.010	<0.010	0.074	0.307	8.79	<0.010
2	EM-30	1	2	2	s13LM22	7.43	0.061	3.17	<0.010	0.184	0.064	0.033	8.44	0.060
2	EM-24	1	2	3	s05LM12	6.10	0.066	0.930	<0.010	0.195	0.064	0.031	11.2	0.063
2	EM-22	1	2	4	s02LM12	3.48	0.064	2.46	<0.010	0.189	0.071	0.035	13.2	0.070
2	EM-25	1	2	5	s14LM22	6.07	0.064	0.959	<0.010	0.194	0.075	0.035	8.31	0.062
2	EM-28	1	2	6	s01LM22	7.46	0.062	1.71	<0.010	0.186	0.071	0.040	8.32	0.064
2	EM-20	1	2	7	s04LM22	3.46	0.071	0.910	<0.010	0.193	0.078	0.031	11.3	0.069
2	EM-24	1	2	8	s05LM22	6.32	0.063	0.970	<0.010	0.190	0.064	0.040	11.3	0.062
2	EM-21	1	2	9	s03LM12	3.60	0.066	1.01	<0.010	0.194	0.077	0.037	13.1	0.059
2	Batch 1	1	2	10	BCHLM2122	2.51	0.124	0.853	<0.010	<0.010	0.072	0.306	8.68	<0.010
2	EM-18	1	2	11	s08LM12	4.77	0.065	0.971	<0.010	0.197	0.074	0.036	9.57	0.063
2	EM-30	1	2	12	s13LM12	7.46	0.061	3.21	<0.010	0.185	0.061	0.035	8.11	0.058
2	EM-22	1	2	13	s02LM22	3.43	0.068	2.44	<0.010	0.201	0.076	0.040	12.6	0.072
2	EM-25	1	2	14	s14LM12	6.10	0.063	0.969	<0.010	0.190	0.074	0.036	8.18	0.059
2	EM-21	1	2	15	s03LM22	3.77	0.065	0.984	<0.010	0.196	0.078	0.035	12.9	0.067
2	EM-18	1	2	16	s08LM22	4.72	0.063	0.943	<0.010	0.190	0.071	0.034	9.64	0.068
2	EM-28	1	2	17	s01LM12	7.42	0.060	1.72	<0.010	0.183	0.063	0.040	7.89	0.068
2	EM-20	1	2	18	s04LM12	3.52	0.069	0.975	<0.010	0.195	0.077	0.041	11.1	0.078
2	Batch 1	1	2	19	BCHLM2123	2.47	0.120	0.867	<0.010	<0.010	0.072	0.305	8.45	<0.010
2	Batch 1	2	1	1	BCHLM2211	2.44	0.120	0.841	<0.010	<0.010	0.071	0.305	8.77	<0.010
2	EM-17	2	1	2	s10LM21	7.28	0.062	0.910	<0.010	0.188	0.068	0.039	9.77	0.064
2	EM-19	2	1	3	s06LM21	3.52	0.059	0.979	<0.010	0.184	0.081	0.033	9.98	0.062
2	EM-26	2	1	4	s07LM11	6.03	0.058	0.955	<0.010	0.191	0.064	0.038	9.60	0.064
2	EM-27	2	1	5	s15LM21	5.88	0.061	0.912	<0.010	0.191	0.073	0.038	9.83	0.066
2	EM-16	2	1	6	s11LM11	6.03	0.063	0.917	<0.010	0.199	0.061	0.041	9.61	0.069
2	EM-29	2	1	7	s09LM21	7.29	0.063	2.36	<0.010	0.193	0.063	0.036	8.32	0.063
2	EM-16	2	1	8	s11LM21	6.01	0.064	0.927	<0.010	0.200	0.062	0.033	9.82	0.068
2	Batch 1	2	1	9	BCHLM2212	2.41	0.122	0.840	<0.010	<0.010	0.073	0.308	8.81	<0.010
2	EM-29	2	1	10	s09LM11	7.37	0.061	2.43	<0.010	0.191	0.065	0.035	8.33	0.064
2	EM-23	2	1	11	s12LM21	3.60	0.060	3.08	<0.010	0.188	0.068	0.036	13.0	0.066
2	EM-23	2	1	12	s12LM11	3.36	0.061	3.00	<0.010	0.193	0.069	0.038	12.9	0.067
2	EM-26	2	1	13	s07LM21	5.94	0.060	0.907	<0.010	0.196	0.058	0.032	9.45	0.066
2	EM-17	2	1	14	s10LM11	7.21	0.063	0.897	<0.010	0.194	0.067	0.043	9.54	0.067
2	EM-19	2	1	15	s06LM11	3.46	0.063	0.916	<0.010	0.191	0.087	0.033	9.91	0.066
2	EM-27	2	1	16	s15LM11	5.94	0.061	0.912	<0.010	0.189	0.076	0.045	9.86	0.067
2	Batch 1	2	1	17	BCHLM2213	2.41	0.124	0.829	<0.010	<0.010	0.071	0.303	8.70	<0.010
2	Batch 1	2	2	1	BCHLM2221	2.47	0.116	0.852	<0.010	<0.010	0.071	0.311	8.49	<0.010
2	EM-23	2	2	2	s12LM12	3.45	0.061	3.10	<0.010	0.195	0.068	0.038	12.5	0.069
2	EM-16	2	2	3	s11LM22	6.02	0.065	0.920	<0.010	0.200	0.061	0.032	9.45	0.070
2	EM-26	2	2	4	s07LM22	5.99	0.060	0.912	<0.010	0.198	0.058	0.032	9.11	0.069
2	EM-16	2	2	5	s11LM12	6.05	0.064	0.903	<0.010	0.202	0.063	0.040	9.49	0.073
2	EM-23	2	2	6	s12LM22	3.65	0.059	3.08	<0.010	0.190	0.068	0.035	12.5	0.068
2	EM-27	2	2	7	s15LM12	5.91	0.059	0.894	<0.010	0.191	0.074	0.045	9.61	0.068
2	EM-27	2	2	8	s15LM22	5.84	0.060	0.895	<0.010	0.192	0.073	0.037	9.55	0.068
2	Batch 1	2	2	9	BCHLM2222	2.40	0.118	0.803	<0.010	<0.010	0.072	0.305	8.35	<0.010
2	EM-29	2	2	10	s09LM22	7.26	0.065	2.36	<0.010	0.196	0.064	0.035	7.95	0.066
2	EM-17	2	2	11	s10LM22	7.16	0.061	0.879	<0.010	0.189	0.067	0.038	9.33	0.067
2	EM-26	2	2	12	s07LM12	5.85	0.057	0.902	<0.010	0.192	0.062	0.037	9.30	0.067
2	EM-29	2	2	13	s09LM12	7.23	0.060	2.37	<0.010	0.190	0.062	0.034	8.05	0.066
2	EM-19	2	2	14	s06LM12	3.41	0.062	0.886	<0.010	0.193	0.084	0.032	9.48	0.068
2	EM-19	2	2	15	s06LM22	3.43	0.058	0.931	<0.010	0.182	0.082	0.031	9.39	0.065

Table D1. Measured Elemental Concentrations (wt%) for the Matrix 2A Study Glasses Prepared Using Lithium Metaborate (part 1)

Set	Glass ID	Block	Sub-Block	Sequence	Lab ID	Al (wt%)	Ba (wt%)	Ca (wt%)	Cd (wt%)	Ce (wt%)	Cr (wt%)	Cu (wt%)	Fe (wt%)	La (wt%)
2	EM-17	2	2	16	s10LM12	7.09	0.062	0.879	<0.010	0.195	0.067	0.042	9.05	0.069
2	Batch 1	2	2	17	BCHLM2223	2.36	0.119	0.798	<0.010	<0.010	0.072	0.306	8.39	<0.010

Table D1. Measured Elemental Concentrations (wt%) for the Matrix 2A Study Glasses Prepared Using Lithium Metaborate (part 2)

Set	Glass ID	Block	Sub-Block	Sequence	Lab ID	Mg (wt%)	Mn (wt%)	Na (wt%)	Ni (wt%)	Pb (wt%)	S (wt%)	Ti (wt%)	Zn (wt%)	Zr (wt%)
1	Batch 1	1	1	1	BCHLM1111	0.789	1.35	6.80	0.522	<0.010	<0.100	0.399	<0.010	0.064
1	EM-15	1	1	2	r10LM21	0.420	2.29	10.2	0.704	0.082	0.146	1.13	0.049	0.128
1	EM-13	1	1	3	r02LM21	0.420	2.26	10.8	0.741	0.081	0.144	1.14	0.052	0.129
1	EM-04	1	1	4	r07LM11	0.419	2.29	12.9	0.783	0.078	0.152	1.19	0.052	0.126
1	EM-15	1	1	5	r10LM11	0.427	2.30	9.89	0.721	0.086	0.150	1.12	0.047	0.133
1	EM-05	1	1	6	r11LM11	0.422	2.29	11.6	0.772	0.085	0.151	1.17	0.048	0.127
1	EM-11	1	1	7	r15LM21	0.415	3.04	9.65	0.738	0.084	0.143	1.17	0.049	0.127
1	EM-07	1	1	8	r09LM21	0.416	2.29	9.82	0.714	0.082	0.147	1.13	0.051	0.127
1	EM-04	1	1	9	r07LM21	0.413	2.27	12.6	0.785	0.078	0.149	1.16	0.050	0.127
1	Batch 1	1	1	10	BCHLM1112	0.774	1.32	6.49	0.514	<0.010	<0.100	0.386	<0.010	0.064
1	EM-05	1	1	11	r11LM21	0.435	2.25	11.9	0.792	0.087	0.158	1.17	0.051	0.128
1	EM-03	1	1	12	r04LM21	0.422	2.27	12.5	0.752	0.082	0.150	1.18	0.053	0.127
1	EM-11	1	1	13	r15LM11	0.422	3.02	9.72	0.751	0.085	0.148	1.16	0.047	0.129
1	EM-13	1	1	14	r02LM11	0.401	2.26	10.9	0.709	0.077	0.140	1.15	0.051	0.125
1	EM-03	1	1	15	r04LM11	0.416	2.26	12.8	0.763	0.080	0.150	1.18	0.051	0.126
1	EM-14	1	1	16	r08LM11	0.410	2.21	10.5	0.696	0.078	0.142	1.18	0.049	0.127
1	EM-07	1	1	17	r09LM11	0.408	2.23	10.0	0.690	0.081	0.152	1.12	0.049	0.126
1	EM-14	1	1	18	r08LM21	0.401	2.21	10.3	0.676	0.077	0.136	1.18	0.044	0.122
1	Batch 1	1	1	19	BCHLM1113	0.773	1.32	6.63	0.512	<0.010	<0.100	0.388	<0.010	0.063
1	Batch 1	1	2	1	BCHLM1121	0.770	1.35	6.78	0.512	<0.010	<0.100	0.398	<0.010	0.064
1	EM-07	1	2	2	r09LM22	0.418	2.31	10.1	0.713	0.084	0.152	1.16	0.054	0.128
1	EM-15	1	2	3	r10LM12	0.419	2.30	10.3	0.699	0.087	0.141	1.14	0.049	0.133
1	EM-11	1	2	4	r15LM12	0.408	3.03	10.2	0.718	0.083	0.140	1.20	0.048	0.129
1	EM-07	1	2	5	r09LM12	0.397	2.29	10.3	0.663	0.081	0.141	1.17	0.051	0.127
1	EM-04	1	2	6	r07LM22	0.403	2.27	13.2	0.760	0.080	0.140	1.20	0.052	0.128
1	EM-14	1	2	7	r08LM12	0.397	2.28	10.6	0.673	0.079	0.138	1.24	0.050	0.127
1	EM-03	1	2	8	r04LM12	0.414	2.34	13.1	0.752	0.083	0.145	1.23	0.054	0.128
1	EM-05	1	2	9	r11LM12	0.412	2.33	12.0	0.751	0.086	0.144	1.21	0.050	0.127
1	Batch 1	1	2	10	BCHLM1122	0.751	1.33	6.86	0.499	<0.010	<0.100	0.395	<0.010	0.064
1	EM-15	1	2	11	r10LM22	0.400	2.27	10.1	0.666	0.082	0.137	1.13	0.050	0.128
1	EM-03	1	2	12	r04LM22	0.403	2.31	12.7	0.712	0.081	0.147	1.21	0.052	0.128
1	EM-14	1	2	13	r08LM22	0.403	2.30	10.4	0.675	0.080	0.140	1.23	0.048	0.127
1	EM-05	1	2	14	r11LM22	0.420	2.35	11.8	0.759	0.086	0.143	1.21	0.051	0.129
1	EM-11	1	2	15	r15LM22	0.405	3.03	10.1	0.712	0.082	0.138	1.19	0.050	0.128
1	EM-04	1	2	16	r07LM12	0.396	2.28	13.2	0.735	0.077	0.139	1.20	0.052	0.125
1	EM-13	1	2	17	r02LM12	0.393	2.27	11.1	0.684	0.077	0.134	1.17	0.053	0.126
1	EM-13	1	2	18	r02LM22	0.404	2.26	10.9	0.705	0.081	0.136	1.16	0.053	0.128
1	Batch 1	1	2	19	BCHLM1123	0.758	1.35	6.93	0.500	<0.010	<0.100	0.397	<0.010	0.064
1	Batch 1	2	1	1	BCHLM1211	0.803	1.35	6.82	0.523	<0.010	<0.100	0.395	<0.010	0.064
1	EM-02	2	1	2	r05LM11	0.420	2.28	10.4	0.757	0.078	0.138	1.25	0.049	0.130
1	EM-06	2	1	3	r13LM21	0.427	2.29	10.4	0.740	0.081	0.138	1.22	0.049	0.128
1	EM-09	2	1	4	r06LM11	0.415	2.27	10.4	0.720	0.081	0.132	1.26	0.050	0.128
1	EM-12	2	1	5	r14LM11	0.423	1.51	12.7	0.733	0.081	0.143	1.23	0.050	0.130
1	EM-10	2	1	6	r01LM21	0.409	2.24	12.9	0.722	0.077	0.141	1.25	0.057	0.125
1	EM-12	2	1	7	r14LM21	0.426	1.43	13.4	0.607	0.080	0.137	1.21	0.049	0.130
1	EM-08	2	1	8	r03LM11	0.421	2.23	10.4	0.693	0.080	0.143	1.35	0.048	0.129
1	Batch 1	2	1	9	BCHLM1212	0.797	1.33	6.79	0.521	<0.010	<0.100	0.395	<0.010	0.065
1	EM-10	2	1	10	r01LM11	0.413	2.24	12.8	0.723	0.079	0.136	1.24	0.057	0.124
1	EM-02	2	1	11	r05LM21	0.422	2.27	10.1	0.767	0.080	0.138	1.23	0.047	0.128
1	EM-08	2	1	12	r03LM21	0.418	2.26	10.3	0.690	0.080	0.141	1.36	0.049	0.129
1	EM-01	2	1	13	r12LM21	0.419	2.25	11.5	0.746	0.082	0.136	1.24	0.045	0.124
1	EM-06	2	1	14	r13LM11	0.442	2.28	10.6	0.767	0.087	0.138	1.22	0.050	0.131
1	EM-09	2	1	15	r06LM21	0.418	2.23	10.4	0.722	0.082	0.128	1.24	0.049	0.129
1	EM-01	2	1	16	r12LM11	0.421	2.24	11.8	0.743	0.084	0.142	1.24	0.046	0.125
1	Batch 1	2	1	17	BCHLM1213	0.778	1.33	6.81	0.514	<0.010	<0.100	0.389	<0.010	0.064
1	Batch 1	2	2	1	BCHLM1221	0.794	1.35	6.64	0.521	<0.010	<0.100	0.39	<0.010	0.067
1	EM-01	2	2	2	r12LM22	0.425	2.31	11.2	0.757	0.085	0.147	1.25	0.048	0.125
1	EM-10	2	2	3	r01LM22	0.420	2.27	12.7	0.733	0.083	0.143	1.24	0.060	0.127
1	EM-08	2	2	4	r03LM12	0.419	2.25	10.3	0.690	0.081	0.146	1.35	0.049	0.130
1	EM-10	2	2	5	r01LM12	0.417	2.25	12.9	0.732	0.081	0.140	1.24	0.060	0.126
1	EM-08	2	2	6	r03LM22	0.420	2.27	9.96	0.692	0.082	0.149	1.34	0.051	0.129
1	EM-02	2	2	7	r05LM12	0.416	2.30	9.91	0.746	0.080	0.144	1.23	0.050	0.130
1	EM-02	2	2	8	r05LM22	0.434	2.31	9.92	0.787	0.084	0.144	1.23	0.051	0.130
1	Batch 1	2	2	9	BCHLM1222	0.807	1.35	6.83	0.528	<0.010	<0.100	0.39	<0.010	0.067
1	EM-12	2	2	10	r14LM22	0.424	1.43	13.1	0.602	0.082	0.143	1.19	0.051	0.132
1	EM-09	2	2	11	r06LM22	0.422	2.26	10.2	0.733	0.083	0.140	1.24	0.051	0.130
1	EM-06	2	2	12	r13LM12	0.438	2.31	10.3	0.761	0.088	0.148	1.21	0.051	0.132
1	EM-09	2	2	13	r06LM12	0.419	2.30	9.93	0.727	0.085	0.136	1.25	0.051	0.129
1	EM-01	2	2	14	r12LM12	0.427	2.30	11.3	0.757	0.086	0.145	1.24	0.048	0.127
1	EM-12	2	2	15	r14LM12	0.437	1.48	12.7	0.749	0.084	0.139	1.21	0.052	0.132
1	EM-06	2	2	16	r13LM22	0.427	2.29	10.2	0.744	0.083	0.146	1.21	0.051	0.130

Table D1. Measured Elemental Concentrations (wt%) for the Matrix 2A Study Glasses Prepared Using Lithium Metaborate (part 2)

Set	Glass ID	Block	Sub-Block	Sequence	Lab ID	Mg (wt%)	Mn (wt%)	Na (wt%)	Ni (wt%)	Pb (wt%)	S (wt%)	Ti (wt%)	Zn (wt%)	Zr (wt%)
1	Batch 1	2	2	17	BCHLM1223	0.786	1.31	6.79	0.516	<0.010	<0.100	0.38	<0.010	0.066
2	Batch 1	1	1	1	BCHLM2111	0.796	1.32	6.61	0.522	<0.010	<0.100	0.393	<0.010	0.066
2	EM-21	1	1	2	s03LM11	0.428	2.28	10.2	0.740	0.081	0.146	1.13	0.049	0.128
2	EM-30	1	1	3	s13LM11	0.408	2.20	10.1	0.640	0.071	0.142	1.20	0.045	0.124
2	EM-22	1	1	4	s02LM21	0.434	2.22	10.0	0.664	0.083	0.142	1.18	0.050	0.135
2	EM-25	1	1	5	s14LM11	0.416	2.25	12.7	0.749	0.073	0.142	1.20	0.047	0.126
2	EM-18	1	1	6	s08LM21	0.415	2.19	12.5	0.741	0.076	0.138	1.17	0.043	0.126
2	EM-25	1	1	7	s14LM21	0.421	2.19	12.7	0.765	0.075	0.139	1.18	0.047	0.128
2	EM-30	1	1	8	s13LM21	0.402	2.16	10.1	0.627	0.069	0.135	1.19	0.045	0.123
2	EM-24	1	1	9	s05LM21	0.426	2.19	10.1	0.690	0.080	0.144	1.21	0.044	0.152
2	Batch 1	1	1	10	BCHLM2112	0.799	1.28	7.08	0.527	<0.010	<0.100	0.386	<0.010	0.065
2	EM-21	1	1	11	s03LM21	0.433	2.33	10.4	0.757	0.082	0.148	1.15	0.048	0.129
2	EM-18	1	1	12	s08LM11	0.425	2.26	12.8	0.764	0.080	0.142	1.20	0.044	0.130
2	EM-20	1	1	13	s04LM11	0.428	2.20	11.9	0.698	0.081	0.143	1.19	0.045	0.130
2	EM-20	1	1	14	s04LM21	0.406	2.19	11.6	0.699	0.075	0.140	1.18	0.044	0.125
2	EM-24	1	1	15	s05LM11	0.431	2.17	9.98	0.699	0.082	0.143	1.19	0.044	0.129
2	EM-28	1	1	16	s01LM21	0.427	2.21	10.9	0.715	0.081	0.144	1.23	0.048	0.130
2	EM-22	1	1	17	s02LM11	0.407	2.21	10.4	0.610	0.072	0.150	1.17	0.048	0.127
2	EM-28	1	1	18	s01LM11	0.407	2.13	10.7	0.602	0.077	0.139	1.20	0.047	0.124
2	Batch 1	1	1	19	BCHLM2113	0.795	1.26	6.71	0.521	<0.010	<0.100	0.383	<0.010	0.066
2	Batch 1	1	2	1	BCHLM2121	0.808	1.33	6.76	0.536	<0.010	<0.100	0.389	<0.010	0.068
2	EM-30	1	2	2	s13LM22	0.406	2.24	10.0	0.637	0.073	0.139	1.22	0.048	0.124
2	EM-24	1	2	3	s05LM12	0.430	2.23	10.1	0.700	0.085	0.141	1.21	0.047	0.130
2	EM-22	1	2	4	s02LM12	0.399	2.26	10.5	0.600	0.073	0.135	1.19	0.050	0.127
2	EM-25	1	2	5	s14LM22	0.421	2.28	12.8	0.765	0.079	0.137	1.21	0.051	0.129
2	EM-28	1	2	6	s01LM22	0.417	2.24	11.1	0.704	0.084	0.137	1.23	0.050	0.130
2	EM-20	1	2	7	s04LM22	0.406	2.22	11.9	0.701	0.078	0.138	1.18	0.047	0.128
2	EM-24	1	2	8	s05LM22	0.425	2.25	10.3	0.689	0.084	0.142	1.23	0.047	0.152
2	EM-21	1	2	9	s03LM12	0.426	2.31	10.7	0.736	0.086	0.144	1.15	0.051	0.128
2	Batch 1	1	2	10	BCHLM2122	0.785	1.31	6.91	0.519	<0.010	<0.100	0.386	<0.010	0.067
2	EM-18	1	2	11	s08LM12	0.424	2.22	12.9	0.764	0.083	0.137	1.19	0.047	0.130
2	EM-30	1	2	12	s13LM12	0.398	2.17	10.2	0.628	0.072	0.132	1.19	0.046	0.123
2	EM-22	1	2	13	s02LM22	0.428	2.22	10.1	0.658	0.085	0.147	1.18	0.052	0.135
2	EM-25	1	2	14	s14LM12	0.419	2.25	12.8	0.755	0.076	0.143	1.19	0.051	0.127
2	EM-21	1	2	15	s03LM22	0.433	2.29	10.4	0.761	0.088	0.142	1.13	0.051	0.130
2	EM-18	1	2	16	s08LM22	0.413	2.23	12.7	0.738	0.079	0.140	1.18	0.045	0.127
2	EM-28	1	2	17	s01LM12	0.397	2.16	10.9	0.586	0.078	0.133	1.21	0.048	0.123
2	EM-20	1	2	18	s04LM12	0.418	2.20	12.1	0.685	0.084	0.138	1.19	0.047	0.129
2	Batch 1	1	2	19	BCHLM2123	0.785	1.28	7.16	0.515	<0.010	<0.100	0.379	<0.010	0.065
2	Batch 1	2	1	1	BCHLM2211	0.798	1.31	6.69	0.524	<0.010	<0.100	0.383	<0.010	0.067
2	EM-17	2	1	2	s10LM21	0.424	2.25	9.85	0.733	0.080	0.148	1.13	0.049	0.127
2	EM-19	2	1	3	s06LM21	0.410	2.27	12.9	0.735	0.073	0.144	1.22	0.047	0.125
2	EM-26	2	1	4	s07LM11	0.414	2.98	10.0	0.618	0.075	0.138	1.18	0.044	0.126
2	EM-27	2	1	5	s15LM21	0.422	1.45	12.5	0.707	0.080	0.148	1.22	0.054	0.129
2	EM-16	2	1	6	s11LM11	0.433	2.20	11.1	0.701	0.085	0.145	1.21	0.048	0.132
2	EM-29	2	1	7	s09LM21	0.422	2.22	10.1	0.671	0.078	0.141	1.20	0.046	0.129
2	EM-16	2	1	8	s11LM21	0.433	2.25	11.0	0.694	0.082	0.143	1.22	0.049	0.134
2	Batch 1	2	1	9	BCHLM2212	0.820	1.32	6.65	0.540	<0.010	<0.100	0.380	<0.010	0.069
2	EM-29	2	1	10	s09LM11	0.433	2.21	10.3	0.679	0.083	0.143	1.21	0.047	0.131
2	EM-23	2	1	11	s12LM21	0.428	2.24	9.88	0.619	0.084	0.151	1.17	0.046	0.128
2	EM-23	2	1	12	s12LM11	0.435	2.23	9.62	0.619	0.088	0.152	1.16	0.048	0.130
2	EM-26	2	1	13	s07LM21	0.435	2.96	9.68	0.588	0.080	0.139	1.17	0.046	0.129
2	EM-17	2	1	14	s10LM11	0.437	2.20	9.66	0.744	0.086	0.143	1.11	0.049	0.130
2	EM-19	2	1	15	s06LM11	0.440	2.27	12.7	0.808	0.083	0.142	1.22	0.048	0.128
2	EM-27	2	1	16	s15LM11	0.433	1.45	12.4	0.724	0.083	0.149	1.21	0.053	0.128
2	Batch 1	2	1	17	BCHLM2213	0.797	1.30	6.55	0.521	<0.010	<0.100	0.376	<0.010	0.067
2	Batch 1	2	2	1	BCHLM2221	0.762	1.28	7.04	0.505	<0.010	<0.100	0.381	<0.010	0.065
2	EM-23	2	2	2	s12LM12	0.419	2.18	10.0	0.600	0.086	0.141	1.16	0.048	0.130
2	EM-16	2	2	3	s11LM22	0.421	2.19	11.3	0.677	0.081	0.142	1.21	0.049	0.134
2	EM-26	2	2	4	s07LM22	0.425	2.88	9.81	0.578	0.081	0.140	1.17	0.046	0.129
2	EM-16	2	2	5	s11LM12	0.434	2.20	11.2	0.701	0.086	0.140	1.21	0.050	0.133
2	EM-23	2	2	6	s12LM22	0.417	2.19	10.0	0.601	0.083	0.142	1.16	0.046	0.127
2	EM-27	2	2	7	s15LM12	0.414	1.43	12.6	0.696	0.081	0.143	1.21	0.052	0.127
2	EM-27	2	2	8	s15LM22	0.411	1.42	12.6	0.692	0.080	0.137	1.21	0.054	0.128
2	Batch 1	2	2	9	BCHLM2222	0.774	1.26	6.50	0.512	<0.010	<0.100	0.372	<0.010	0.067
2	EM-29	2	2	10	s09LM22	0.420	2.15	10.1	0.666	0.080	0.137	1.18	0.047	0.128
2	EM-17	2	2	11	s10LM22	0.412	2.18	9.70	0.713	0.078	0.137	1.10	0.049	0.125
2	EM-26	2	2	12	s07LM12	0.401	2.94	9.72	0.600	0.073	0.134	1.15	0.044	0.125
2	EM-29	2	2	13	s09LM12	0.411	2.17	10.1	0.648	0.079	0.138	1.19	0.046	0.128
2	EM-19	2	2	14	s06LM12	0.423	2.19	12.7	0.781	0.081	0.144	1.19	0.048	0.127
2	EM-19	2	2	15	s06LM22	0.406	2.17	12.6	0.727	0.072	0.138	1.18	0.047	0.123

Table D1. Measured Elemental Concentrations (wt%) for the Matrix 2A Study Glasses Prepared Using Lithium Metaborate (part 2)

Set	Glass ID	Block	Sub-Block	Sequence	Lab ID	Mg (wt%)	Mn (wt%)	Na (wt%)	Ni (wt%)	Pb (wt%)	S (wt%)	Ti (wt%)	Zn (wt%)	Zr (wt%)
2	EM-17	2	2	16	s10LM12	0.428	2.12	9.60	0.732	0.084	0.138	1.08	0.049	0.129
2	Batch 1	2	2	17	BCHLM2223	0.798	1.27	6.47	0.529	<0.010	<0.100	0.369	<0.010	0.068

Table D2. Measured Elemental Concentrations (wt%) for the Matrix 2A Study Glasses Prepared Using Peroxide Fusion

Set	Glass ID	Block	Sub-Block	Sequence	Lab ID	B (wt%)	Li (wt%)	Si (wt%)
1	Batch 1	1	1	1	BCHPF1111	2.68	2.14	22.9
1	EM-15	1	1	2	r10PF21	1.41	1.95	19.4
1	EM-01	1	1	3	r12PF21	1.30	1.87	19.3
1	EM-01	1	1	4	r12PF11	1.30	1.90	19.8
1	EM-12	1	1	5	r14PF21	1.30	1.92	19.1
1	EM-14	1	1	6	r08PF11	1.27	1.90	18.8
1	EM-11	1	1	7	r15PF21	1.28	1.91	20.1
1	EM-15	1	1	8	r10PF11	1.28	1.93	18.8
1	EM-12	1	1	9	r14PF11	1.24	1.88	18.5
1	Batch 1	1	1	10	BCHPF1112	2.50	2.16	22.7
1	EM-13	1	1	11	r02PF21	1.33	1.91	19.3
1	EM-14	1	1	12	r08PF21	1.29	1.89	18.8
1	EM-02	1	1	13	r05PF11	1.29	1.89	19.3
1	EM-03	1	1	14	r04PF11	1.27	1.87	19.5
1	EM-13	1	1	15	r02PF11	1.27	1.89	19.1
1	EM-11	1	1	16	r15PF11	1.27	1.89	20.0
1	EM-03	1	1	17	r04PF21	1.24	1.86	19.3
1	EM-02	1	1	18	r05PF21	1.24	1.87	19.0
1	Batch 1	1	1	19	BCHPF1113	2.49	2.15	22.8
1	Batch 1	1	2	1	BCHPF1121	2.58	2.07	21.9
1	EM-03	1	2	2	r04PF12	1.34	1.81	18.6
1	EM-02	1	2	3	r05PF22	1.30	1.78	18.3
1	EM-15	1	2	4	r10PF12	1.32	1.85	18.3
1	EM-01	1	2	5	r12PF22	1.29	1.83	18.7
1	EM-14	1	2	6	r08PF22	1.26	1.80	17.8
1	EM-12	1	2	7	r14PF22	1.28	1.83	18.2
1	EM-14	1	2	8	r08PF12	1.26	1.80	17.9
1	EM-15	1	2	9	r10PF22	1.31	1.89	18.6
1	Batch 1	1	2	10	BCHPF1122	2.45	2.07	21.8
1	EM-12	1	2	11	r14PF12	1.31	1.80	17.9
1	EM-11	1	2	12	r15PF12	1.30	1.82	19.1
1	EM-13	1	2	13	r02PF22	1.29	1.82	18.4
1	EM-03	1	2	14	r04PF22	1.27	1.80	18.5
1	EM-11	1	2	15	r15PF22	1.30	1.85	19.5
1	EM-13	1	2	16	r02PF12	1.26	1.81	18.2
1	EM-01	1	2	17	r12PF12	1.27	1.85	19.1
1	EM-02	1	2	18	r05PF12	1.26	1.82	18.4
1	Batch 1	1	2	19	BCHPF1123	2.43	2.05	21.6
1	Batch 1	2	1	1	BCHPF1211	2.51	2.04	22.2
1	EM-04	2	1	2	r07PF21	1.28	1.80	19.6
1	EM-05	2	1	3	r11PF11	1.27	1.82	19.6
1	EM-07	2	1	4	r09PF11	1.28	1.88	19.2
1	EM-08	2	1	5	r03PF21	1.26	1.83	18.6
1	EM-10	2	1	6	r01PF11	1.22	1.79	18.5
1	EM-05	2	1	7	r11PF21	1.22	1.84	19.6
1	EM-06	2	1	8	r13PF21	1.21	1.81	19.6
1	Batch 1	2	1	9	BCHPF1212	2.41	2.08	22.1
1	EM-09	2	1	10	r06PF21	1.27	1.82	18.5
1	EM-10	2	1	11	r01PF21	1.22	1.79	18.6
1	EM-06	2	1	12	r13PF11	1.23	1.84	19.7
1	EM-09	2	1	13	r06PF11	1.21	1.84	18.5
1	EM-04	2	1	14	r07PF11	1.23	1.81	19.9
1	EM-08	2	1	15	r03PF11	1.22	1.85	18.3
1	EM-07	2	1	16	r09PF21	1.22	1.86	18.9
1	Batch 1	2	1	17	BCHPF1213	2.35	2.05	21.7
1	Batch 1	2	2	1	BCHPF1221	2.56	2.09	22.1
1	EM-07	2	2	2	r09PF22	1.35	1.85	18.6
1	EM-05	2	2	3	r11PF22	1.31	1.85	19.4
1	EM-10	2	2	4	r01PF22	1.29	1.81	18.6
1	EM-08	2	2	5	r03PF22	1.29	1.83	18.2
1	EM-05	2	2	6	r11PF12	1.27	1.86	19.5
1	EM-07	2	2	7	r09PF12	1.29	1.86	18.8
1	EM-09	2	2	8	r06PF22	1.27	1.84	18.3
1	Batch 1	2	2	9	BCHPF1222	2.40	2.06	22.0

Table D2. Measured Elemental Concentrations (wt%) for the Matrix 2A Study Glasses Prepared Using Peroxide Fusion

Set	Glass ID	Block	Sub-Block	Sequence	Lab ID	B (wt%)	Li (wt%)	Si (wt%)
1	EM-04	2	2	10	r07PF12	1.36	1.85	19.9
1	EM-10	2	2	11	r01PF12	1.28	1.81	18.5
1	EM-06	2	2	12	r13PF12	1.28	1.85	19.5
1	EM-08	2	2	13	r03PF12	1.27	1.85	17.8
1	EM-04	2	2	14	r07PF22	1.24	1.81	19.4
1	EM-06	2	2	15	r13PF22	1.25	1.82	19.3
1	EM-09	2	2	16	r06PF12	1.24	1.84	18.2
1	Batch 1	2	2	17	BCHPF1223	2.40	2.07	22.1
2	Batch 1	1	1	1	BCHPF2111	2.50	2.01	21.8
2	EM-23	1	1	2	s12PF21	2.25	1.83	17.6
2	EM-23	1	1	3	s12PF11	2.20	1.81	17.4
2	EM-26	1	1	4	s07PF11	2.18	1.81	17.6
2	EM-22	1	1	5	s02PF21	2.19	1.79	17.2
2	EM-28	1	1	6	s01PF21	2.20	1.78	17.1
2	EM-29	1	1	7	s09PF21	2.22	1.80	17.0
2	EM-25	1	1	8	s14PF21	2.17	1.77	17.3
2	EM-20	1	1	9	s04PF21	2.14	1.75	17.6
2	Batch 1	1	1	10	BCHPF2112	2.40	2.02	21.6
2	EM-25	1	1	11	s14PF11	2.22	1.77	17.3
2	EM-22	1	1	12	s02PF11	2.23	1.81	17.3
2	EM-28	1	1	13	s01PF11	2.20	1.78	17.0
2	EM-21	1	1	14	s03PF11	2.23	1.83	18.2
2	EM-20	1	1	15	s04PF11	2.20	1.79	18.0
2	EM-29	1	1	16	s09PF11	2.27	1.85	17.3
2	EM-21	1	1	17	s03PF21	2.18	1.79	18.0
2	EM-26	1	1	18	s07PF21	2.16	1.77	17.5
2	Batch 1	1	1	19	BCHPF2113	2.41	2.02	21.8
2	Batch 1	1	2	1	BCHPF2121	2.45	2.01	21.5
2	EM-22	1	2	2	s02PF22	2.20	1.83	17.3
2	EM-26	1	2	3	s07PF12	2.14	1.80	17.6
2	EM-29	1	2	4	s09PF22	2.19	1.82	17.1
2	EM-21	1	2	5	s03PF12	2.14	1.81	18.0
2	EM-25	1	2	6	s14PF12	2.12	1.80	17.3
2	EM-23	1	2	7	s12PF22	2.20	1.88	17.9
2	EM-25	1	2	8	s14PF22	2.14	1.81	17.4
2	EM-23	1	2	9	s12PF12	2.12	1.81	17.3
2	Batch 1	1	2	10	BCHPF2122	2.33	2.02	21.7
2	EM-21	1	2	11	s03PF22	2.18	1.81	18.0
2	EM-29	1	2	12	s09PF12	2.17	1.81	16.9
2	EM-22	1	2	13	s02PF12	2.15	1.81	17.2
2	EM-26	1	2	14	s07PF22	2.10	1.79	17.5
2	EM-28	1	2	15	s01PF22	2.11	1.79	16.9
2	EM-20	1	2	16	s04PF12	2.08	1.78	17.6
2	EM-28	1	2	17	s01PF12	2.08	1.77	16.6
2	EM-20	1	2	18	s04PF22	2.06	1.76	17.4
2	Batch 1	1	2	19	BCHPF2123	2.32	2.01	21.5
2	Batch 1	2	1	1	BCHPF2211	2.50	2.07	22.0
2	EM-24	2	1	2	s05PF11	2.27	1.88	17.7
2	EM-30	2	1	3	s13PF11	2.20	1.86	17.1
2	EM-19	2	1	4	s06PF21	2.40	1.97	18.6
2	EM-27	2	1	5	s15PF11	2.20	1.86	17.0
2	EM-30	2	1	6	s13PF21	2.17	1.83	16.8
2	EM-27	2	1	7	s15PF21	2.17	1.84	17.0
2	EM-17	2	1	8	s10PF11	2.14	1.82	17.0
2	Batch 1	2	1	9	BCHPF2212	2.39	2.10	22.0
2	EM-16	2	1	10	s11PF11	2.21	1.86	17.6
2	EM-19	2	1	11	s06PF11	2.20	1.84	18.1
2	EM-18	2	1	12	s08PF21	2.12	1.81	17.4
2	EM-18	2	1	13	s08PF11	2.13	1.83	17.5
2	EM-24	2	1	14	s05PF21	2.17	1.85	17.4
2	EM-17	2	1	15	s10PF21	2.13	1.83	17.1
2	EM-16	2	1	16	s11PF21	2.10	1.82	17.3
2	Batch 1	2	1	17	BCHPF2213	2.37	2.07	22.0
2	Batch 1	2	2	1	BCHPF2221	2.47	2.06	21.6

Table D2. Measured Elemental Concentrations (wt%) for the Matrix 2A Study Glasses Prepared Using Peroxide Fusion

Set	Glass ID	Block	Sub-Block	Sequence	Lab ID	B (wt%)	Li (wt%)	Si (wt%)
2	EM-16	2	2	2	s11PF22	2.18	1.85	17.2
2	EM-19	2	2	3	s06PF12	2.22	1.87	18.2
2	EM-18	2	2	4	s08PF22	2.12	1.81	17.2
2	EM-18	2	2	5	s08PF12	2.13	1.83	17.3
2	EM-24	2	2	6	s05PF22	2.17	1.86	17.2
2	EM-27	2	2	7	s15PF22	2.12	1.84	16.7
2	EM-27	2	2	8	s15PF12	2.12	1.84	16.8
2	Batch 1	2	2	9	BCHPF2222	2.33	2.04	21.5
2	EM-16	2	2	10	s11PF12	2.19	1.85	17.4
2	EM-17	2	2	11	s10PF12	2.11	1.81	16.8
2	EM-19	2	2	12	s06PF22	2.35	1.97	18.4
2	EM-17	2	2	13	s10PF22	2.14	1.83	16.9
2	EM-30	2	2	14	s13PF12	2.14	1.84	16.7
2	EM-30	2	2	15	s13PF22	2.15	1.84	16.8
2	EM-24	2	2	16	s05PF12	2.18	1.87	17.4
2	Batch 1	2	2	17	BCHPF2223	2.36	2.07	21.9

Table D3. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by Glass ID for the Matrix 2A Study

Set	Glass #	Oxide	Measured (wt%)	Measured Bias-Corrected (wt%)	Targeted (wt%)	Diff of Measured	Diff of Meas BC	% Diff of Measured	% Diff of Meas BC
1	Batch 1	Al2O3 (wt%)	4.7379	4.8770	4.8770	-0.1391	0.0000	-2.9%	0.0%
1	Batch 1	B2O3 (wt%)	7.9854	7.7770	7.7770	0.2084	0.0000	2.7%	0.0%
1	Batch 1	BaO (wt%)	0.1342	0.1510	0.1510	-0.0168	0.0000	-11.1%	0.0%
1	Batch 1	CaO (wt%)	1.2060	1.2200	1.2200	-0.0140	0.0000	-1.1%	0.0%
1	Batch 1	Ce2O3 (wt%)	0.0059	0.0059	0.0000	0.0059	0.0059		
1	Batch 1	Cr2O3 (wt%)	0.1044	0.1070	0.1070	-0.0026	0.0000	-2.4%	0.0%
1	Batch 1	CuO (wt%)	0.3866	0.3990	0.3990	-0.0124	0.0000	-3.1%	0.0%
1	Batch 1	Fe2O3 (wt%)	12.5635	12.8390	12.8390	-0.2755	0.0000	-2.1%	0.0%
1	Batch 1	La2O3 (wt%)	0.0059	0.0059	0.0000	0.0059	0.0059		
1	Batch 1	Li2O (wt%)	4.4906	4.4290	4.4290	0.0616	0.0000	1.4%	0.0%
1	Batch 1	MgO (wt%)	1.2962	1.4190	1.4190	-0.1228	0.0000	-8.7%	0.0%
1	Batch 1	MnO (wt%)	1.7259	1.7260	1.7260	-0.0001	0.0000	0.0%	0.0%
1	Batch 1	Na2O (wt%)	9.1181	9.0030	9.0030	0.1151	0.0000	1.3%	0.0%
1	Batch 1	NiO (wt%)	0.6555	0.7510	0.7510	-0.0955	0.0000	-12.7%	0.0%
1	Batch 1	PbO (wt%)	0.0054	0.0054	0.0000	0.0054	0.0054		
1	Batch 1	SiO2 (wt%)	47.4033	50.2200	50.2200	-2.8167	0.0000	-5.6%	0.0%
1	Batch 1	SO4 (wt%)	0.1498	0.1498	0.0000	0.1498	0.1498		
1	Batch 1	TiO2 (wt%)	0.6536	0.6770	0.6770	-0.0234	0.0000	-3.5%	0.0%
1	Batch 1	ZnO (wt%)	0.0062	0.0062	0.0000	0.0062	0.0062		
1	Batch 1	ZrO2 (wt%)	0.0874	0.0874	0.0980	-0.0106	-0.0106	-10.9%	-10.9%
1	Batch 1	ZZ sum	92.7217	95.8555	95.6930	-2.9713	0.1625	-3.1%	0.2%
1	EM-01	Al2O3 (wt%)	11.4882	11.8133	11.5900	-0.1018	0.2233	-0.9%	1.9%
1	EM-01	B2O3 (wt%)	4.1537	3.9788	4.0000	0.1537	-0.0212	3.8%	-0.5%
1	EM-01	BaO (wt%)	0.0684	0.0764	0.0800	-0.0116	-0.0036	-14.5%	-4.5%
1	EM-01	CaO (wt%)	1.3352	1.3556	1.3200	0.0152	0.0356	1.2%	2.7%
1	EM-01	Ce2O3 (wt%)	0.2264	0.2264	0.2400	-0.0136	-0.0136	-5.7%	-5.7%
1	EM-01	Cr2O3 (wt%)	0.1027	0.1046	0.1400	-0.0373	-0.0354	-26.7%	-25.3%
1	EM-01	CuO (wt%)	0.0448	0.0466	0.0400	0.0048	0.0066	11.9%	16.5%
1	EM-01	Fe2O3 (wt%)	14.1433	14.4314	14.9500	-0.8067	-0.5186	-5.4%	-3.5%
1	EM-01	La2O3 (wt%)	0.0692	0.0692	0.0800	-0.0108	-0.0108	-13.5%	-13.5%
1	EM-01	Li2O (wt%)	4.0098	3.9164	4.0000	0.0098	-0.0836	0.2%	-2.1%
1	EM-01	MgO (wt%)	0.7015	0.7558	0.7100	-0.0085	0.0458	-1.2%	6.5%
1	EM-01	MnO (wt%)	2.9375	2.9376	2.9200	0.0175	0.0176	0.6%	0.6%
1	EM-01	Na2O (wt%)	15.4346	15.2034	15.4800	-0.0454	-0.2766	-0.3%	-1.8%
1	EM-01	NiO (wt%)	0.9553	1.0832	1.1400	-0.1847	-0.0568	-16.2%	-5.0%
1	EM-01	PbO (wt%)	0.0908	0.0908	0.1000	-0.0092	-0.0092	-9.2%	-9.2%
1	EM-01	SiO2 (wt%)	41.1280	43.3337	40.4200	0.7080	2.9137	1.8%	7.2%
1	EM-01	SO4 (wt%)	0.4269	0.4269	0.4500	-0.0231	-0.0231	-5.1%	-5.1%
1	EM-01	TiO2 (wt%)	2.0725	2.1580	2.0000	0.0725	0.1580	3.6%	7.9%
1	EM-01	ZnO (wt%)	0.0582	0.0582	0.0700	-0.0118	-0.0118	-16.9%	-16.9%
1	EM-01	ZrO2 (wt%)	0.1692	0.1692	0.1700	-0.0008	-0.0008	-0.5%	-0.5%
1	EM-01	ZZ sum	99.6159	102.2354	99.9000	-0.2841	2.3354	-0.3%	2.3%
1	EM-02	Al2O3 (wt%)	14.1382	14.5383	14.0900	0.0482	0.4483	0.3%	3.2%
1	EM-02	B2O3 (wt%)	4.0973	3.9256	4.0000	0.0973	-0.0744	2.4%	-1.9%
1	EM-02	BaO (wt%)	0.0681	0.0761	0.0800	-0.0119	-0.0039	-14.9%	-4.9%
1	EM-02	CaO (wt%)	1.3338	1.3542	1.3200	0.0138	0.0342	1.0%	2.6%
1	EM-02	Ce2O3 (wt%)	0.2255	0.2255	0.2400	-0.0145	-0.0145	-6.1%	-6.1%
1	EM-02	Cr2O3 (wt%)	0.1107	0.1128	0.1400	-0.0293	-0.0272	-20.9%	-19.4%
1	EM-02	CuO (wt%)	0.0476	0.0495	0.0400	0.0076	0.0095	18.9%	23.8%
1	EM-02	Fe2O3 (wt%)	14.0790	14.3670	14.9500	-0.8710	-0.5830	-5.8%	-3.9%
1	EM-02	La2O3 (wt%)	0.0704	0.0704	0.0800	-0.0096	-0.0096	-12.0%	-12.0%
1	EM-02	Li2O (wt%)	3.9613	3.8683	4.0000	-0.0387	-0.1317	-1.0%	-3.3%
1	EM-02	MgO (wt%)	0.7015	0.7558	0.7100	-0.0085	0.0458	-1.2%	6.5%
1	EM-02	MnO (wt%)	2.9568	2.9570	2.9200	0.0368	0.0370	1.3%	1.3%
1	EM-02	Na2O (wt%)	13.5912	13.3876	13.6000	-0.0088	-0.2124	-0.1%	-1.6%
1	EM-02	NiO (wt%)	0.9725	1.1027	1.1400	-0.1675	-0.0373	-14.7%	-3.3%
1	EM-02	PbO (wt%)	0.0867	0.0867	0.1000	-0.0133	-0.0133	-13.3%	-13.3%
1	EM-02	SiO2 (wt%)	40.1119	42.2587	39.8100	0.3019	2.4487	0.8%	6.2%

Table D3. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by Glass ID for the Matrix 2A Study

Set	Glass #	Oxide	Measured (wt%)	Measured Bias-Corrected (wt%)	Targeted (wt%)	Diff of Measured	Diff of Meas BC	% Diff of Measured	% Diff of Meas BC
1	EM-02	SO4 (wt%)	0.4224	0.4224	0.4500	-0.0276	-0.0276	-6.1%	-6.1%
1	EM-02	TiO2 (wt%)	2.0600	2.1448	2.0000	0.0600	0.1448	3.0%	7.2%
1	EM-02	ZnO (wt%)	0.0613	0.0613	0.0700	-0.0087	-0.0087	-12.4%	-12.4%
1	EM-02	ZrO2 (wt%)	0.1749	0.1749	0.1700	0.0049	0.0049	2.9%	2.9%
1	EM-02	ZZ sum	99.2711	101.9397	99.9100	-0.6389	2.0297	-0.6%	2.0%
1	EM-03	Al2O3 (wt%)	9.0885	9.3649	9.0900	-0.0015	0.2749	0.0%	3.0%
1	EM-03	B2O3 (wt%)	4.1215	3.9494	4.0000	0.1215	-0.0506	3.0%	-1.3%
1	EM-03	BaO (wt%)	0.0695	0.0788	0.0800	-0.0105	-0.0012	-13.1%	-1.5%
1	EM-03	CaO (wt%)	1.3695	1.3803	1.3200	0.0495	0.0603	3.7%	4.6%
1	EM-03	Ce2O3 (wt%)	0.2319	0.2319	0.2400	-0.0081	-0.0081	-3.4%	-3.4%
1	EM-03	Cr2O3 (wt%)	0.1162	0.1198	0.1400	-0.0238	-0.0202	-17.0%	-14.4%
1	EM-03	CuO (wt%)	0.0548	0.0561	0.0400	0.0148	0.0161	36.9%	40.2%
1	EM-03	Fe2O3 (wt%)	14.0861	14.4144	14.9500	-0.8639	-0.5356	-5.8%	-3.6%
1	EM-03	La2O3 (wt%)	0.0692	0.0692	0.0800	-0.0108	-0.0108	-13.5%	-13.5%
1	EM-03	Li2O (wt%)	3.9506	3.8582	4.0000	-0.0494	-0.1418	-1.2%	-3.5%
1	EM-03	MgO (wt%)	0.6861	0.7633	0.7100	-0.0239	0.0533	-3.4%	7.5%
1	EM-03	MnO (wt%)	2.9633	2.9633	2.9200	0.0433	0.0433	1.5%	1.5%
1	EM-03	Na2O (wt%)	17.2207	17.0449	17.5100	-0.2893	-0.4651	-1.7%	-2.7%
1	EM-03	NiO (wt%)	0.9477	1.0970	1.1400	-0.1923	-0.0430	-16.9%	-3.8%
1	EM-03	PbO (wt%)	0.0878	0.0878	0.1000	-0.0122	-0.0122	-12.2%	-12.2%
1	EM-03	SiO2 (wt%)	40.5932	42.7648	40.9000	-0.3068	1.8648	-0.8%	4.6%
1	EM-03	SO4 (wt%)	0.4434	0.4434	0.4500	-0.0066	-0.0066	-1.5%	-1.5%
1	EM-03	TiO2 (wt%)	2.0016	2.0627	2.0000	0.0016	0.0627	0.1%	3.1%
1	EM-03	ZnO (wt%)	0.0654	0.0654	0.0700	-0.0046	-0.0046	-6.6%	-6.6%
1	EM-03	ZrO2 (wt%)	0.1719	0.1719	0.1700	0.0019	0.0019	1.1%	1.1%
1	EM-03	ZZ sum	98.3388	100.9873	99.9100	-1.5712	1.0773	-1.6%	1.1%
1	EM-04	Al2O3 (wt%)	6.5755	6.7752	6.5900	-0.0145	0.1852	-0.2%	2.8%
1	EM-04	B2O3 (wt%)	4.1134	4.0743	4.0000	0.1134	0.0743	2.8%	1.9%
1	EM-04	BaO (wt%)	0.0689	0.0781	0.0800	-0.0111	-0.0019	-13.8%	-2.3%
1	EM-04	CaO (wt%)	1.3177	1.3279	1.3200	-0.0023	0.0079	-0.2%	0.6%
1	EM-04	Ce2O3 (wt%)	0.2284	0.2284	0.2400	-0.0116	-0.0116	-4.8%	-4.8%
1	EM-04	Cr2O3 (wt%)	0.1188	0.1225	0.1400	-0.0212	-0.0175	-15.2%	-12.5%
1	EM-04	CuO (wt%)	0.0538	0.0551	0.0400	0.0138	0.0151	34.6%	37.8%
1	EM-04	Fe2O3 (wt%)	14.2112	14.5445	14.9500	-0.7388	-0.4055	-4.9%	-2.7%
1	EM-04	La2O3 (wt%)	0.0642	0.0642	0.0800	-0.0158	-0.0158	-19.7%	-19.7%
1	EM-04	Li2O (wt%)	3.9129	3.8981	4.0000	-0.0871	-0.1019	-2.2%	-2.5%
1	EM-04	MgO (wt%)	0.6762	0.7522	0.7100	-0.0338	0.0422	-4.8%	5.9%
1	EM-04	MnO (wt%)	2.9407	2.9410	2.9200	0.0207	0.0210	0.7%	0.7%
1	EM-04	Na2O (wt%)	17.4903	17.3097	17.9300	-0.4397	-0.6203	-2.5%	-3.5%
1	EM-04	NiO (wt%)	0.9744	1.1278	1.1400	-0.1656	-0.0122	-14.5%	-1.1%
1	EM-04	PbO (wt%)	0.0843	0.0843	0.1000	-0.0157	-0.0157	-15.7%	-15.7%
1	EM-04	SiO2 (wt%)	42.1442	44.9020	42.9800	-0.8358	1.9220	-1.9%	4.5%
1	EM-04	SO4 (wt%)	0.4344	0.4344	0.4500	-0.0156	-0.0156	-3.5%	-3.5%
1	EM-04	TiO2 (wt%)	1.9808	2.0413	2.0000	-0.0193	0.0413	-1.0%	2.1%
1	EM-04	ZnO (wt%)	0.0641	0.0641	0.0700	-0.0059	-0.0059	-8.4%	-8.4%
1	EM-04	ZrO2 (wt%)	0.1709	0.1709	0.1700	0.0009	0.0009	0.5%	0.5%
1	EM-04	ZZ sum	97.6251	100.9958	99.9100	-2.2849	1.0858	-2.3%	1.1%
1	EM-05	Al2O3 (wt%)	6.5896	6.7901	6.5900	-0.0004	0.2001	0.0%	3.0%
1	EM-05	B2O3 (wt%)	4.0812	4.0424	4.0000	0.0812	0.0424	2.0%	1.1%
1	EM-05	BaO (wt%)	0.0701	0.0794	0.0800	-0.0099	-0.0006	-12.4%	-0.7%
1	EM-05	CaO (wt%)	1.3313	1.3419	1.3200	0.0113	0.0219	0.9%	1.7%
1	EM-05	Ce2O3 (wt%)	0.2357	0.2357	0.2400	-0.0043	-0.0043	-1.8%	-1.8%
1	EM-05	Cr2O3 (wt%)	0.1063	0.1096	0.1400	-0.0337	-0.0304	-24.0%	-21.7%
1	EM-05	CuO (wt%)	0.0432	0.0442	0.0400	0.0032	0.0042	8.0%	10.5%
1	EM-05	Fe2O3 (wt%)	16.2628	16.6415	17.4500	-1.1872	-0.8085	-6.8%	-4.6%
1	EM-05	La2O3 (wt%)	0.0701	0.0701	0.0800	-0.0099	-0.0099	-12.4%	-12.4%
1	EM-05	Li2O (wt%)	3.9667	3.9517	4.0000	-0.0333	-0.0483	-0.8%	-1.2%
1	EM-05	MgO (wt%)	0.7002	0.7790	0.7100	-0.0098	0.0690	-1.4%	9.7%

Table D3. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by Glass ID for the Matrix 2A Study

Set	Glass #	Oxide	Measured (wt%)	Measured Bias-Corrected (wt%)	Targeted (wt%)	Diff of Measured	Diff of Meas BC	% Diff of Measured	% Diff of Meas BC
1	EM-05	MnO (wt%)	2.9762	2.9762	2.9200	0.0562	0.0562	1.9%	1.9%
1	EM-05	Na2O (wt%)	15.9401	15.7783	16.2700	-0.3299	-0.4917	-2.0%	-3.0%
1	EM-05	NiO (wt%)	0.9779	1.1319	1.1400	-0.1621	-0.0081	-14.2%	-0.7%
1	EM-05	PbO (wt%)	0.0926	0.0926	0.1000	-0.0074	-0.0074	-7.4%	-7.4%
1	EM-05	SiO2 (wt%)	41.7698	44.5032	42.1400	-0.3702	2.3632	-0.9%	5.6%
1	EM-05	SO4 (wt%)	0.4464	0.4464	0.4500	-0.0036	-0.0036	-0.8%	-0.8%
1	EM-05	TiO2 (wt%)	1.9849	2.0455	2.0000	-0.0151	0.0455	-0.8%	2.3%
1	EM-05	ZnO (wt%)	0.0622	0.0622	0.0700	-0.0078	-0.0078	-11.1%	-11.1%
1	EM-05	ZrO2 (wt%)	0.1726	0.1726	0.1700	0.0026	0.0026	1.5%	1.5%
1	EM-05	ZZ sum	97.8802	101.2946	99.9100	-2.0298	1.3846	-2.0%	1.4%
1	EM-06	Al2O3 (wt%)	6.7077	6.8976	6.5900	0.1177	0.3076	1.8%	4.7%
1	EM-06	B2O3 (wt%)	4.0007	3.9626	4.0000	0.0007	-0.0374	0.0%	-0.9%
1	EM-06	BaO (wt%)	0.0695	0.0777	0.0800	-0.0105	-0.0023	-13.1%	-2.9%
1	EM-06	CaO (wt%)	1.3558	1.3766	1.3200	0.0358	0.0566	2.7%	4.3%
1	EM-06	Ce2O3 (wt%)	0.2331	0.2331	0.2400	-0.0069	-0.0069	-2.9%	-2.9%
1	EM-06	Cr2O3 (wt%)	0.1052	0.1072	0.1400	-0.0348	-0.0328	-24.8%	-23.4%
1	EM-06	CuO (wt%)	0.0441	0.0459	0.0400	0.0041	0.0059	10.3%	14.8%
1	EM-06	Fe2O3 (wt%)	18.1572	18.5290	19.9500	-1.7928	-1.4210	-9.0%	-7.1%
1	EM-06	La2O3 (wt%)	0.0686	0.0686	0.0800	-0.0114	-0.0114	-14.2%	-14.2%
1	EM-06	Li2O (wt%)	3.9398	3.9250	4.0000	-0.0602	-0.0750	-1.5%	-1.9%
1	EM-06	MgO (wt%)	0.7189	0.7746	0.7100	0.0089	0.0646	1.2%	9.1%
1	EM-06	MnO (wt%)	2.9601	2.9602	2.9200	0.0401	0.0402	1.4%	1.4%
1	EM-06	Na2O (wt%)	13.9855	13.7763	13.7700	0.2155	0.0063	1.6%	0.0%
1	EM-06	NiO (wt%)	0.9582	1.0865	1.1400	-0.1818	-0.0535	-15.9%	-4.7%
1	EM-06	PbO (wt%)	0.0913	0.0913	0.1000	-0.0087	-0.0087	-8.7%	-8.7%
1	EM-06	SiO2 (wt%)	41.7698	44.5034	42.1400	-0.3702	2.3634	-0.9%	5.6%
1	EM-06	SO4 (wt%)	0.4269	0.4269	0.4500	-0.0231	-0.0231	-5.1%	-5.1%
1	EM-06	TiO2 (wt%)	2.0266	2.1101	2.0000	0.0266	0.1101	1.3%	5.5%
1	EM-06	ZnO (wt%)	0.0626	0.0626	0.0700	-0.0074	-0.0074	-10.6%	-10.6%
1	EM-06	ZrO2 (wt%)	0.1759	0.1759	0.1700	0.0059	0.0059	3.5%	3.5%
1	EM-06	ZZ sum	97.8576	101.1911	99.9100	-2.0524	1.2811	-2.1%	1.3%
1	EM-07	Al2O3 (wt%)	6.6652	6.8678	6.5900	0.0752	0.2778	1.1%	4.2%
1	EM-07	B2O3 (wt%)	4.1376	4.0979	4.0000	0.1376	0.0979	3.4%	2.4%
1	EM-07	BaO (wt%)	0.0684	0.0775	0.0800	-0.0116	-0.0025	-14.5%	-3.1%
1	EM-07	CaO (wt%)	3.4175	3.4442	3.3200	0.0975	0.1242	2.9%	3.7%
1	EM-07	Ce2O3 (wt%)	0.2343	0.2343	0.2400	-0.0057	-0.0057	-2.4%	-2.4%
1	EM-07	Cr2O3 (wt%)	0.0943	0.0972	0.1400	-0.0457	-0.0428	-32.7%	-30.6%
1	EM-07	CuO (wt%)	0.0642	0.0657	0.0400	0.0242	0.0257	60.4%	64.2%
1	EM-07	Fe2O3 (wt%)	17.8355	18.2518	19.9500	-2.1145	-1.6982	-10.6%	-8.5%
1	EM-07	La2O3 (wt%)	0.0686	0.0686	0.0800	-0.0114	-0.0114	-14.2%	-14.2%
1	EM-07	Li2O (wt%)	4.0098	3.9948	4.0000	0.0098	-0.0052	0.2%	-0.1%
1	EM-07	MgO (wt%)	0.6795	0.7560	0.7100	-0.0305	0.0460	-4.3%	6.5%
1	EM-07	MnO (wt%)	2.9439	2.9440	2.9200	0.0239	0.0240	0.8%	0.8%
1	EM-07	Na2O (wt%)	13.5541	13.4148	13.6000	-0.0459	-0.1852	-0.3%	-1.4%
1	EM-07	NiO (wt%)	0.8844	1.0238	1.1400	-0.2556	-0.1162	-22.4%	-10.2%
1	EM-07	PbO (wt%)	0.0883	0.0883	0.1000	-0.0117	-0.0117	-11.7%	-11.7%
1	EM-07	SiO2 (wt%)	40.3793	43.0220	40.3100	0.0693	2.7120	0.2%	6.7%
1	EM-07	SO4 (wt%)	0.4434	0.4434	0.4500	-0.0066	-0.0066	-1.5%	-1.5%
1	EM-07	TiO2 (wt%)	1.9099	1.9681	2.0000	-0.0901	-0.0319	-4.5%	-1.6%
1	EM-07	ZnO (wt%)	0.0638	0.0638	0.0700	-0.0062	-0.0062	-8.9%	-8.9%
1	EM-07	ZrO2 (wt%)	0.1716	0.1716	0.1700	0.0016	0.0016	0.9%	0.9%
1	EM-07	ZZ sum	97.7135	101.0956	99.9100	-2.1965	1.1856	-2.2%	1.2%
1	EM-08	Al2O3 (wt%)	6.6416	6.8297	6.5900	0.0516	0.2397	0.8%	3.6%
1	EM-08	B2O3 (wt%)	4.0571	4.0185	4.0000	0.0571	0.0185	1.4%	0.5%
1	EM-08	BaO (wt%)	0.0611	0.0683	0.0800	-0.0189	-0.0117	-23.6%	-14.6%
1	EM-08	CaO (wt%)	4.4914	4.5608	4.3200	0.1714	0.2408	4.0%	5.6%
1	EM-08	Ce2O3 (wt%)	0.2293	0.2293	0.2400	-0.0107	-0.0107	-4.5%	-4.5%
1	EM-08	Cr2O3 (wt%)	0.0870	0.0886	0.1400	-0.0530	-0.0514	-37.9%	-36.7%

Table D3. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by Glass ID for the Matrix 2A Study

Set	Glass #	Oxide	Measured (wt%)	Measured Bias-Corrected (wt%)	Targeted (wt%)	Diff of Measured	Diff of Meas BC	% Diff of Measured	% Diff of Meas BC
1	EM-08	CuO (wt%)	0.0407	0.0424	0.0400	0.0007	0.0024	1.7%	5.9%
1	EM-08	Fe2O3 (wt%)	18.2287	18.6020	19.9500	-1.7213	-1.3480	-8.6%	-6.8%
1	EM-08	La2O3 (wt%)	0.0677	0.0677	0.0800	-0.0123	-0.0123	-15.3%	-15.3%
1	EM-08	Li2O (wt%)	3.9613	3.9465	4.0000	-0.0387	-0.0535	-1.0%	-1.3%
1	EM-08	MgO (wt%)	0.6957	0.7496	0.7100	-0.0143	0.0396	-2.0%	5.6%
1	EM-08	MnO (wt%)	2.9084	2.9086	2.9200	-0.0116	-0.0114	-0.4%	-0.4%
1	EM-08	Na2O (wt%)	13.8035	13.5971	13.6000	0.2035	-0.0029	1.5%	0.0%
1	EM-08	NiO (wt%)	0.8796	0.9974	1.1400	-0.2604	-0.1426	-22.8%	-12.5%
1	EM-08	PbO (wt%)	0.0870	0.0870	0.1000	-0.0130	-0.0130	-13.0%	-13.0%
1	EM-08	SiO2 (wt%)	38.9887	41.5406	39.3100	-0.3213	2.2306	-0.8%	5.7%
1	EM-08	SO4 (wt%)	0.4337	0.4337	0.4500	-0.0163	-0.0163	-3.6%	-3.6%
1	EM-08	TiO2 (wt%)	2.2518	2.3445	2.0000	0.2518	0.3445	12.6%	17.2%
1	EM-08	ZnO (wt%)	0.0613	0.0613	0.0700	-0.0087	-0.0087	-12.4%	-12.4%
1	EM-08	ZrO2 (wt%)	0.1746	0.1746	0.1700	0.0046	0.0046	2.7%	2.7%
1	EM-08	ZZ sum	98.1502	101.3480	99.9100	-1.7598	1.4380	-1.8%	1.4%
1	EM-09	Al2O3 (wt%)	11.6724	12.0027	11.5900	0.0824	0.4127	0.7%	3.6%
1	EM-09	B2O3 (wt%)	4.0168	3.9789	4.0000	0.0168	-0.0211	0.4%	-0.5%
1	EM-09	BaO (wt%)	0.0673	0.0752	0.0800	-0.0127	-0.0048	-15.9%	-6.0%
1	EM-09	CaO (wt%)	1.3590	1.3798	1.3200	0.0390	0.0598	3.0%	4.5%
1	EM-09	Ce2O3 (wt%)	0.2266	0.2266	0.2400	-0.0134	-0.0134	-5.6%	-5.6%
1	EM-09	Cr2O3 (wt%)	0.0943	0.0961	0.1400	-0.0457	-0.0439	-32.7%	-31.4%
1	EM-09	CuO (wt%)	0.0545	0.0567	0.0400	0.0145	0.0167	36.1%	41.7%
1	EM-09	Fe2O3 (wt%)	15.9769	16.3037	17.4500	-1.4731	-1.1463	-8.4%	-6.6%
1	EM-09	La2O3 (wt%)	0.0671	0.0671	0.0800	-0.0129	-0.0129	-16.1%	-16.1%
1	EM-09	Li2O (wt%)	3.9506	3.9357	4.0000	-0.0494	-0.0643	-1.2%	-1.6%
1	EM-09	MgO (wt%)	0.6940	0.7478	0.7100	-0.0160	0.0378	-2.3%	5.3%
1	EM-09	MnO (wt%)	2.9246	2.9247	2.9200	0.0046	0.0047	0.2%	0.2%
1	EM-09	Na2O (wt%)	13.7934	13.5868	13.6000	0.1934	-0.0132	1.4%	-0.1%
1	EM-09	NiO (wt%)	0.9232	1.0468	1.1400	-0.2168	-0.0932	-19.0%	-8.2%
1	EM-09	PbO (wt%)	0.0891	0.0891	0.1000	-0.0109	-0.0109	-10.9%	-10.9%
1	EM-09	SiO2 (wt%)	39.3096	41.8822	39.8100	-0.5004	2.0722	-1.3%	5.2%
1	EM-09	SO4 (wt%)	0.4015	0.4015	0.4500	-0.0485	-0.0485	-10.8%	-10.8%
1	EM-09	TiO2 (wt%)	2.0808	2.1666	2.0000	0.0808	0.1666	4.0%	8.3%
1	EM-09	ZnO (wt%)	0.0626	0.0626	0.0700	-0.0074	-0.0074	-10.6%	-10.6%
1	EM-09	ZrO2 (wt%)	0.1743	0.1743	0.1700	0.0043	0.0043	2.5%	2.5%
1	EM-09	ZZ sum	97.9385	101.2048	99.9100	-1.9715	1.2948	-2.0%	1.3%
1	EM-10	Al2O3 (wt%)	11.5071	11.8334	11.5900	-0.0829	0.2434	-0.7%	2.1%
1	EM-10	B2O3 (wt%)	4.0329	3.9943	4.0000	0.0329	-0.0057	0.8%	-0.1%
1	EM-10	BaO (wt%)	0.0667	0.0746	0.0800	-0.0133	-0.0054	-16.6%	-6.8%
1	EM-10	CaO (wt%)	1.3341	1.3548	1.3200	0.0141	0.0348	1.1%	2.6%
1	EM-10	Ce2O3 (wt%)	0.2208	0.2208	0.2400	-0.0192	-0.0192	-8.0%	-8.0%
1	EM-10	Cr2O3 (wt%)	0.1019	0.1039	0.1400	-0.0381	-0.0361	-27.2%	-25.8%
1	EM-10	CuO (wt%)	0.0570	0.0593	0.0400	0.0170	0.0193	42.4%	48.2%
1	EM-10	Fe2O3 (wt%)	11.9130	12.1570	12.4500	-0.5370	-0.2930	-4.3%	-2.4%
1	EM-10	La2O3 (wt%)	0.0683	0.0683	0.0800	-0.0117	-0.0117	-14.6%	-14.6%
1	EM-10	Li2O (wt%)	3.8752	3.8606	4.0000	-0.1248	-0.1394	-3.1%	-3.5%
1	EM-10	MgO (wt%)	0.6878	0.7411	0.7100	-0.0222	0.0311	-3.1%	4.4%
1	EM-10	MnO (wt%)	2.9052	2.9054	2.9200	-0.0148	-0.0146	-0.5%	-0.5%
1	EM-10	Na2O (wt%)	17.2881	17.0301	17.5100	-0.2219	-0.4799	-1.3%	-2.7%
1	EM-10	NiO (wt%)	0.9257	1.0497	1.1400	-0.2143	-0.0903	-18.8%	-7.9%
1	EM-10	PbO (wt%)	0.0862	0.0862	0.1000	-0.0138	-0.0138	-13.8%	-13.8%
1	EM-10	SiO2 (wt%)	39.6840	42.2806	40.9000	-1.2160	1.3806	-3.0%	3.4%
1	EM-10	SO4 (wt%)	0.4194	0.4194	0.4500	-0.0306	-0.0306	-6.8%	-6.8%
1	EM-10	TiO2 (wt%)	2.0725	2.1579	2.0000	0.0725	0.1579	3.6%	7.9%
1	EM-10	ZnO (wt%)	0.0728	0.0728	0.0700	0.0028	0.0028	4.0%	4.0%
1	EM-10	ZrO2 (wt%)	0.1695	0.1695	0.1700	-0.0005	-0.0005	-0.3%	-0.3%
1	EM-10	ZZ sum	97.4883	100.6397	99.9100	-2.4217	0.7297	-2.4%	0.7%
1	EM-11	Al2O3 (wt%)	11.4929	11.8419	11.5900	-0.0971	0.2519	-0.8%	2.2%

Table D3. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by Glass ID for the Matrix 2A Study

Set	Glass #	Oxide	Measured (wt%)	Measured Bias-Corrected (wt%)	Targeted (wt%)	Diff of Measured	Diff of Meas BC	% Diff of Measured	% Diff of Meas BC
1	EM-11	B2O3 (wt%)	4.1456	3.9720	4.0000	0.1456	-0.0280	3.6%	-0.7%
1	EM-11	BaO (wt%)	0.0701	0.0794	0.0800	-0.0099	-0.0006	-12.4%	-0.8%
1	EM-11	CaO (wt%)	1.3317	1.3420	1.3200	0.0117	0.0220	0.9%	1.7%
1	EM-11	Ce2O3 (wt%)	0.2398	0.2398	0.2400	-0.0002	-0.0002	-0.1%	-0.1%
1	EM-11	Cr2O3 (wt%)	0.0935	0.0965	0.1400	-0.0465	-0.0435	-33.2%	-31.1%
1	EM-11	CuO (wt%)	0.0466	0.0477	0.0400	0.0066	0.0077	16.6%	19.3%
1	EM-11	Fe2O3 (wt%)	13.4892	13.8054	14.9500	-1.4608	-1.1446	-9.8%	-7.7%
1	EM-11	La2O3 (wt%)	0.0710	0.0710	0.0800	-0.0090	-0.0090	-11.3%	-11.3%
1	EM-11	Li2O (wt%)	4.0205	3.9264	4.0000	0.0205	-0.0736	0.5%	-1.8%
1	EM-11	MgO (wt%)	0.6840	0.7610	0.7100	-0.0260	0.0510	-3.7%	7.2%
1	EM-11	MnO (wt%)	3.9123	3.9127	3.9200	-0.0077	-0.0073	-0.2%	-0.2%
1	EM-11	Na2O (wt%)	13.3688	13.2294	13.6000	-0.2312	-0.3706	-1.7%	-2.7%
1	EM-11	NiO (wt%)	0.9286	1.0748	1.1400	-0.2114	-0.0652	-18.5%	-5.7%
1	EM-11	PbO (wt%)	0.0899	0.0899	0.1000	-0.0101	-0.0101	-10.1%	-10.1%
1	EM-11	SiO2 (wt%)	42.0907	44.3458	41.3100	0.7807	3.0358	1.9%	7.3%
1	EM-11	SO4 (wt%)	0.4262	0.4262	0.4500	-0.0238	-0.0238	-5.3%	-5.3%
1	EM-11	TiO2 (wt%)	1.9682	2.0283	2.0000	-0.0318	0.0283	-1.6%	1.4%
1	EM-11	ZnO (wt%)	0.0604	0.0604	0.0700	-0.0096	-0.0096	-13.8%	-13.8%
1	EM-11	ZrO2 (wt%)	0.1732	0.1732	0.1700	0.0032	0.0032	1.9%	1.9%
1	EM-11	ZZ sum	98.7034	101.5240	99.9100	-1.2066	1.6140	-1.2%	1.6%
1	EM-12	Al2O3 (wt%)	11.4882	11.8137	11.5900	-0.1018	0.2237	-0.9%	1.9%
1	EM-12	B2O3 (wt%)	4.1295	3.9566	4.0000	0.1295	-0.0434	3.2%	-1.1%
1	EM-12	BaO (wt%)	0.0715	0.0799	0.0800	-0.0085	-0.0001	-10.7%	-0.2%
1	EM-12	CaO (wt%)	1.3425	1.3633	1.3200	0.0225	0.0433	1.7%	3.3%
1	EM-12	Ce2O3 (wt%)	0.2293	0.2293	0.2400	-0.0107	-0.0107	-4.5%	-4.5%
1	EM-12	Cr2O3 (wt%)	0.1191	0.1214	0.1400	-0.0209	-0.0186	-14.9%	-13.3%
1	EM-12	CuO (wt%)	0.0466	0.0485	0.0400	0.0066	0.0085	16.6%	21.4%
1	EM-12	Fe2O3 (wt%)	13.9110	14.1965	14.9500	-1.0390	-0.7535	-6.9%	-5.0%
1	EM-12	La2O3 (wt%)	0.0712	0.0712	0.0800	-0.0088	-0.0088	-10.9%	-10.9%
1	EM-12	Li2O (wt%)	3.9990	3.9050	4.0000	-0.0010	-0.0950	0.0%	-2.4%
1	EM-12	MgO (wt%)	0.7089	0.7638	0.7100	-0.0011	0.0538	-0.2%	7.6%
1	EM-12	MnO (wt%)	1.8884	1.8885	1.9200	-0.0316	-0.0315	-1.6%	-1.6%
1	EM-12	Na2O (wt%)	17.4903	17.2291	17.5100	-0.0197	-0.2809	-0.1%	-1.6%
1	EM-12	NiO (wt%)	0.8561	0.9707	1.1400	-0.2839	-0.1693	-24.9%	-14.9%
1	EM-12	PbO (wt%)	0.0881	0.0881	0.1000	-0.0119	-0.0119	-11.9%	-11.9%
1	EM-12	SiO2 (wt%)	39.4166	41.5272	39.4000	0.0166	2.1272	0.0%	5.4%
1	EM-12	SO4 (wt%)	0.4209	0.4209	0.4500	-0.0291	-0.0291	-6.5%	-6.5%
1	EM-12	TiO2 (wt%)	2.0183	2.1013	2.0000	0.0183	0.1013	0.9%	5.1%
1	EM-12	ZnO (wt%)	0.0629	0.0629	0.0700	-0.0071	-0.0071	-10.2%	-10.2%
1	EM-12	ZrO2 (wt%)	0.1770	0.1770	0.1700	0.0070	0.0070	4.1%	4.1%
1	EM-12	ZZ sum	98.5353	101.0148	99.9100	-1.3747	1.1048	-1.4%	1.1%
1	EM-13	Al2O3 (wt%)	14.2988	14.7336	14.0900	0.2088	0.6436	1.5%	4.6%
1	EM-13	B2O3 (wt%)	4.1456	3.9710	4.0000	0.1456	-0.0290	3.6%	-0.7%
1	EM-13	BaO (wt%)	0.0625	0.0709	0.0800	-0.0175	-0.0091	-21.8%	-11.4%
1	EM-13	CaO (wt%)	2.4556	2.4749	2.3200	0.1356	0.1549	5.8%	6.7%
1	EM-13	Ce2O3 (wt%)	0.2281	0.2281	0.2400	-0.0119	-0.0119	-5.0%	-5.0%
1	EM-13	Cr2O3 (wt%)	0.0928	0.0957	0.1400	-0.0472	-0.0443	-33.7%	-31.6%
1	EM-13	CuO (wt%)	0.0501	0.0513	0.0400	0.0101	0.0113	25.2%	28.2%
1	EM-13	Fe2O3 (wt%)	11.5627	11.8336	12.9500	-1.3873	-1.1164	-10.7%	-8.6%
1	EM-13	La2O3 (wt%)	0.0657	0.0657	0.0800	-0.0143	-0.0143	-17.9%	-17.9%
1	EM-13	Li2O (wt%)	3.9990	3.9050	4.0000	-0.0010	-0.0950	0.0%	-2.4%
1	EM-13	MgO (wt%)	0.6708	0.7462	0.7100	-0.0392	0.0362	-5.5%	5.1%
1	EM-13	MnO (wt%)	2.9213	2.9216	2.9200	0.0013	0.0016	0.0%	0.1%
1	EM-13	Na2O (wt%)	14.7269	14.5773	14.5600	0.1669	0.0173	1.1%	0.1%
1	EM-13	NiO (wt%)	0.9032	1.0454	1.1400	-0.2368	-0.0946	-20.8%	-8.3%
1	EM-13	PbO (wt%)	0.0851	0.0851	0.1000	-0.0149	-0.0149	-14.9%	-14.9%
1	EM-13	SiO2 (wt%)	40.1119	42.2561	39.8500	0.2619	2.4061	0.7%	6.0%
1	EM-13	SO4 (wt%)	0.4149	0.4149	0.4500	-0.0351	-0.0351	-7.8%	-7.8%

Table D3. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by Glass ID for the Matrix 2A Study

Set	Glass #	Oxide	Measured (wt%)	Measured Bias-Corrected (wt%)	Targeted (wt%)	Diff of Measured	Diff of Meas BC	% Diff of Measured	% Diff of Meas BC
1	EM-13	TiO2 (wt%)	1.9265	1.9854	2.0000	-0.0735	-0.0146	-3.7%	-0.7%
1	EM-13	ZnO (wt%)	0.0650	0.0650	0.0700	-0.0050	-0.0050	-7.1%	-7.1%
1	EM-13	ZrO2 (wt%)	0.1716	0.1716	0.1700	0.0016	0.0016	0.9%	0.9%
1	EM-13	ZZ sum	98.9581	101.6983	99.9100	-0.9519	1.7883	-1.0%	1.8%
1	EM-14	Al2O3 (wt%)	14.2516	14.6853	14.0900	0.1616	0.5953	1.1%	4.2%
1	EM-14	B2O3 (wt%)	4.0893	3.9171	4.0000	0.0893	-0.0829	2.2%	-2.1%
1	EM-14	BaO (wt%)	0.0692	0.0785	0.0800	-0.0108	-0.0015	-13.5%	-1.9%
1	EM-14	CaO (wt%)	3.7743	3.8043	3.3200	0.4543	0.4843	13.7%	14.6%
1	EM-14	Ce2O3 (wt%)	0.2278	0.2278	0.2400	-0.0122	-0.0122	-5.1%	-5.1%
1	EM-14	Cr2O3 (wt%)	0.0914	0.0942	0.1400	-0.0487	-0.0458	-34.8%	-32.7%
1	EM-14	CuO (wt%)	0.0529	0.0541	0.0400	0.0129	0.0141	32.2%	35.4%
1	EM-14	Fe2O3 (wt%)	11.7950	12.0692	12.9500	-1.1550	-0.8808	-8.9%	-6.8%
1	EM-14	La2O3 (wt%)	0.0686	0.0686	0.0800	-0.0114	-0.0114	-14.2%	-14.2%
1	EM-14	Li2O (wt%)	3.9775	3.8837	4.0000	-0.0225	-0.1163	-0.6%	-2.9%
1	EM-14	MgO (wt%)	0.6679	0.7431	0.7100	-0.0421	0.0331	-5.9%	4.7%
1	EM-14	MnO (wt%)	2.9052	2.9052	2.9200	-0.0148	-0.0148	-0.5%	-0.5%
1	EM-14	Na2O (wt%)	14.0866	13.9439	14.0600	0.0266	-0.1161	0.2%	-0.8%
1	EM-14	NiO (wt%)	0.8653	1.0017	1.1400	-0.2747	-0.1383	-24.1%	-12.1%
1	EM-14	PbO (wt%)	0.0846	0.0846	0.1000	-0.0154	-0.0154	-15.4%	-15.4%
1	EM-14	SiO2 (wt%)	39.2027	41.2965	39.3500	-0.1473	1.9465	-0.4%	4.9%
1	EM-14	SO4 (wt%)	0.4164	0.4164	0.4500	-0.0336	-0.0336	-7.5%	-7.5%
1	EM-14	TiO2 (wt%)	2.0141	2.0755	2.0000	0.0141	0.0755	0.7%	3.8%
1	EM-14	ZnO (wt%)	0.0594	0.0594	0.0700	-0.0106	-0.0106	-15.1%	-15.1%
1	EM-14	ZrO2 (wt%)	0.1699	0.1699	0.1700	-0.0001	-0.0001	-0.1%	-0.1%
1	EM-14	ZZ sum	98.8696	101.5789	99.9100	-1.0404	1.6689	-1.0%	1.7%
1	EM-15	Al2O3 (wt%)	14.3082	14.7434	14.0900	0.2182	0.6534	1.5%	4.6%
1	EM-15	B2O3 (wt%)	4.2825	4.1020	4.0000	0.2825	0.1020	7.1%	2.5%
1	EM-15	BaO (wt%)	0.0695	0.0788	0.0800	-0.0105	-0.0012	-13.1%	-1.5%
1	EM-15	CaO (wt%)	4.4704	4.5057	4.3200	0.1504	0.1857	3.5%	4.3%
1	EM-15	Ce2O3 (wt%)	0.2360	0.2360	0.2400	-0.0040	-0.0040	-1.7%	-1.7%
1	EM-15	Cr2O3 (wt%)	0.0840	0.0867	0.1400	-0.0560	-0.0533	-40.0%	-38.1%
1	EM-15	CuO (wt%)	0.0444	0.0455	0.0400	0.0044	0.0055	11.1%	13.7%
1	EM-15	Fe2O3 (wt%)	11.3911	11.6581	12.9500	-1.5589	-1.2919	-12.0%	-10.0%
1	EM-15	La2O3 (wt%)	0.0692	0.0692	0.0800	-0.0108	-0.0108	-13.5%	-13.5%
1	EM-15	Li2O (wt%)	4.1013	4.0052	4.0000	0.1013	0.0052	2.5%	0.1%
1	EM-15	MgO (wt%)	0.6907	0.7683	0.7100	-0.0193	0.0583	-2.7%	8.2%
1	EM-15	MnO (wt%)	2.9568	2.9571	2.9200	0.0368	0.0371	1.3%	1.3%
1	EM-15	Na2O (wt%)	13.6451	13.5063	13.5600	0.0851	-0.0537	0.6%	-0.4%
1	EM-15	NiO (wt%)	0.8876	1.0273	1.1400	-0.2524	-0.1127	-22.1%	-9.9%
1	EM-15	PbO (wt%)	0.0908	0.0908	0.1000	-0.0092	-0.0092	-9.2%	-9.2%
1	EM-15	SiO2 (wt%)	40.1654	42.3190	38.8500	1.3154	3.4690	3.4%	8.9%
1	EM-15	SO4 (wt%)	0.4299	0.4299	0.4500	-0.0201	-0.0201	-4.5%	-4.5%
1	EM-15	TiO2 (wt%)	1.8848	1.9425	2.0000	-0.1152	-0.0575	-5.8%	-2.9%
1	EM-15	ZnO (wt%)	0.0607	0.0607	0.0700	-0.0093	-0.0093	-13.3%	-13.3%
1	EM-15	ZrO2 (wt%)	0.1763	0.1763	0.1700	0.0063	0.0063	3.7%	3.7%
1	EM-15	ZZ sum	100.0448	102.8087	99.9100	0.1348	2.8987	0.1%	2.9%
2	Batch 1	Al2O3 (wt%)	4.6198	4.8770	4.8770	-0.2572	0.0000	-5.3%	0.0%
2	Batch 1	B2O3 (wt%)	7.7358	7.7770	7.7770	-0.0412	0.0000	-0.5%	0.0%
2	Batch 1	BaO (wt%)	0.1340	0.1510	0.1510	-0.0170	0.0000	-11.3%	0.0%
2	Batch 1	CaO (wt%)	1.1795	1.2200	1.2200	-0.0405	0.0000	-3.3%	0.0%
2	Batch 1	Ce2O3 (wt%)	0.0059	0.0059	0.0000	0.0059	0.0059		
2	Batch 1	Cr2O3 (wt%)	0.1047	0.1070	0.1070	-0.0023	0.0000	-2.1%	0.0%
2	Batch 1	CuO (wt%)	0.3824	0.3990	0.3990	-0.0166	0.0000	-4.2%	0.0%
2	Batch 1	Fe2O3 (wt%)	12.2835	12.8390	12.8390	-0.5555	0.0000	-4.3%	0.0%
2	Batch 1	La2O3 (wt%)	0.0059	0.0059	0.0000	0.0059	0.0059		
2	Batch 1	Li2O (wt%)	4.3955	4.4290	4.4290	-0.0335	0.0000	-0.8%	0.0%
2	Batch 1	MgO (wt%)	1.3152	1.4190	1.4190	-0.1038	0.0000	-7.3%	0.0%
2	Batch 1	MnO (wt%)	1.6700	1.7260	1.7260	-0.0560	0.0000	-3.2%	0.0%

Table D3. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by Glass ID for the Matrix 2A Study

Set	Glass #	Oxide	Measured (wt%)	Measured Bias-Corrected (wt%)	Targeted (wt%)	Diff of Measured	Diff of Meas BC	% Diff of Measured	% Diff of Meas BC
2	Batch 1	Na2O (wt%)	9.1136	9.0030	9.0030	0.1106	0.0000	1.2%	0.0%
2	Batch 1	NiO (wt%)	0.6650	0.7510	0.7510	-0.0860	0.0000	-11.5%	0.0%
2	Batch 1	PbO (wt%)	0.0054	0.0054	0.0000	0.0054	0.0054		
2	Batch 1	SiO2 (wt%)	46.5119	50.2200	50.2200	-3.7081	0.0000	-7.4%	0.0%
2	Batch 1	SO4 (wt%)	0.1498	0.1498	0.0000	0.1498	0.1498		
2	Batch 1	TiO2 (wt%)	0.6362	0.6770	0.6770	-0.0408	0.0000	-6.0%	0.0%
2	Batch 1	ZnO (wt%)	0.0062	0.0062	0.0000	0.0062	0.0062		
2	Batch 1	ZrO2 (wt%)	0.0901	0.0901	0.0980	-0.0079	-0.0079	-8.1%	-8.1%
2	Batch 1	ZZ sum	91.0104	95.8582	95.6930	-4.6826	0.1652	-4.9%	0.2%
2	EM-16	Al2O3 (wt%)	11.3890	12.1724	11.5900	-0.2010	0.5824	-1.7%	5.0%
2	EM-16	B2O3 (wt%)	6.9872	7.0226	7.0000	-0.0128	0.0226	-0.2%	0.3%
2	EM-16	BaO (wt%)	0.0715	0.0807	0.0800	-0.0085	0.0007	-10.7%	0.9%
2	EM-16	CaO (wt%)	1.2827	1.3522	1.3200	-0.0373	0.0322	-2.8%	2.4%
2	EM-16	Ce2O3 (wt%)	0.2346	0.2346	0.2400	-0.0054	-0.0054	-2.3%	-2.3%
2	EM-16	Cr2O3 (wt%)	0.0903	0.0922	0.1400	-0.0497	-0.0478	-35.5%	-34.1%
2	EM-16	CuO (wt%)	0.0457	0.0475	0.0400	0.0057	0.0075	14.2%	18.9%
2	EM-16	Fe2O3 (wt%)	13.7144	14.3480	14.9500	-1.2356	-0.6020	-8.3%	-4.0%
2	EM-16	La2O3 (wt%)	0.0821	0.0821	0.0800	0.0021	0.0021	2.6%	2.6%
2	EM-16	Li2O (wt%)	3.9721	3.9510	4.0000	-0.0279	-0.0490	-0.7%	-1.2%
2	EM-16	MgO (wt%)	0.7135	0.7715	0.7100	0.0035	0.0615	0.5%	8.7%
2	EM-16	MnO (wt%)	2.8536	2.9573	2.9200	-0.0664	0.0373	-2.3%	1.3%
2	EM-16	Na2O (wt%)	15.0302	15.0950	15.4800	-0.4498	-0.3850	-2.9%	-2.5%
2	EM-16	NiO (wt%)	0.8822	0.9978	1.1400	-0.2578	-0.1422	-22.6%	-12.5%
2	EM-16	PbO (wt%)	0.0899	0.0899	0.1000	-0.0101	-0.0101	-10.1%	-10.1%
2	EM-16	SiO2 (wt%)	37.1703	39.9662	37.4200	-0.2497	2.5462	-0.7%	6.8%
2	EM-16	SO4 (wt%)	0.4269	0.4269	0.4500	-0.0231	-0.0231	-5.1%	-5.1%
2	EM-16	TiO2 (wt%)	2.0225	2.1784	2.0000	0.0225	0.1784	1.1%	8.9%
2	EM-16	ZnO (wt%)	0.0610	0.0610	0.0700	-0.0090	-0.0090	-12.9%	-12.9%
2	EM-16	ZrO2 (wt%)	0.1800	0.1800	0.1700	0.0100	0.0100	5.9%	5.9%
2	EM-16	ZZ sum	97.2994	102.1072	99.9000	-2.6006	2.2072	-2.6%	2.2%
2	EM-17	Al2O3 (wt%)	13.5761	14.5096	14.0900	-0.5139	0.4196	-3.6%	3.0%
2	EM-17	B2O3 (wt%)	6.8584	6.8927	7.0000	-0.1416	-0.1073	-2.0%	-1.5%
2	EM-17	BaO (wt%)	0.0692	0.0781	0.0800	-0.0108	-0.0019	-13.5%	-2.3%
2	EM-17	CaO (wt%)	1.2470	1.3145	1.3200	-0.0730	-0.0055	-5.5%	-0.4%
2	EM-17	Ce2O3 (wt%)	0.2243	0.2243	0.2400	-0.0157	-0.0157	-6.5%	-6.5%
2	EM-17	Cr2O3 (wt%)	0.0983	0.1004	0.1400	-0.0417	-0.0396	-29.8%	-28.3%
2	EM-17	CuO (wt%)	0.0507	0.0528	0.0400	0.0107	0.0128	26.7%	31.9%
2	EM-17	Fe2O3 (wt%)	13.4713	14.0903	14.9500	-1.4787	-0.8597	-9.9%	-5.8%
2	EM-17	La2O3 (wt%)	0.0783	0.0783	0.0800	-0.0017	-0.0017	-2.1%	-2.1%
2	EM-17	Li2O (wt%)	3.9237	3.9027	4.0000	-0.0763	-0.0973	-1.9%	-2.4%
2	EM-17	MgO (wt%)	0.7052	0.7624	0.7100	-0.0048	0.0524	-0.7%	7.4%
2	EM-17	MnO (wt%)	2.8245	2.9268	2.9200	-0.0955	0.0068	-3.3%	0.2%
2	EM-17	Na2O (wt%)	13.0790	13.1359	13.6000	-0.5210	-0.4641	-3.8%	-3.4%
2	EM-17	NiO (wt%)	0.9296	1.0513	1.1400	-0.2104	-0.0887	-18.5%	-7.8%
2	EM-17	PbO (wt%)	0.0883	0.0883	0.1000	-0.0117	-0.0117	-11.7%	-11.7%
2	EM-17	SiO2 (wt%)	36.2611	38.9881	36.8100	-0.5489	2.1781	-1.5%	5.9%
2	EM-17	SO4 (wt%)	0.4239	0.4239	0.4500	-0.0261	-0.0261	-5.8%	-5.8%
2	EM-17	TiO2 (wt%)	1.8431	1.9851	2.0000	-0.1569	-0.0149	-7.8%	-0.7%
2	EM-17	ZnO (wt%)	0.0610	0.0610	0.0700	-0.0090	-0.0090	-12.9%	-12.9%
2	EM-17	ZrO2 (wt%)	0.1726	0.1726	0.1700	0.0026	0.0026	1.5%	1.5%
2	EM-17	ZZ sum	95.9856	100.8392	99.9100	-3.9244	0.9292	-3.9%	0.9%
2	EM-18	Al2O3 (wt%)	8.9704	9.3550	9.0900	-0.1196	0.2650	-1.3%	2.9%
2	EM-18	B2O3 (wt%)	6.8423	6.8767	7.0000	-0.1577	-0.1233	-2.3%	-1.8%
2	EM-18	BaO (wt%)	0.0692	0.0779	0.0800	-0.0108	-0.0021	-13.5%	-2.6%
2	EM-18	CaO (wt%)	1.3425	1.3630	1.3200	0.0225	0.0430	1.7%	3.3%
2	EM-18	Ce2O3 (wt%)	0.2269	0.2269	0.2400	-0.0131	-0.0131	-5.4%	-5.4%
2	EM-18	Cr2O3 (wt%)	0.1049	0.1071	0.1400	-0.0351	-0.0329	-25.1%	-23.5%
2	EM-18	CuO (wt%)	0.0444	0.0465	0.0400	0.0044	0.0065	11.1%	16.2%

Table D3. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by Glass ID for the Matrix 2A Study

Set	Glass #	Oxide	Measured (wt%)	Measured Bias-Corrected (wt%)	Targeted (wt%)	Diff of Measured	Diff of Meas BC	% Diff of Measured	% Diff of Meas BC
2	EM-18	Fe2O3 (wt%)	13.7787	14.3913	14.9500	-1.1713	-0.5587	-7.8%	-3.7%
2	EM-18	La2O3 (wt%)	0.0739	0.0739	0.0800	-0.0061	-0.0061	-7.6%	-7.6%
2	EM-18	Li2O (wt%)	3.9183	3.8974	4.0000	-0.0817	-0.1026	-2.0%	-2.6%
2	EM-18	MgO (wt%)	0.6952	0.7486	0.7100	-0.0148	0.0386	-2.1%	5.4%
2	EM-18	MnO (wt%)	2.8729	2.9619	2.9200	-0.0471	0.0419	-1.6%	1.4%
2	EM-18	Na2O (wt%)	17.1533	16.6726	17.5100	-0.3567	-0.8374	-2.0%	-4.8%
2	EM-18	NiO (wt%)	0.9566	1.0788	1.1400	-0.1834	-0.0612	-16.1%	-5.4%
2	EM-18	PbO (wt%)	0.0856	0.0856	0.1000	-0.0144	-0.0144	-14.4%	-14.4%
2	EM-18	SiO2 (wt%)	37.1169	39.9082	37.9000	-0.7831	2.0082	-2.1%	5.3%
2	EM-18	SO4 (wt%)	0.4172	0.4172	0.4500	-0.0328	-0.0328	-7.3%	-7.3%
2	EM-18	TiO2 (wt%)	1.9766	2.0784	2.0000	-0.0234	0.0784	-1.2%	3.9%
2	EM-18	ZnO (wt%)	0.0557	0.0557	0.0700	-0.0143	-0.0143	-20.4%	-20.4%
2	EM-18	ZrO2 (wt%)	0.1732	0.1732	0.1700	0.0032	0.0032	1.9%	1.9%
2	EM-18	ZZ sum	96.8749	100.5959	99.9100	-3.0351	0.6859	-3.0%	0.7%
2	EM-19	Al2O3 (wt%)	6.5282	6.9771	6.5900	-0.0618	0.3871	-0.9%	5.9%
2	EM-19	B2O3 (wt%)	7.3816	7.4185	7.0000	0.3816	0.4185	5.5%	6.0%
2	EM-19	BaO (wt%)	0.0675	0.0762	0.0800	-0.0125	-0.0038	-15.6%	-4.7%
2	EM-19	CaO (wt%)	1.2985	1.3686	1.3200	-0.0215	0.0486	-1.6%	3.7%
2	EM-19	Ce2O3 (wt%)	0.2196	0.2196	0.2400	-0.0204	-0.0204	-8.5%	-8.5%
2	EM-19	Cr2O3 (wt%)	0.1220	0.1247	0.1400	-0.0180	-0.0153	-12.8%	-11.0%
2	EM-19	CuO (wt%)	0.0404	0.0420	0.0400	0.0004	0.0020	0.9%	5.0%
2	EM-19	Fe2O3 (wt%)	13.8538	14.4898	14.9500	-1.0962	-0.4602	-7.3%	-3.1%
2	EM-19	La2O3 (wt%)	0.0765	0.0765	0.0800	-0.0035	-0.0035	-4.3%	-4.3%
2	EM-19	Li2O (wt%)	4.1174	4.0955	4.0000	0.1174	0.0955	2.9%	2.4%
2	EM-19	MgO (wt%)	0.6961	0.7526	0.7100	-0.0139	0.0426	-2.0%	6.0%
2	EM-19	MnO (wt%)	2.8729	2.9768	2.9200	-0.0471	0.0568	-1.6%	1.9%
2	EM-19	Na2O (wt%)	17.1533	17.2280	17.9300	-0.7767	-0.7020	-4.3%	-3.9%
2	EM-19	NiO (wt%)	0.9706	1.0977	1.1400	-0.1694	-0.0423	-14.9%	-3.7%
2	EM-19	PbO (wt%)	0.0832	0.0832	0.1000	-0.0168	-0.0168	-16.8%	-16.8%
2	EM-19	SiO2 (wt%)	39.2027	42.1523	39.9800	-0.7773	2.1723	-1.9%	5.4%
2	EM-19	SO4 (wt%)	0.4254	0.4254	0.4500	-0.0246	-0.0246	-5.5%	-5.5%
2	EM-19	TiO2 (wt%)	2.0058	2.1602	2.0000	0.0058	0.1602	0.3%	8.0%
2	EM-19	ZnO (wt%)	0.0591	0.0591	0.0700	-0.0109	-0.0109	-15.5%	-15.5%
2	EM-19	ZrO2 (wt%)	0.1699	0.1699	0.1700	-0.0001	-0.0001	-0.1%	-0.1%
2	EM-19	ZZ sum	97.3446	101.9939	99.9100	-2.5654	2.0839	-2.6%	2.1%
2	EM-20	Al2O3 (wt%)	6.5849	6.8672	6.5900	-0.0051	0.2772	-0.1%	4.2%
2	EM-20	B2O3 (wt%)	6.8262	6.8640	7.0000	-0.1738	-0.1360	-2.5%	-1.9%
2	EM-20	BaO (wt%)	0.0759	0.0854	0.0800	-0.0041	0.0054	-5.1%	6.8%
2	EM-20	CaO (wt%)	1.3194	1.3396	1.3200	-0.0006	0.0196	0.0%	1.5%
2	EM-20	Ce2O3 (wt%)	0.2266	0.2266	0.2400	-0.0134	-0.0134	-5.6%	-5.6%
2	EM-20	Cr2O3 (wt%)	0.1125	0.1150	0.1400	-0.0275	-0.0250	-19.6%	-17.9%
2	EM-20	CuO (wt%)	0.0457	0.0478	0.0400	0.0057	0.0078	14.2%	19.5%
2	EM-20	Fe2O3 (wt%)	16.0126	16.7242	17.4500	-1.4374	-0.7258	-8.2%	-4.2%
2	EM-20	La2O3 (wt%)	0.0827	0.0827	0.0800	0.0027	0.0027	3.4%	3.4%
2	EM-20	Li2O (wt%)	3.8106	3.8905	4.0000	-0.1894	-0.1095	-4.7%	-2.7%
2	EM-20	MgO (wt%)	0.6874	0.7401	0.7100	-0.0226	0.0301	-3.2%	4.2%
2	EM-20	MnO (wt%)	2.8439	2.9319	2.9200	-0.0761	0.0119	-2.6%	0.4%
2	EM-20	Na2O (wt%)	16.0075	15.5582	16.2700	-0.2625	-0.7118	-1.6%	-4.4%
2	EM-20	NiO (wt%)	0.8853	0.9985	1.1400	-0.2547	-0.1415	-22.3%	-12.4%
2	EM-20	PbO (wt%)	0.0856	0.0856	0.1000	-0.0144	-0.0144	-14.4%	-14.4%
2	EM-20	SiO2 (wt%)	37.7586	40.9407	39.1400	-1.3814	1.8007	-3.5%	4.6%
2	EM-20	SO4 (wt%)	0.4187	0.4187	0.4500	-0.0313	-0.0313	-7.0%	-7.0%
2	EM-20	TiO2 (wt%)	1.9766	2.0784	2.0000	-0.0234	0.0784	-1.2%	3.9%
2	EM-20	ZnO (wt%)	0.0569	0.0569	0.0700	-0.0131	-0.0131	-18.6%	-18.6%
2	EM-20	ZrO2 (wt%)	0.1729	0.1729	0.1700	0.0029	0.0029	1.7%	1.7%
2	EM-20	ZZ sum	95.9908	100.2250	99.9100	-3.9192	0.3150	-3.9%	0.3%
2	EM-21	Al2O3 (wt%)	6.9628	7.2613	6.5900	0.3728	0.6713	5.7%	10.2%
2	EM-21	B2O3 (wt%)	7.0274	7.0677	7.0000	0.0274	0.0677	0.4%	1.0%

Table D3. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by Glass ID for the Matrix 2A Study

Set	Glass #	Oxide	Measured (wt%)	Measured Bias-Corrected (wt%)	Targeted (wt%)	Diff of Measured	Diff of Meas BC	% Diff of Measured	% Diff of Meas BC
2	EM-21	BaO (wt%)	0.0703	0.0791	0.0800	-0.0097	-0.0009	-12.1%	-1.1%
2	EM-21	CaO (wt%)	1.3926	1.4138	1.3200	0.0726	0.0938	5.5%	7.1%
2	EM-21	Ce2O3 (wt%)	0.2284	0.2284	0.2400	-0.0116	-0.0116	-4.8%	-4.8%
2	EM-21	Cr2O3 (wt%)	0.1114	0.1138	0.1400	-0.0286	-0.0262	-20.4%	-18.7%
2	EM-21	CuO (wt%)	0.0457	0.0478	0.0400	0.0057	0.0078	14.2%	19.5%
2	EM-21	Fe2O3 (wt%)	18.6218	19.4495	19.9500	-1.3282	-0.5005	-6.7%	-2.5%
2	EM-21	La2O3 (wt%)	0.0710	0.0710	0.0800	-0.0090	-0.0090	-11.3%	-11.3%
2	EM-21	Li2O (wt%)	3.8967	3.9784	4.0000	-0.1033	-0.0216	-2.6%	-0.5%
2	EM-21	MgO (wt%)	0.7131	0.7678	0.7100	0.0031	0.0578	0.4%	8.1%
2	EM-21	MnO (wt%)	2.9730	3.0651	2.9200	0.0530	0.1451	1.8%	5.0%
2	EM-21	Na2O (wt%)	14.0529	13.6582	13.7700	0.2829	-0.1118	2.1%	-0.8%
2	EM-21	NiO (wt%)	0.9525	1.0742	1.1400	-0.1875	-0.0658	-16.5%	-5.8%
2	EM-21	PbO (wt%)	0.0908	0.0908	0.1000	-0.0092	-0.0092	-9.2%	-9.2%
2	EM-21	SiO2 (wt%)	38.6144	41.8695	39.1400	-0.5256	2.7295	-1.3%	7.0%
2	EM-21	SO4 (wt%)	0.4344	0.4344	0.4500	-0.0156	-0.0156	-3.5%	-3.5%
2	EM-21	TiO2 (wt%)	1.9015	1.9995	2.0000	-0.0985	-0.0005	-4.9%	0.0%
2	EM-21	ZnO (wt%)	0.0619	0.0619	0.0700	-0.0081	-0.0081	-11.5%	-11.5%
2	EM-21	ZrO2 (wt%)	0.1739	0.1739	0.1700	0.0039	0.0039	2.3%	2.3%
2	EM-21	ZZ sum	98.3965	102.9062	99.9100	-1.5135	2.9962	-1.5%	3.0%
2	EM-22	Al2O3 (wt%)	6.5329	6.8130	6.5900	-0.0571	0.2230	-0.9%	3.4%
2	EM-22	B2O3 (wt%)	7.0596	7.1004	7.0000	0.0596	0.1004	0.9%	1.4%
2	EM-22	BaO (wt%)	0.0723	0.0814	0.0800	-0.0077	0.0014	-9.6%	1.7%
2	EM-22	CaO (wt%)	3.4315	3.4839	3.3200	0.1115	0.1639	3.4%	4.9%
2	EM-22	Ce2O3 (wt%)	0.2290	0.2290	0.2400	-0.0110	-0.0110	-4.6%	-4.6%
2	EM-22	Cr2O3 (wt%)	0.1063	0.1086	0.1400	-0.0337	-0.0314	-24.0%	-22.4%
2	EM-22	CuO (wt%)	0.0476	0.0498	0.0400	0.0076	0.0098	18.9%	24.4%
2	EM-22	Fe2O3 (wt%)	18.4074	19.2252	19.9500	-1.5426	-0.7248	-7.7%	-3.6%
2	EM-22	La2O3 (wt%)	0.0827	0.0827	0.0800	0.0027	0.0027	3.4%	3.4%
2	EM-22	Li2O (wt%)	3.8967	3.9784	4.0000	-0.1033	-0.0216	-2.6%	-0.5%
2	EM-22	MgO (wt%)	0.6915	0.7446	0.7100	-0.0185	0.0346	-2.6%	4.9%
2	EM-22	MnO (wt%)	2.8761	2.9651	2.9200	-0.0439	0.0451	-1.5%	1.5%
2	EM-22	Na2O (wt%)	13.8170	13.4299	13.6000	0.2170	-0.1701	1.6%	-1.3%
2	EM-22	NiO (wt%)	0.8055	0.9084	1.1400	-0.3345	-0.2316	-29.3%	-20.3%
2	EM-22	PbO (wt%)	0.0843	0.0843	0.1000	-0.0157	-0.0157	-15.7%	-15.7%
2	EM-22	SiO2 (wt%)	36.9029	40.0142	37.3100	-0.4071	2.7042	-1.1%	7.2%
2	EM-22	SO4 (wt%)	0.4299	0.4299	0.4500	-0.0201	-0.0201	-4.5%	-4.5%
2	EM-22	TiO2 (wt%)	1.9682	2.0696	2.0000	-0.0318	0.0696	-1.6%	3.5%
2	EM-22	ZnO (wt%)	0.0622	0.0622	0.0700	-0.0078	-0.0078	-11.1%	-11.1%
2	EM-22	ZrO2 (wt%)	0.1770	0.1770	0.1700	0.0070	0.0070	4.1%	4.1%
2	EM-22	ZZ sum	97.6808	102.0376	99.9100	-2.2292	2.1276	-2.2%	2.1%
2	EM-23	Al2O3 (wt%)	6.6416	7.0986	6.5900	0.0516	0.5086	0.8%	7.7%
2	EM-23	B2O3 (wt%)	7.0596	7.0997	7.0000	0.0596	0.0997	0.9%	1.4%
2	EM-23	BaO (wt%)	0.0673	0.0759	0.0800	-0.0127	-0.0041	-15.9%	-5.1%
2	EM-23	CaO (wt%)	4.2885	4.5216	4.3200	-0.0315	0.2016	-0.7%	4.7%
2	EM-23	Ce2O3 (wt%)	0.2243	0.2243	0.2400	-0.0157	-0.0157	-6.5%	-6.5%
2	EM-23	Cr2O3 (wt%)	0.0998	0.1019	0.1400	-0.0402	-0.0381	-28.7%	-27.2%
2	EM-23	CuO (wt%)	0.0460	0.0479	0.0400	0.0060	0.0079	15.0%	19.7%
2	EM-23	Fe2O3 (wt%)	18.1929	19.0315	19.9500	-1.7571	-0.9185	-8.8%	-4.6%
2	EM-23	La2O3 (wt%)	0.0792	0.0792	0.0800	-0.0008	-0.0008	-1.0%	-1.0%
2	EM-23	Li2O (wt%)	3.9452	4.0279	4.0000	-0.0548	0.0279	-1.4%	0.7%
2	EM-23	MgO (wt%)	0.7044	0.7615	0.7100	-0.0056	0.0515	-0.8%	7.3%
2	EM-23	MnO (wt%)	2.8536	2.9571	2.9200	-0.0664	0.0371	-2.3%	1.3%
2	EM-23	Na2O (wt%)	13.3115	13.3687	13.6000	-0.2885	-0.2313	-2.1%	-1.7%
2	EM-23	NiO (wt%)	0.7759	0.8775	1.1400	-0.3641	-0.2625	-31.9%	-23.0%
2	EM-23	PbO (wt%)	0.0918	0.0918	0.1000	-0.0082	-0.0082	-8.2%	-8.2%
2	EM-23	SiO2 (wt%)	37.5447	40.7106	36.3100	1.2347	4.4006	3.4%	12.1%
2	EM-23	SO4 (wt%)	0.4389	0.4389	0.4500	-0.0111	-0.0111	-2.5%	-2.5%
2	EM-23	TiO2 (wt%)	1.9391	2.0886	2.0000	-0.0610	0.0886	-3.0%	4.4%

Table D3. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by Glass ID for the Matrix 2A Study

Set	Glass #	Oxide	Measured (wt%)	Measured Bias-Corrected (wt%)	Targeted (wt%)	Diff of Measured	Diff of Meas BC	% Diff of Measured	% Diff of Meas BC
2	EM-23	ZnO (wt%)	0.0585	0.0585	0.0700	-0.0115	-0.0115	-16.4%	-16.4%
2	EM-23	ZrO2 (wt%)	0.1739	0.1739	0.1700	0.0039	0.0039	2.3%	2.3%
2	EM-23	ZZ sum	98.5366	103.8356	99.9100	-1.3734	3.9256	-1.4%	3.9%
2	EM-24	Al2O3 (wt%)	11.7291	12.2319	11.5900	0.1391	0.6419	1.2%	5.5%
2	EM-24	B2O3 (wt%)	7.0757	7.1108	7.0000	0.0757	0.1108	1.1%	1.6%
2	EM-24	BaO (wt%)	0.0698	0.0785	0.0800	-0.0102	-0.0015	-12.8%	-1.9%
2	EM-24	CaO (wt%)	1.3387	1.3591	1.3200	0.0187	0.0391	1.4%	3.0%
2	EM-24	Ce2O3 (wt%)	0.2261	0.2261	0.2400	-0.0139	-0.0139	-5.8%	-5.8%
2	EM-24	Cr2O3 (wt%)	0.0921	0.0941	0.1400	-0.0479	-0.0459	-34.2%	-32.8%
2	EM-24	CuO (wt%)	0.0448	0.0468	0.0400	0.0048	0.0068	11.9%	17.1%
2	EM-24	Fe2O3 (wt%)	15.8697	16.5738	17.4500	-1.5803	-0.8762	-9.1%	-5.0%
2	EM-24	La2O3 (wt%)	0.0715	0.0715	0.0800	-0.0085	-0.0085	-10.6%	-10.6%
2	EM-24	Li2O (wt%)	4.0152	3.9937	4.0000	0.0152	-0.0063	0.4%	-0.2%
2	EM-24	MgO (wt%)	0.7098	0.7643	0.7100	-0.0002	0.0543	0.0%	7.6%
2	EM-24	MnO (wt%)	2.8536	2.9416	2.9200	-0.0664	0.0216	-2.3%	0.7%
2	EM-24	Na2O (wt%)	13.6418	13.2592	13.6000	0.0418	-0.3408	0.3%	-2.5%
2	EM-24	NiO (wt%)	0.8838	0.9967	1.1400	-0.2562	-0.1433	-22.5%	-12.6%
2	EM-24	PbO (wt%)	0.0891	0.0891	0.1000	-0.0109	-0.0109	-10.9%	-10.9%
2	EM-24	SiO2 (wt%)	37.2773	40.0803	36.8100	0.4673	3.2703	1.3%	8.9%
2	EM-24	SO4 (wt%)	0.4269	0.4269	0.4500	-0.0231	-0.0231	-5.1%	-5.1%
2	EM-24	TiO2 (wt%)	2.0183	2.1223	2.0000	0.0183	0.1223	0.9%	6.1%
2	EM-24	ZnO (wt%)	0.0566	0.0566	0.0700	-0.0134	-0.0134	-19.1%	-19.1%
2	EM-24	ZrO2 (wt%)	0.1901	0.1901	0.1700	0.0201	0.0201	11.8%	11.8%
2	EM-24	ZZ sum	98.6797	102.7134	99.9100	-1.2303	2.8034	-1.2%	2.8%
2	EM-25	Al2O3 (wt%)	11.4929	11.9856	11.5900	-0.0971	0.3956	-0.8%	3.4%
2	EM-25	B2O3 (wt%)	6.9630	7.0025	7.0000	-0.0370	0.0025	-0.5%	0.0%
2	EM-25	BaO (wt%)	0.0684	0.0769	0.0800	-0.0116	-0.0031	-14.5%	-3.8%
2	EM-25	CaO (wt%)	1.3541	1.3747	1.3200	0.0341	0.0547	2.6%	4.1%
2	EM-25	Ce2O3 (wt%)	0.2249	0.2249	0.2400	-0.0151	-0.0151	-6.3%	-6.3%
2	EM-25	Cr2O3 (wt%)	0.1067	0.1090	0.1400	-0.0333	-0.0310	-23.8%	-22.2%
2	EM-25	CuO (wt%)	0.0448	0.0468	0.0400	0.0048	0.0068	11.9%	17.1%
2	EM-25	Fe2O3 (wt%)	11.7128	12.2329	12.4500	-0.7372	-0.2171	-5.9%	-1.7%
2	EM-25	La2O3 (wt%)	0.0707	0.0707	0.0800	-0.0093	-0.0093	-11.7%	-11.7%
2	EM-25	Li2O (wt%)	3.8483	3.9290	4.0000	-0.1517	-0.0710	-3.8%	-1.8%
2	EM-25	MgO (wt%)	0.6952	0.7486	0.7100	-0.0148	0.0386	-2.1%	5.4%
2	EM-25	MnO (wt%)	2.8955	2.9850	2.9200	-0.0245	0.0650	-0.8%	2.2%
2	EM-25	Na2O (wt%)	17.1870	16.7057	17.5100	-0.3230	-0.8043	-1.8%	-4.6%
2	EM-25	NiO (wt%)	0.9652	1.0885	1.1400	-0.1748	-0.0515	-15.3%	-4.5%
2	EM-25	PbO (wt%)	0.0816	0.0816	0.1000	-0.0184	-0.0184	-18.4%	-18.4%
2	EM-25	SiO2 (wt%)	37.0634	40.1884	37.9000	-0.8366	2.2884	-2.2%	6.0%
2	EM-25	SO4 (wt%)	0.4202	0.4202	0.4500	-0.0298	-0.0298	-6.6%	-6.6%
2	EM-25	TiO2 (wt%)	1.9933	2.0959	2.0000	-0.0067	0.0959	-0.3%	4.8%
2	EM-25	ZnO (wt%)	0.0610	0.0610	0.0700	-0.0090	-0.0090	-12.9%	-12.9%
2	EM-25	ZrO2 (wt%)	0.1722	0.1722	0.1700	0.0022	0.0022	1.3%	1.3%
2	EM-25	ZZ sum	97.4211	101.6002	99.9100	-2.4889	1.6902	-2.5%	1.7%
2	EM-26	Al2O3 (wt%)	11.2472	12.0208	11.5900	-0.3428	0.4308	-3.0%	3.7%
2	EM-26	B2O3 (wt%)	6.9067	6.9462	7.0000	-0.0933	-0.0538	-1.3%	-0.8%
2	EM-26	BaO (wt%)	0.0656	0.0740	0.0800	-0.0144	-0.0060	-18.0%	-7.4%
2	EM-26	CaO (wt%)	1.2859	1.3554	1.3200	-0.0341	0.0354	-2.6%	2.7%
2	EM-26	Ce2O3 (wt%)	0.2275	0.2275	0.2400	-0.0125	-0.0125	-5.2%	-5.2%
2	EM-26	Cr2O3 (wt%)	0.0884	0.0903	0.1400	-0.0516	-0.0497	-36.8%	-35.5%
2	EM-26	CuO (wt%)	0.0435	0.0453	0.0400	0.0035	0.0053	8.8%	13.2%
2	EM-26	Fe2O3 (wt%)	13.3891	14.0064	14.9500	-1.5609	-0.9436	-10.4%	-6.3%
2	EM-26	La2O3 (wt%)	0.0780	0.0780	0.0800	-0.0020	-0.0020	-2.5%	-2.5%
2	EM-26	Li2O (wt%)	3.8591	3.9399	4.0000	-0.1409	-0.0601	-3.5%	-1.5%
2	EM-26	MgO (wt%)	0.6944	0.7508	0.7100	-0.0156	0.0408	-2.2%	5.7%
2	EM-26	MnO (wt%)	3.7961	3.9340	3.9200	-0.1239	0.0140	-3.2%	0.4%
2	EM-26	Na2O (wt%)	13.2138	13.2712	13.6000	-0.3862	-0.3288	-2.8%	-2.4%

Table D3. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by Glass ID for the Matrix 2A Study

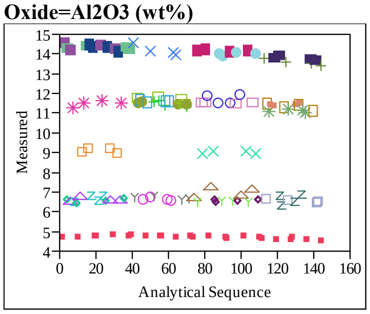
Set	Glass #	Oxide	Measured (wt%)	Measured Bias-Corrected (wt%)	Targeted (wt%)	Diff of Measured	Diff of Meas BC	% Diff of Measured	% Diff of Meas BC
2	EM-26	NiO (wt%)	0.7584	0.8577	1.1400	-0.3816	-0.2823	-33.5%	-24.8%
2	EM-26	PbO (wt%)	0.0832	0.0832	0.1000	-0.0168	-0.0168	-16.8%	-16.8%
2	EM-26	SiO2 (wt%)	37.5447	40.7101	38.3100	-0.7653	2.4001	-2.0%	6.3%
2	EM-26	SO4 (wt%)	0.4127	0.4127	0.4500	-0.0373	-0.0373	-8.3%	-8.3%
2	EM-26	TiO2 (wt%)	1.9474	2.0975	2.0000	-0.0526	0.0975	-2.6%	4.9%
2	EM-26	ZnO (wt%)	0.0560	0.0560	0.0700	-0.0140	-0.0140	-20.0%	-20.0%
2	EM-26	ZrO2 (wt%)	0.1719	0.1719	0.1700	0.0019	0.0019	1.1%	1.1%
2	EM-26	ZZ sum	95.8697	101.1291	99.9100	-4.0403	1.2191	-4.0%	1.2%
2	EM-27	Al2O3 (wt%)	11.1339	11.8997	11.5900	-0.4561	0.3097	-3.9%	2.7%
2	EM-27	B2O3 (wt%)	6.9308	6.9649	7.0000	-0.0692	-0.0351	-1.0%	-0.5%
2	EM-27	BaO (wt%)	0.0673	0.0759	0.0800	-0.0127	-0.0041	-15.9%	-5.1%
2	EM-27	CaO (wt%)	1.2638	1.3322	1.3200	-0.0562	0.0122	-4.3%	0.9%
2	EM-27	Ce2O3 (wt%)	0.2234	0.2234	0.2400	-0.0166	-0.0166	-6.9%	-6.9%
2	EM-27	Cr2O3 (wt%)	0.1082	0.1105	0.1400	-0.0318	-0.0295	-22.7%	-21.1%
2	EM-27	CuO (wt%)	0.0516	0.0537	0.0400	0.0116	0.0137	29.1%	34.3%
2	EM-27	Fe2O3 (wt%)	13.8860	14.5272	14.9500	-1.0640	-0.4228	-7.1%	-2.8%
2	EM-27	La2O3 (wt%)	0.0789	0.0789	0.0800	-0.0011	-0.0011	-1.4%	-1.4%
2	EM-27	Li2O (wt%)	3.9721	3.9508	4.0000	-0.0279	-0.0492	-0.7%	-1.2%
2	EM-27	MgO (wt%)	0.6965	0.7530	0.7100	-0.0135	0.0430	-1.9%	6.1%
2	EM-27	MnO (wt%)	1.8561	1.9236	1.9200	-0.0639	0.0036	-3.3%	0.2%
2	EM-27	Na2O (wt%)	16.8837	16.9566	17.5100	-0.6263	-0.5534	-3.6%	-3.2%
2	EM-27	NiO (wt%)	0.8968	1.0142	1.1400	-0.2432	-0.1258	-21.3%	-11.0%
2	EM-27	PbO (wt%)	0.0873	0.0873	0.1000	-0.0127	-0.0127	-12.7%	-12.7%
2	EM-27	SiO2 (wt%)	36.1007	38.8151	36.4000	-0.2993	2.4151	-0.8%	6.6%
2	EM-27	SO4 (wt%)	0.4322	0.4322	0.4500	-0.0178	-0.0178	-4.0%	-4.0%
2	EM-27	TiO2 (wt%)	2.0225	2.1784	2.0000	0.0225	0.1784	1.1%	8.9%
2	EM-27	ZnO (wt%)	0.0663	0.0663	0.0700	-0.0037	-0.0037	-5.3%	-5.3%
2	EM-27	ZrO2 (wt%)	0.1729	0.1729	0.1700	0.0029	0.0029	1.7%	1.7%
2	EM-27	ZZ sum	96.9308	101.6168	99.9100	-2.9792	1.7068	-3.0%	1.7%
2	EM-28	Al2O3 (wt%)	14.0154	14.6163	14.0900	-0.0746	0.5263	-0.5%	3.7%
2	EM-28	B2O3 (wt%)	6.9147	6.9530	7.0000	-0.0853	-0.0470	-1.2%	-0.7%
2	EM-28	BaO (wt%)	0.0667	0.0751	0.0800	-0.0133	-0.0049	-16.6%	-6.2%
2	EM-28	CaO (wt%)	2.3996	2.4362	2.3200	0.0796	0.1162	3.4%	5.0%
2	EM-28	Ce2O3 (wt%)	0.2170	0.2170	0.2400	-0.0230	-0.0230	-9.6%	-9.6%
2	EM-28	Cr2O3 (wt%)	0.0972	0.0993	0.1400	-0.0428	-0.0407	-30.6%	-29.1%
2	EM-28	CuO (wt%)	0.0501	0.0524	0.0400	0.0101	0.0124	25.2%	31.0%
2	EM-28	Fe2O3 (wt%)	11.5305	12.0426	12.9500	-1.4195	-0.9074	-11.0%	-7.0%
2	EM-28	La2O3 (wt%)	0.0739	0.0739	0.0800	-0.0061	-0.0061	-7.6%	-7.6%
2	EM-28	Li2O (wt%)	3.8322	3.9125	4.0000	-0.1678	-0.0875	-4.2%	-2.2%
2	EM-28	MgO (wt%)	0.6832	0.7357	0.7100	-0.0268	0.0257	-3.8%	3.6%
2	EM-28	MnO (wt%)	2.8213	2.9085	2.9200	-0.0987	-0.0115	-3.4%	-0.4%
2	EM-28	Na2O (wt%)	14.6932	14.2810	14.5600	0.1332	-0.2790	0.9%	-1.9%
2	EM-28	NiO (wt%)	0.8294	0.9353	1.1400	-0.3106	-0.2047	-27.2%	-18.0%
2	EM-28	PbO (wt%)	0.0862	0.0862	0.1000	-0.0138	-0.0138	-13.8%	-13.8%
2	EM-28	SiO2 (wt%)	36.1542	39.2010	36.8500	-0.6958	2.3510	-1.9%	6.4%
2	EM-28	SO4 (wt%)	0.4142	0.4142	0.4500	-0.0358	-0.0358	-8.0%	-8.0%
2	EM-28	TiO2 (wt%)	2.0308	2.1354	2.0000	0.0308	0.1354	1.5%	6.8%
2	EM-28	ZnO (wt%)	0.0601	0.0601	0.0700	-0.0099	-0.0099	-14.2%	-14.2%
2	EM-28	ZrO2 (wt%)	0.1712	0.1712	0.1700	0.0012	0.0012	0.7%	0.7%
2	EM-28	ZZ sum	97.1409	101.4066	99.9100	-2.7691	1.4966	-2.8%	1.5%
2	EM-29	Al2O3 (wt%)	13.7697	14.7167	14.0900	-0.3203	0.6267	-2.3%	4.4%
2	EM-29	B2O3 (wt%)	7.1240	7.1644	7.0000	0.1240	0.1644	1.8%	2.3%
2	EM-29	BaO (wt%)	0.0695	0.0785	0.0800	-0.0105	-0.0015	-13.1%	-1.9%
2	EM-29	CaO (wt%)	3.3301	3.5105	3.3200	0.0101	0.1905	0.3%	5.7%
2	EM-29	Ce2O3 (wt%)	0.2255	0.2255	0.2400	-0.0145	-0.0145	-6.1%	-6.1%
2	EM-29	Cr2O3 (wt%)	0.0928	0.0948	0.1400	-0.0472	-0.0452	-33.7%	-32.3%
2	EM-29	CuO (wt%)	0.0438	0.0456	0.0400	0.0038	0.0056	9.5%	14.0%
2	EM-29	Fe2O3 (wt%)	11.6699	12.2073	12.9500	-1.2801	-0.7427	-9.9%	-5.7%

Table D3. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by Glass ID for the Matrix 2A Study

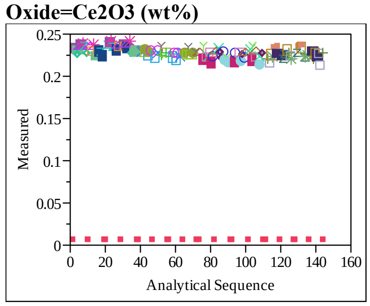
Set	Glass #	Oxide	Measured (wt%)	Measured Bias-Corrected (wt%)	Targeted (wt%)	Diff of Measured	Diff of Meas BC	% Diff of Measured	% Diff of Meas BC
2	EM-29	La2O3 (wt%)	0.0759	0.0759	0.0800	-0.0041	-0.0041	-5.1%	-5.1%
2	EM-29	Li2O (wt%)	3.9183	4.0004	4.0000	-0.0817	0.0004	-2.0%	0.0%
2	EM-29	MgO (wt%)	0.6990	0.7557	0.7100	-0.0110	0.0457	-1.6%	6.4%
2	EM-29	MnO (wt%)	2.8245	2.9270	2.9200	-0.0955	0.0070	-3.3%	0.2%
2	EM-29	Na2O (wt%)	13.6822	13.7417	14.0600	-0.3778	-0.3183	-2.7%	-2.3%
2	EM-29	NiO (wt%)	0.8475	0.9585	1.1400	-0.2925	-0.1815	-25.7%	-15.9%
2	EM-29	PbO (wt%)	0.0862	0.0862	0.1000	-0.0138	-0.0138	-13.8%	-13.8%
2	EM-29	SiO2 (wt%)	36.5285	39.6076	36.3500	0.1785	3.2576	0.5%	9.0%
2	EM-29	SO4 (wt%)	0.4187	0.4187	0.4500	-0.0313	-0.0313	-7.0%	-7.0%
2	EM-29	TiO2 (wt%)	1.9933	2.1469	2.0000	-0.0067	0.1469	-0.3%	7.3%
2	EM-29	ZnO (wt%)	0.0579	0.0579	0.0700	-0.0121	-0.0121	-17.3%	-17.3%
2	EM-29	ZrO2 (wt%)	0.1743	0.1743	0.1700	0.0043	0.0043	2.5%	2.5%
2	EM-29	ZZ sum	97.6316	102.9939	99.9100	-2.2784	3.0839	-2.3%	3.1%
2	EM-30	Al2O3 (wt%)	14.0862	14.6901	14.0900	-0.0038	0.6001	0.0%	4.3%
2	EM-30	B2O3 (wt%)	6.9711	7.0057	7.0000	-0.0289	0.0057	-0.4%	0.1%
2	EM-30	BaO (wt%)	0.0662	0.0744	0.0800	-0.0138	-0.0056	-17.3%	-7.0%
2	EM-30	CaO (wt%)	4.4739	4.5422	4.3200	0.1539	0.2222	3.6%	5.1%
2	EM-30	Ce2O3 (wt%)	0.2161	0.2161	0.2400	-0.0239	-0.0239	-10.0%	-10.0%
2	EM-30	Cr2O3 (wt%)	0.0899	0.0918	0.1400	-0.0501	-0.0482	-35.8%	-34.4%
2	EM-30	CuO (wt%)	0.0432	0.0452	0.0400	0.0032	0.0052	8.0%	13.0%
2	EM-30	Fe2O3 (wt%)	11.7772	12.3002	12.9500	-1.1728	-0.6498	-9.1%	-5.0%
2	EM-30	La2O3 (wt%)	0.0689	0.0689	0.0800	-0.0111	-0.0111	-13.9%	-13.9%
2	EM-30	Li2O (wt%)	3.9667	3.9455	4.0000	-0.0333	-0.0545	-0.8%	-1.4%
2	EM-30	MgO (wt%)	0.6691	0.7205	0.7100	-0.0409	0.0105	-5.8%	1.5%
2	EM-30	MnO (wt%)	2.8310	2.9185	2.9200	-0.0890	-0.0015	-3.0%	-0.1%
2	EM-30	Na2O (wt%)	13.6148	13.2341	13.5600	0.0548	-0.3259	0.4%	-2.4%
2	EM-30	NiO (wt%)	0.8055	0.9084	1.1400	-0.3345	-0.2316	-29.3%	-20.3%
2	EM-30	PbO (wt%)	0.0768	0.0768	0.1000	-0.0232	-0.0232	-23.2%	-23.2%
2	EM-30	SiO2 (wt%)	36.0472	38.7581	35.8500	0.1972	2.9081	0.6%	8.1%
2	EM-30	SO4 (wt%)	0.4104	0.4104	0.4500	-0.0396	-0.0396	-8.8%	-8.8%
2	EM-30	TiO2 (wt%)	2.0016	2.1047	2.0000	0.0016	0.1047	0.1%	5.2%
2	EM-30	ZnO (wt%)	0.0573	0.0573	0.0700	-0.0127	-0.0127	-18.2%	-18.2%
2	EM-30	ZrO2 (wt%)	0.1668	0.1668	0.1700	-0.0032	-0.0032	-1.9%	-1.9%
2	EM-30	ZZ sum	98.4398	102.3357	99.9100	-1.4702	2.4257	-1.5%	2.4%

Exhibit D1. Matrix 2A Sample Measurements in Analytical Sequence by Oxide

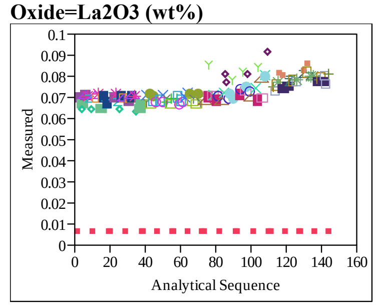
Measured By Analytical Sequence
Oxide=Al2O3 (wt%)



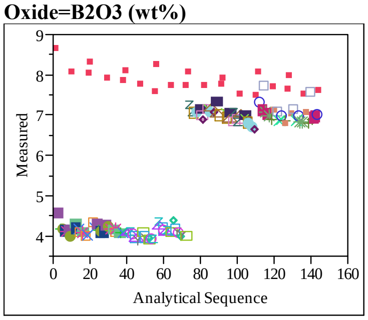
Measured By Analytical Sequence
Oxide=Ce2O3 (wt%)



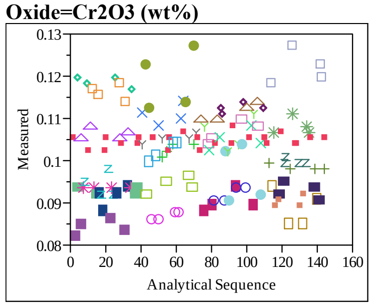
Measured By Analytical Sequence
Oxide=La2O3 (wt%)



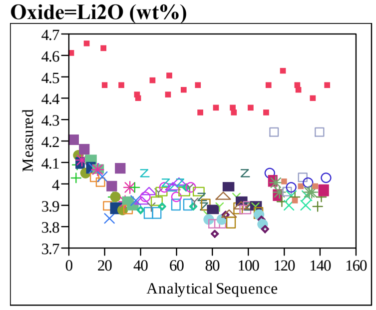
Measured By Analytical Sequence
Oxide=B2O3 (wt%)



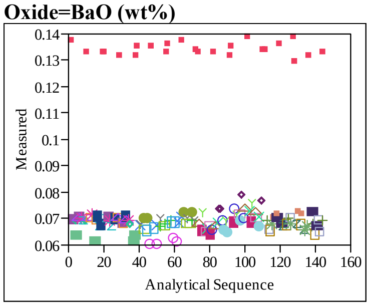
Measured By Analytical Sequence
Oxide=Cr2O3 (wt%)



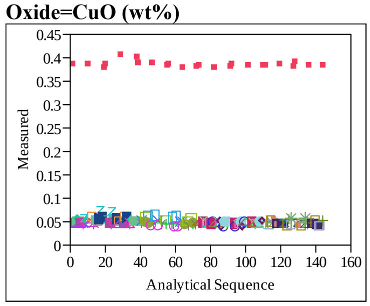
Measured By Analytical Sequence
Oxide=Li2O (wt%)



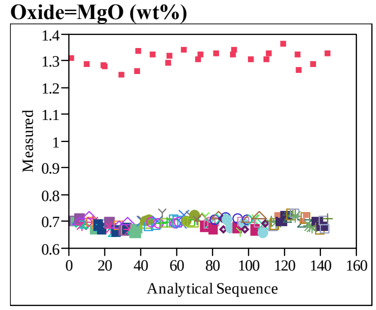
Measured By Analytical Sequence
Oxide=BaO (wt%)



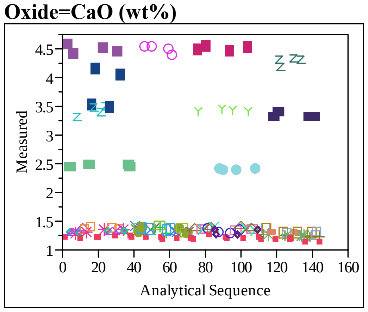
Measured By Analytical Sequence
Oxide=CuO (wt%)



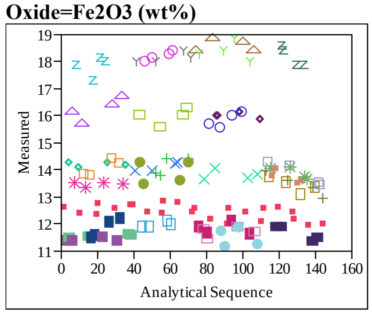
Measured By Analytical Sequence
Oxide=MgO (wt%)



Measured By Analytical Sequence
Oxide=CaO (wt%)



Measured By Analytical Sequence
Oxide=Fe2O3 (wt%)



Measured By Analytical Sequence
Oxide=MnO (wt%)

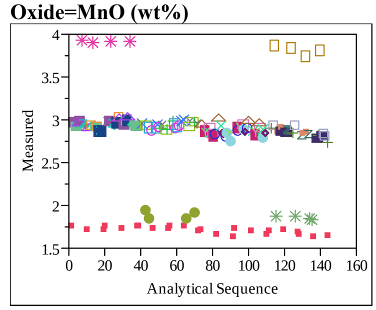
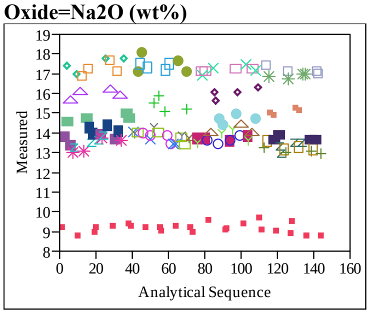
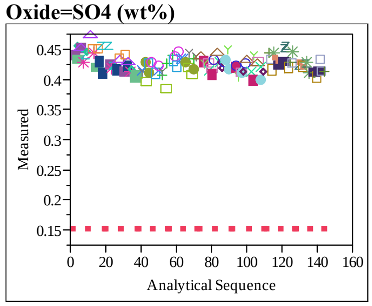


Exhibit D1. Matrix 2A Sample Measurements in Analytical Sequence by Oxide

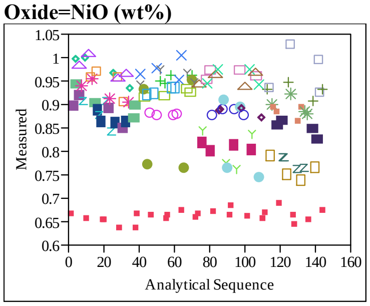
Measured By Analytical Sequence
Oxide=Na2O (wt%)



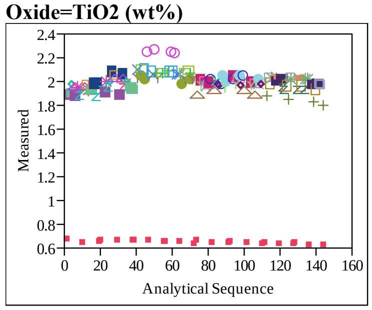
Measured By Analytical Sequence
Oxide=SO4 (wt%)



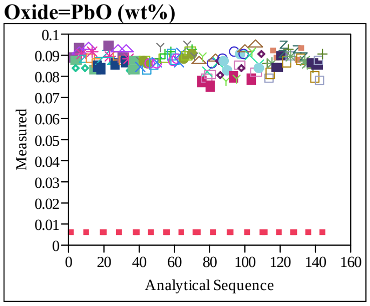
Measured By Analytical Sequence
Oxide=NiO (wt%)



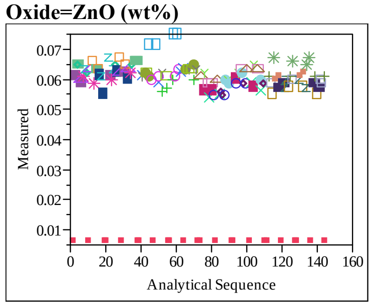
Measured By Analytical Sequence
Oxide=TiO2 (wt%)



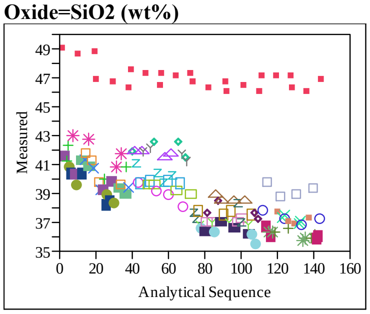
Measured By Analytical Sequence
Oxide=PbO (wt%)



Measured By Analytical Sequence
Oxide=ZnO (wt%)



Measured By Analytical Sequence
Oxide=SiO2 (wt%)



Measured By Analytical Sequence
Oxide=ZrO2 (wt%)

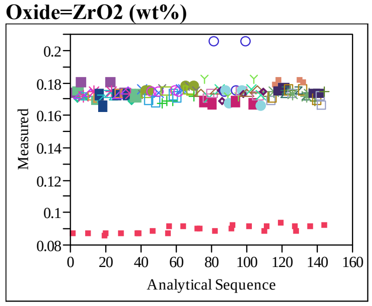
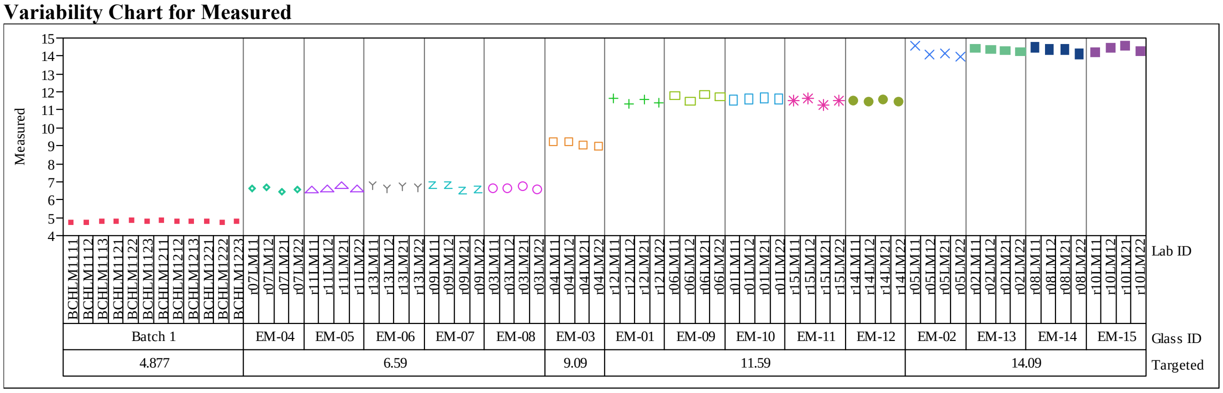
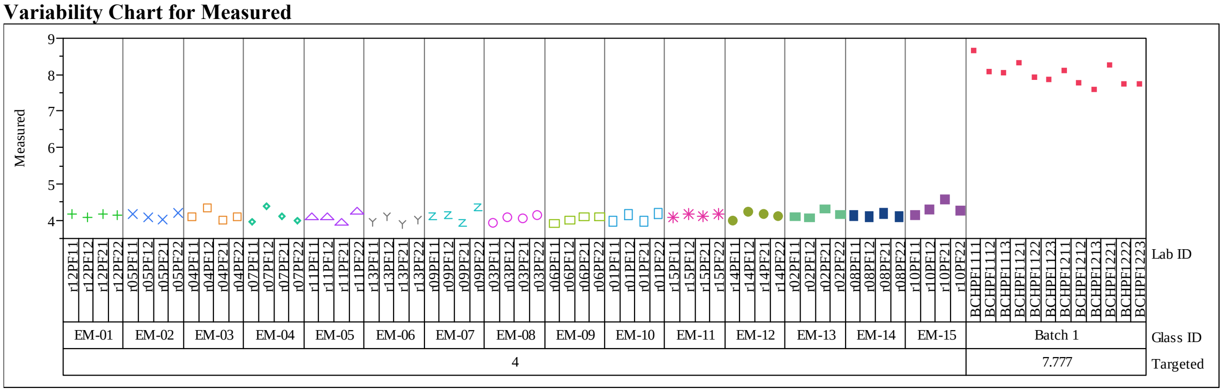


Exhibit D2. Matrix 2A Sample Measurements by Lab ID within Glass ID by Oxide by Analytical Block

Set=1, Oxide=Al2O3 (wt%)
Variability Chart for Measured



Set=1, Oxide=B2O3 (wt%)
Variability Chart for Measured



Set=1, Oxide=BaO (wt%)
Variability Chart for Measured

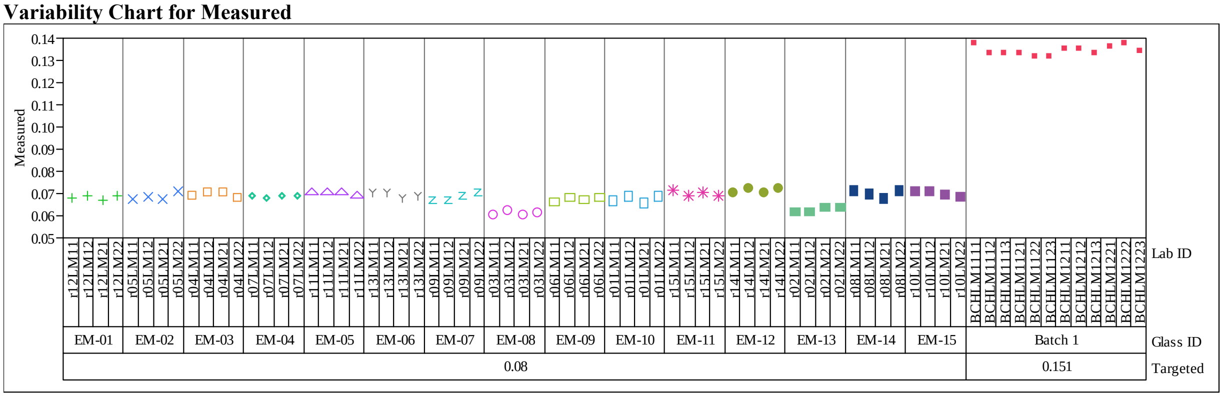
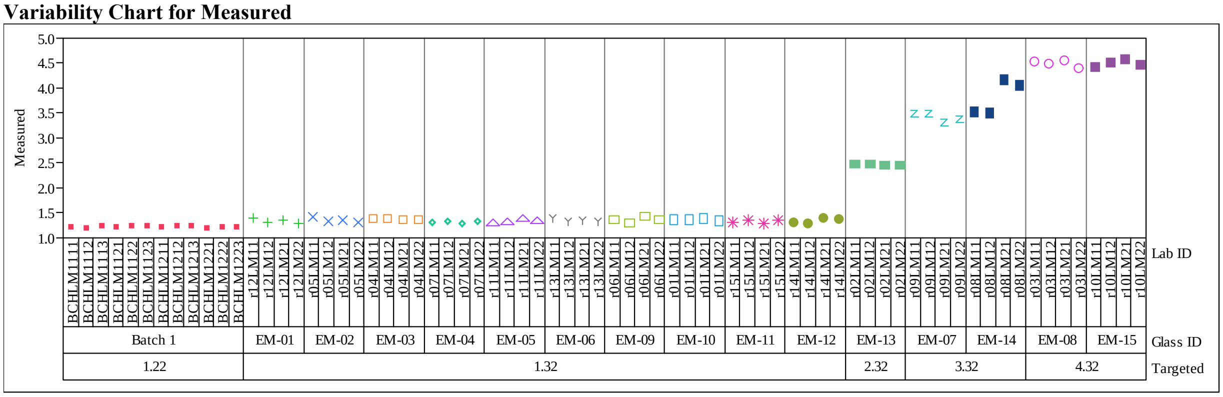
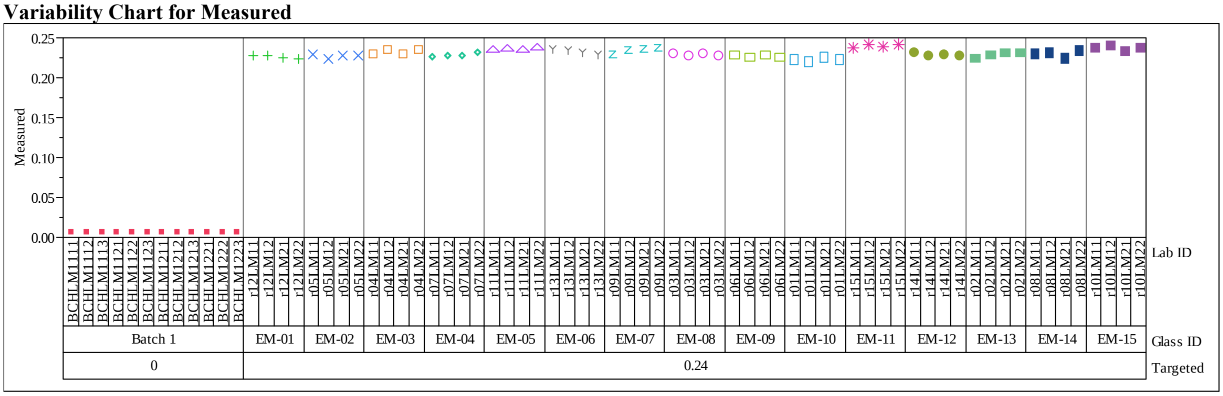


Exhibit D2. Matrix 2A Sample Measurements by Lab ID within Glass ID by Oxide by Analytical Block

Set=1, Oxide=CaO (wt%)
Variability Chart for Measured



Set=1, Oxide=Ce2O3 (wt%)
Variability Chart for Measured



Set=1, Oxide=Cr2O3 (wt%)
Variability Chart for Measured

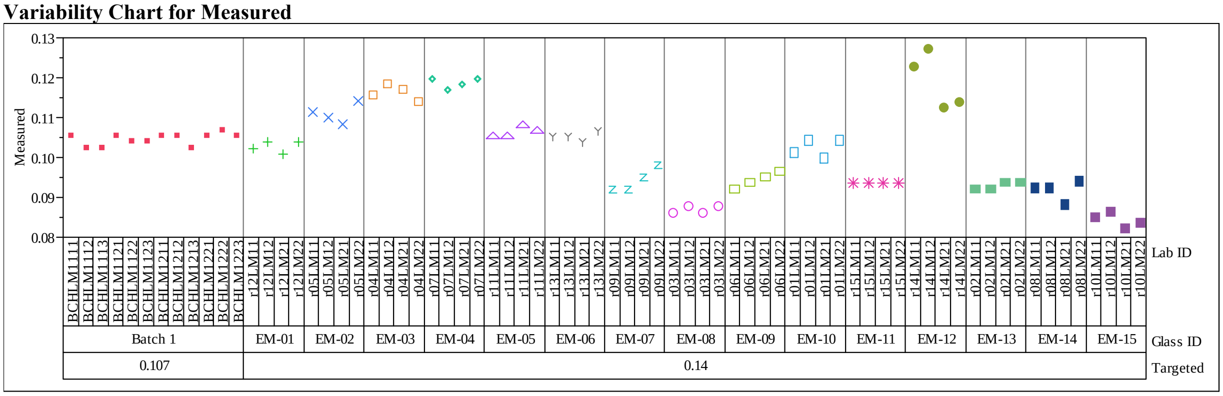
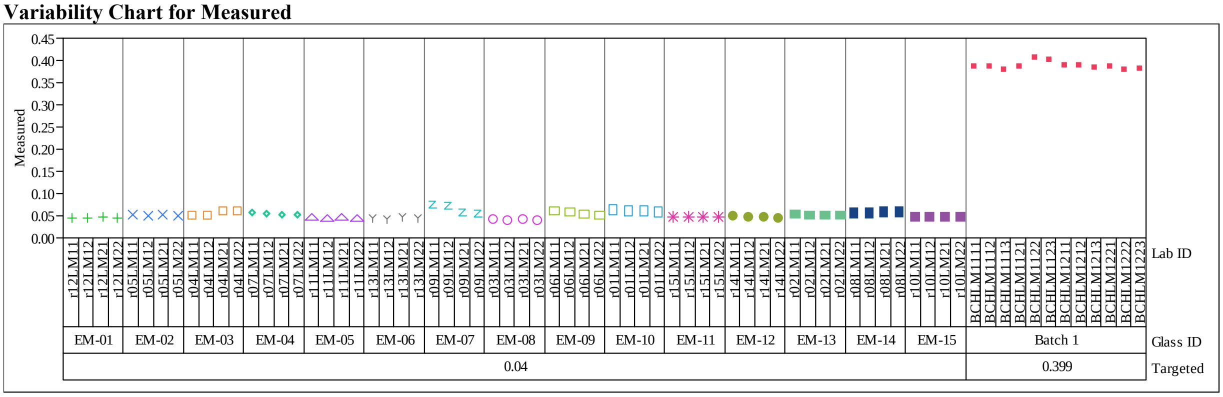
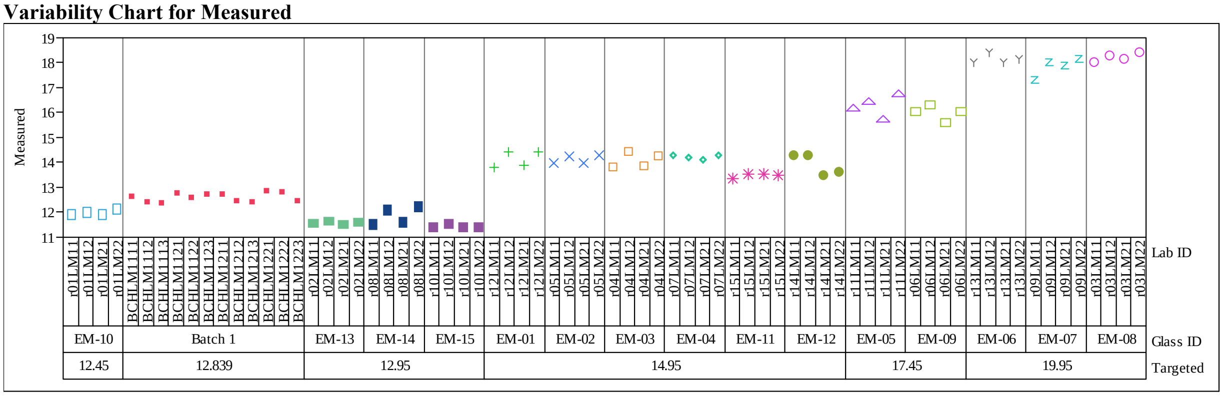


Exhibit D2. Matrix 2A Sample Measurements by Lab ID within Glass ID by Oxide by Analytical Block

Set=1, Oxide=CuO (wt%)
Variability Chart for Measured



Set=1, Oxide=Fe2O3 (wt%)
Variability Chart for Measured



Set=1, Oxide=La2O3 (wt%)
Variability Chart for Measured

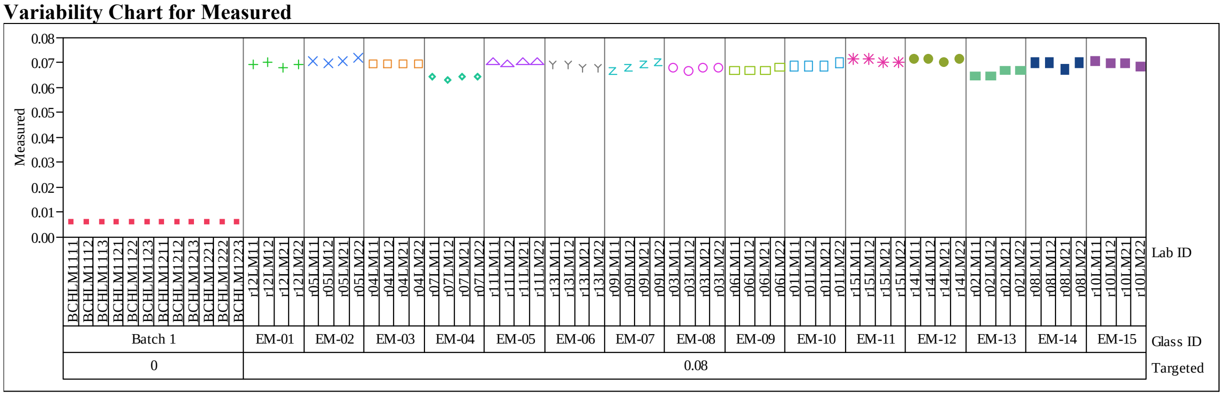
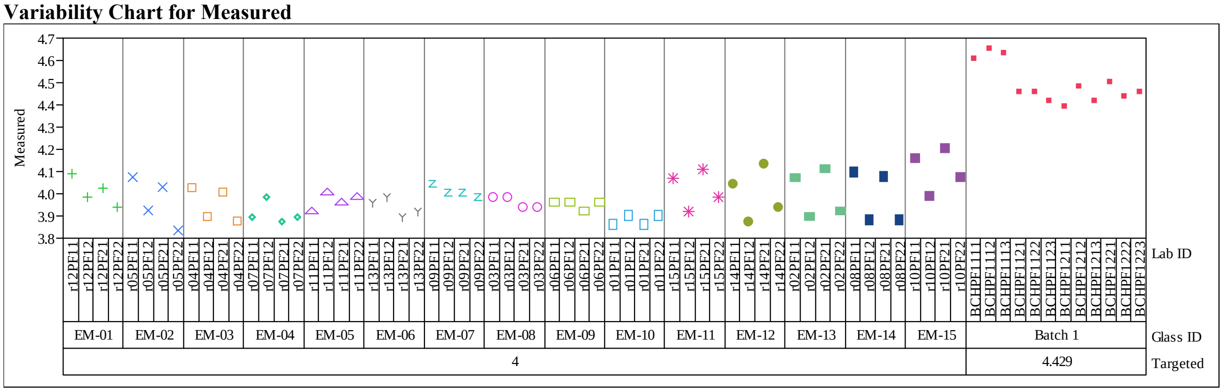
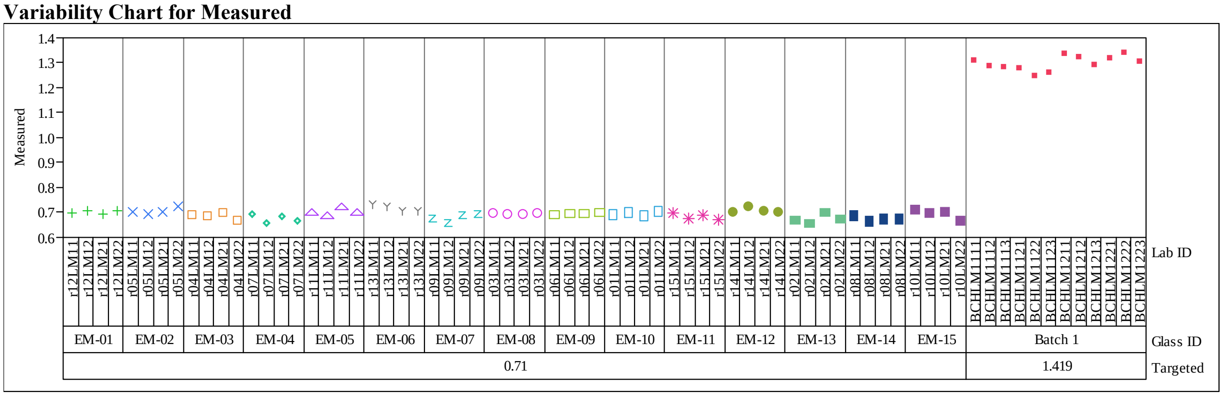


Exhibit D2. Matrix 2A Sample Measurements by Lab ID within Glass ID by Oxide by Analytical Block

Set=1, Oxide=Li2O (wt%)
Variability Chart for Measured



Set=1, Oxide=MgO (wt%)
Variability Chart for Measured



Set=1, Oxide=MnO (wt%)
Variability Chart for Measured

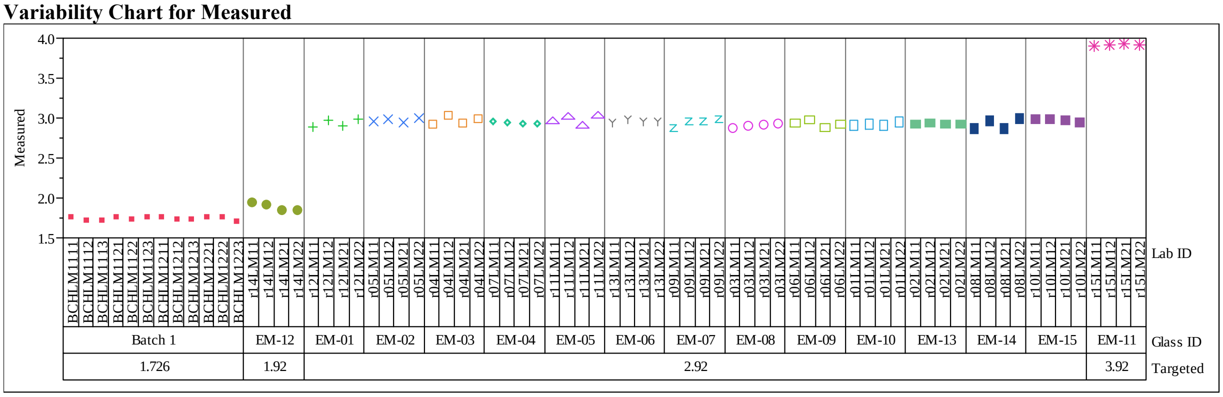
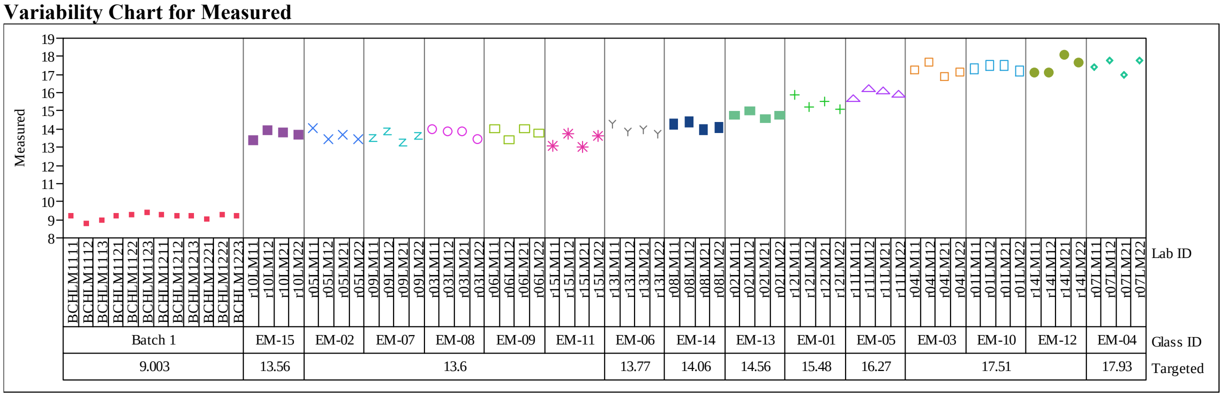
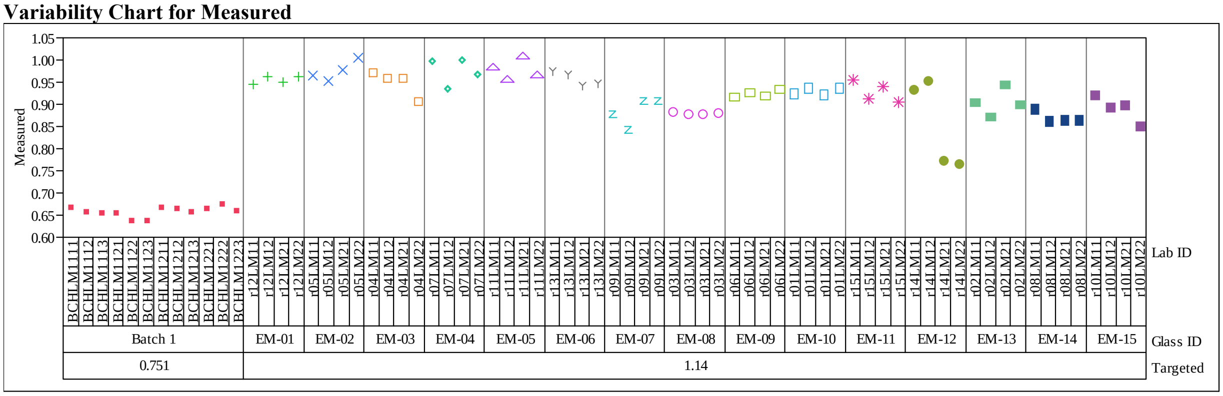


Exhibit D2. Matrix 2A Sample Measurements by Lab ID within Glass ID by Oxide by Analytical Block

Set=1, Oxide=Na2O (wt%)
Variability Chart for Measured



Set=1, Oxide=NiO (wt%)
Variability Chart for Measured



Set=1, Oxide=PbO (wt%)
Variability Chart for Measured

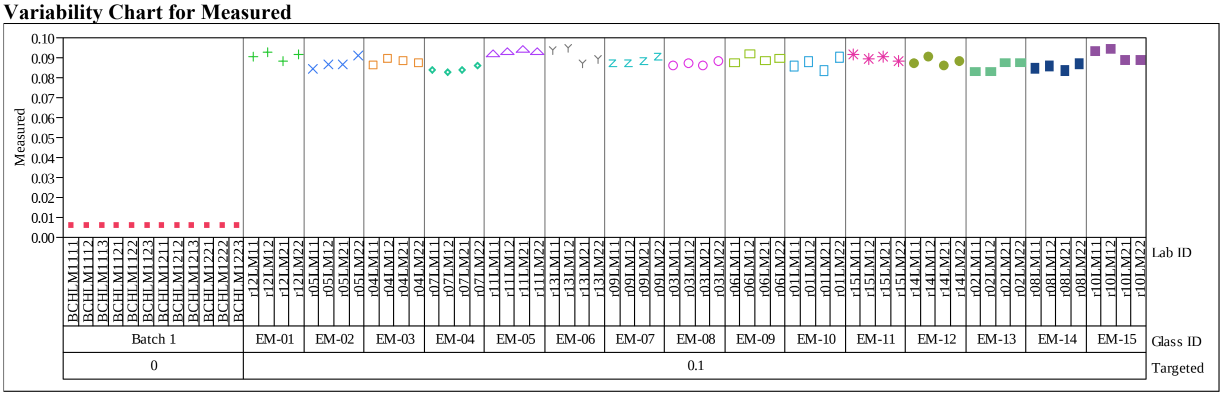
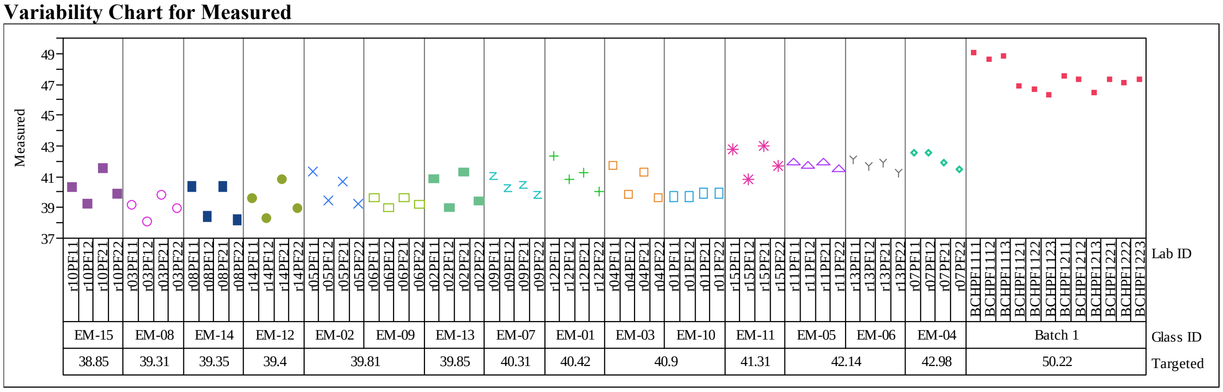
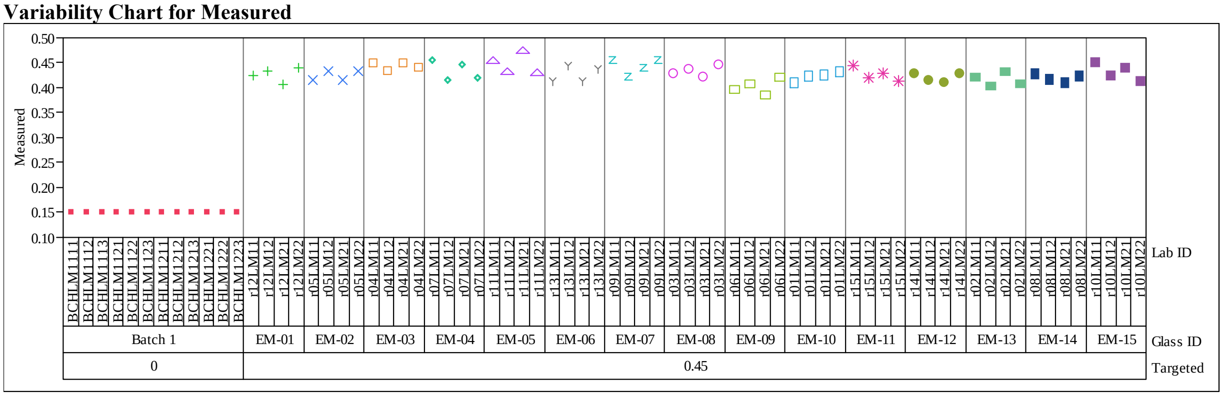


Exhibit D2. Matrix 2A Sample Measurements by Lab ID within Glass ID by Oxide by Analytical Block

Set=1, Oxide=SiO2 (wt%)
Variability Chart for Measured



Set=1, Oxide=SO4 (wt%)
Variability Chart for Measured



Set=1, Oxide=TiO2 (wt%)
Variability Chart for Measured

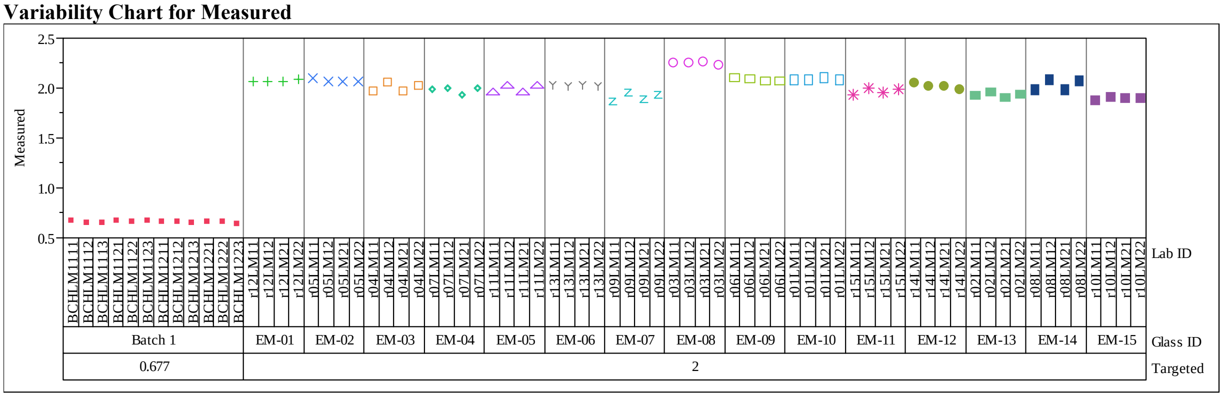
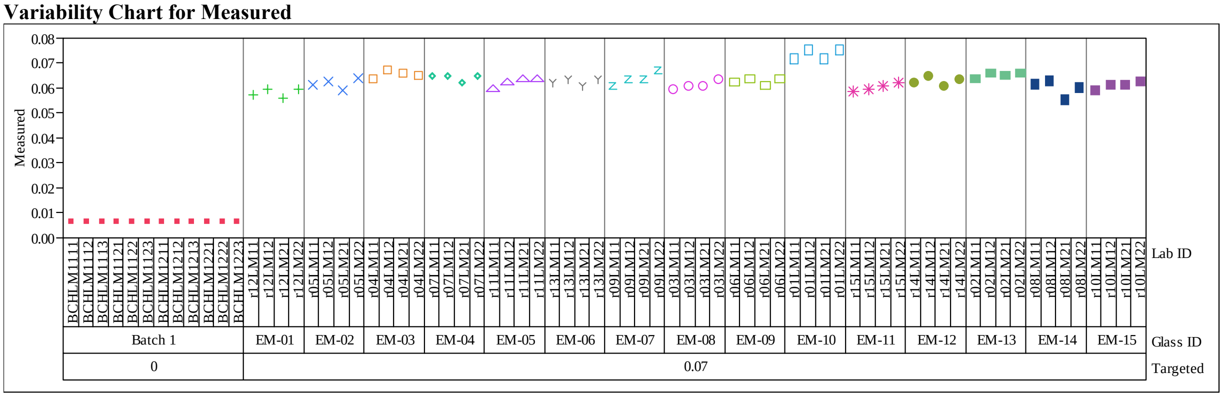
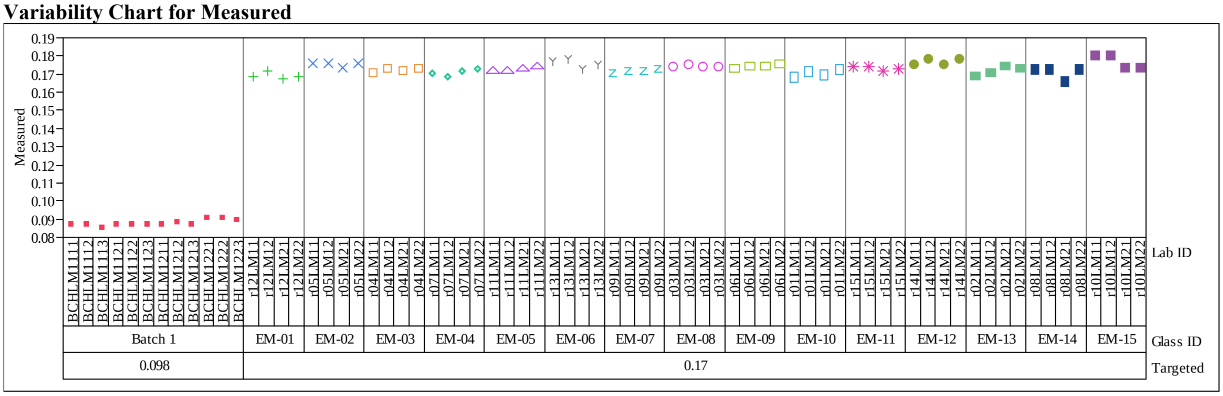


Exhibit D2. Matrix 2A Sample Measurements by Lab ID within Glass ID by Oxide by Analytical Block

Set=1, Oxide=ZnO (wt%)
Variability Chart for Measured



Set=1, Oxide=ZrO2 (wt%)
Variability Chart for Measured



Set=2, Oxide=Al2O3 (wt%)
Variability Chart for Measured

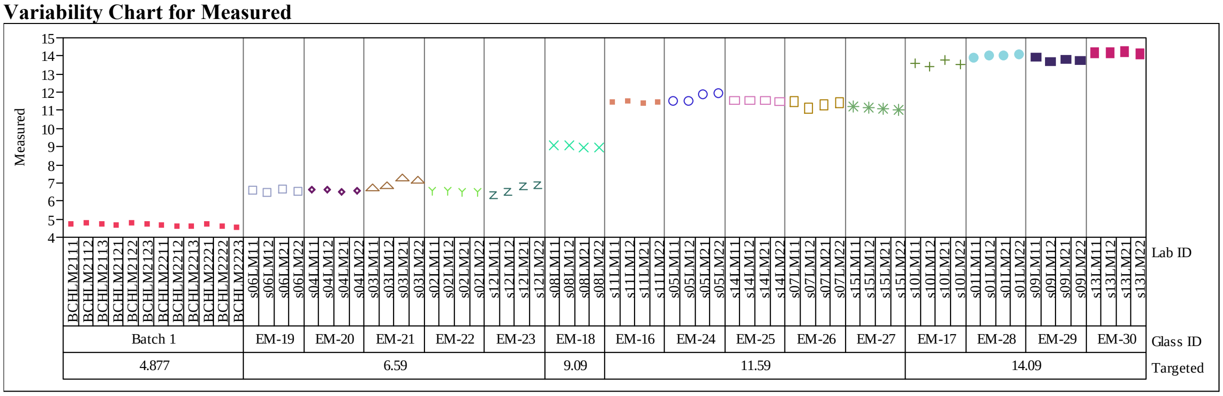
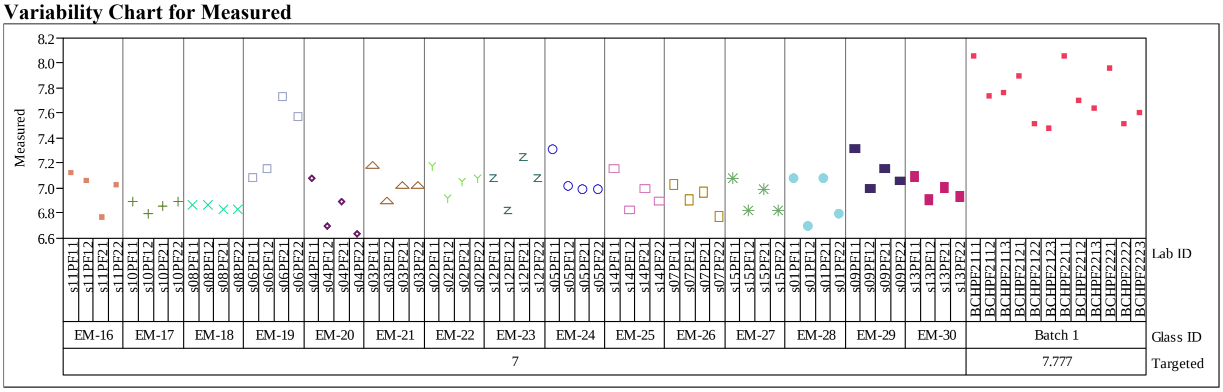
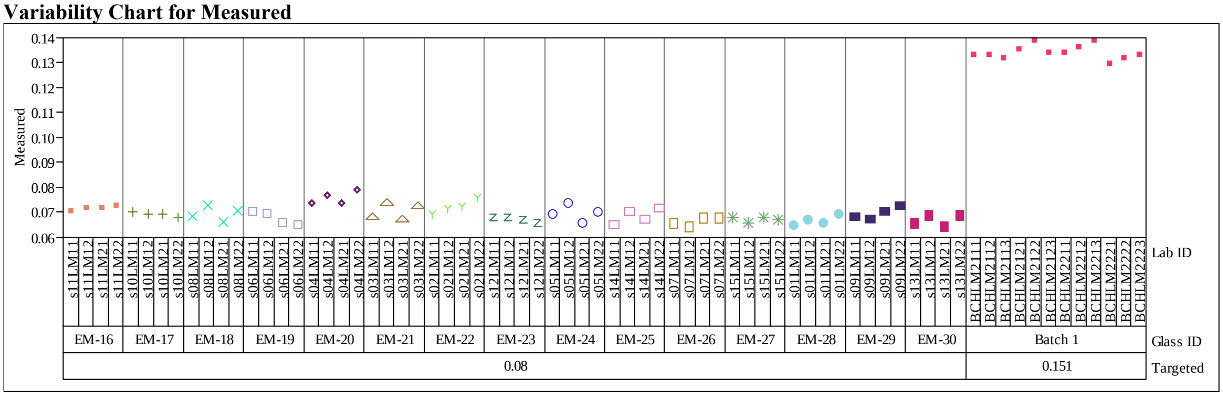


Exhibit D2. Matrix 2A Sample Measurements by Lab ID within Glass ID by Oxide by Analytical Block

Set=2, Oxide=B2O3 (wt%)
Variability Chart for Measured



Set=2, Oxide=BaO (wt%)
Variability Chart for Measured



Set=2, Oxide=CaO (wt%)
Variability Chart for Measured

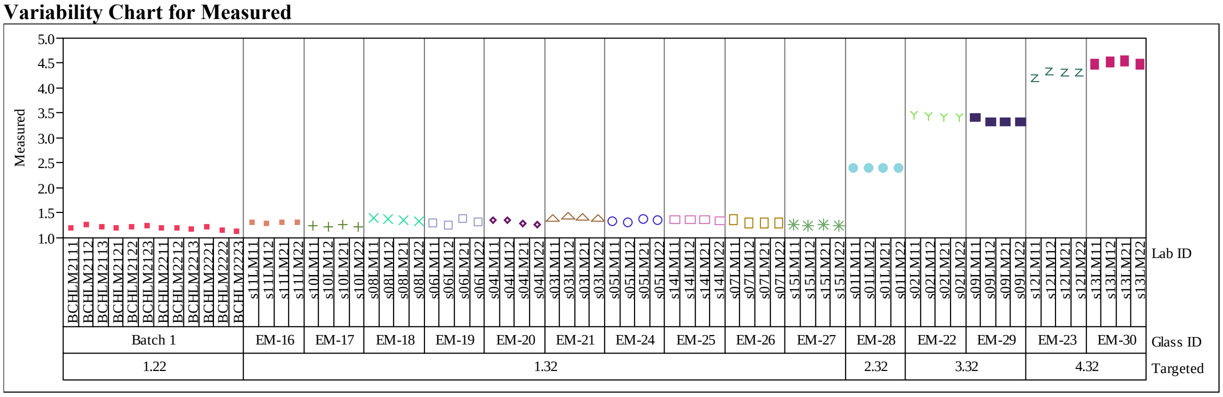
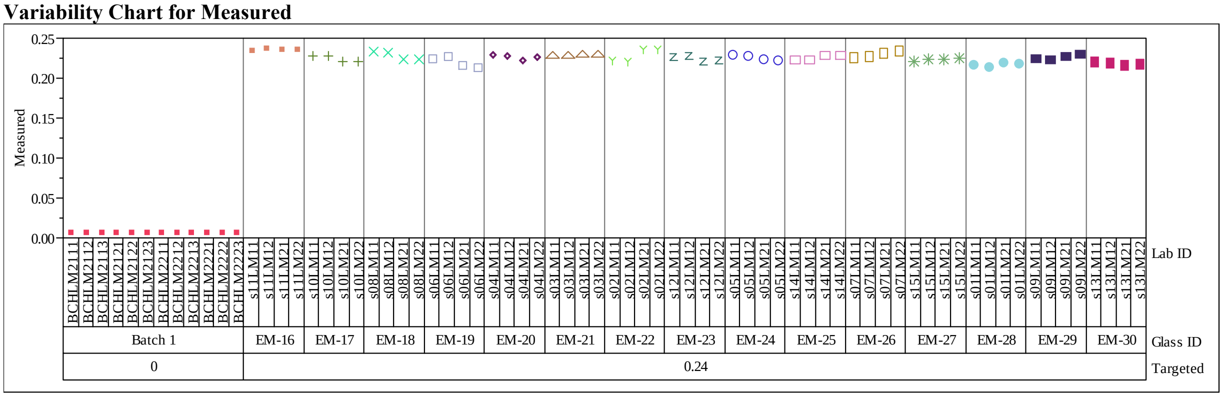
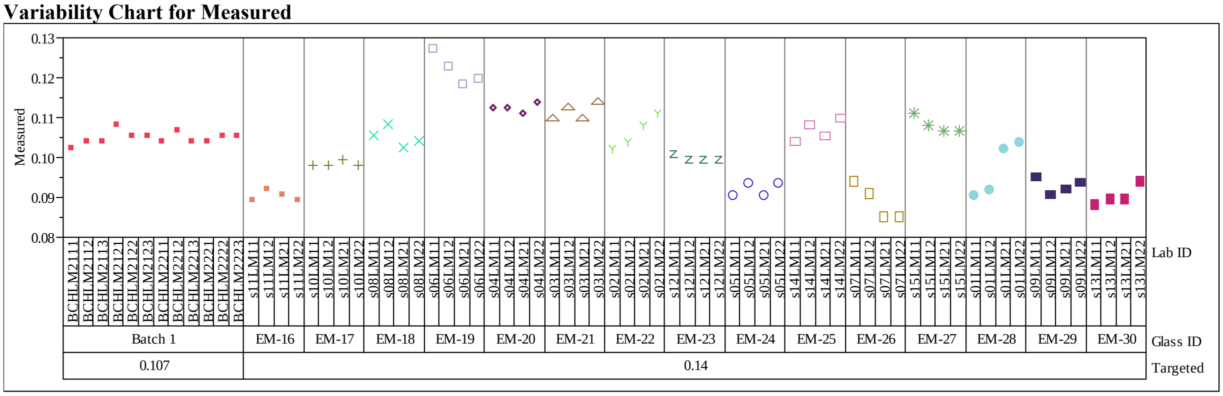


Exhibit D2. Matrix 2A Sample Measurements by Lab ID within Glass ID by Oxide by Analytical Block

Set=2, Oxide=Ce2O3 (wt%)
Variability Chart for Measured



Set=2, Oxide=Cr2O3 (wt%)
Variability Chart for Measured



Set=2, Oxide=CuO (wt%)
Variability Chart for Measured

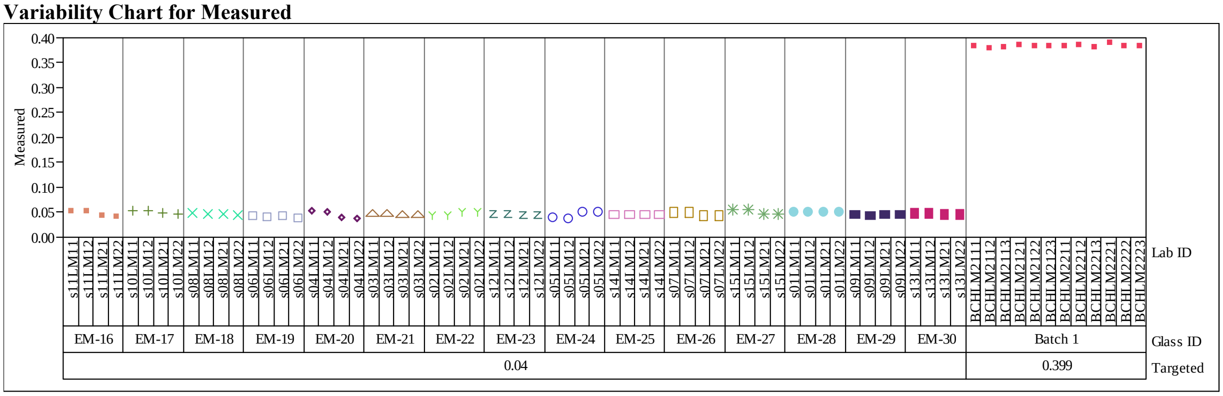
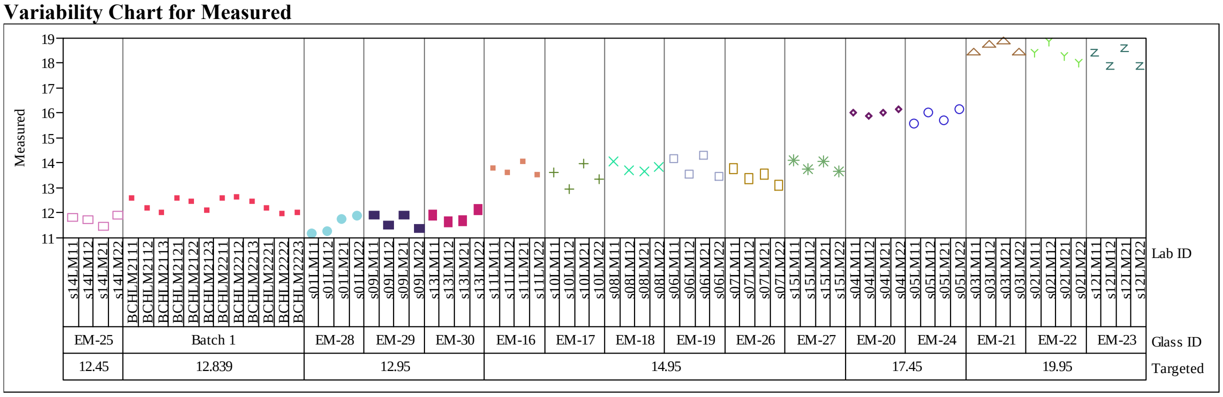
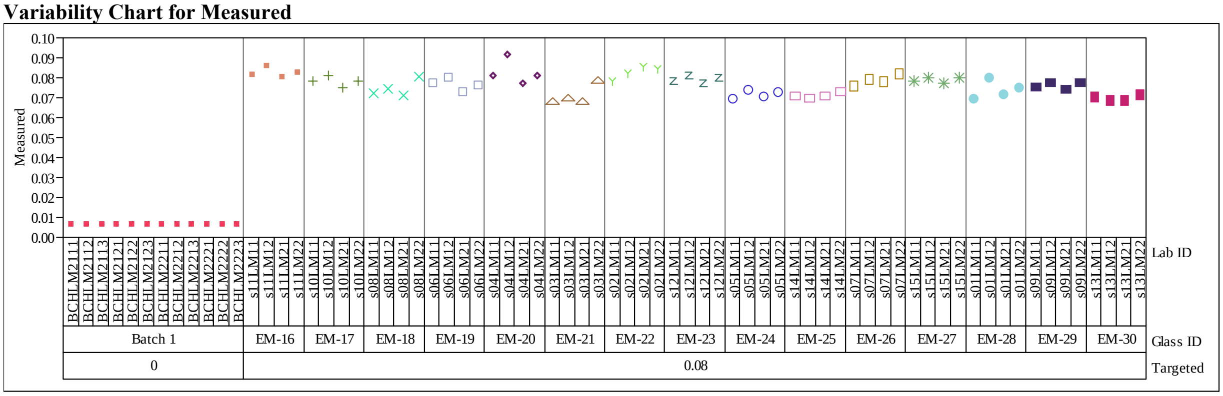


Exhibit D2. Matrix 2A Sample Measurements by Lab ID within Glass ID by Oxide by Analytical Block

Set=2, Oxide=Fe2O3 (wt%)
Variability Chart for Measured



Set=2, Oxide=La2O3 (wt%)
Variability Chart for Measured



Set=2, Oxide=Li2O (wt%)
Variability Chart for Measured

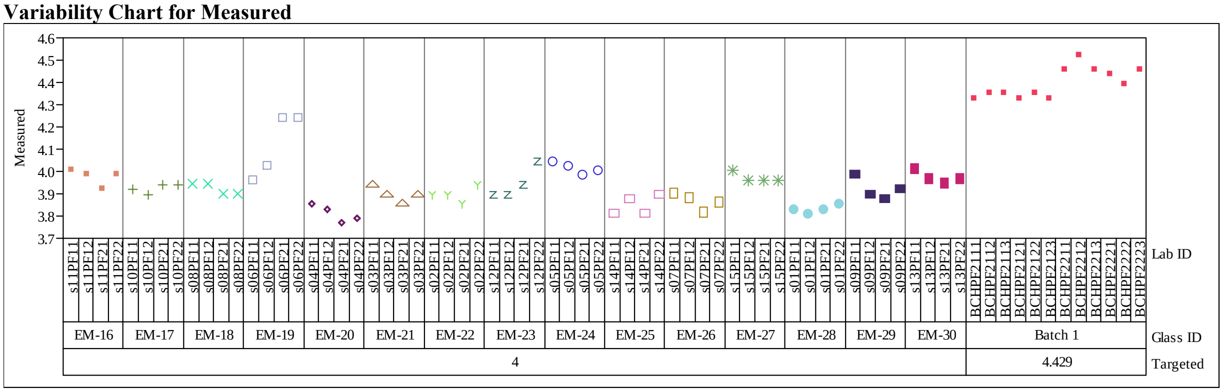
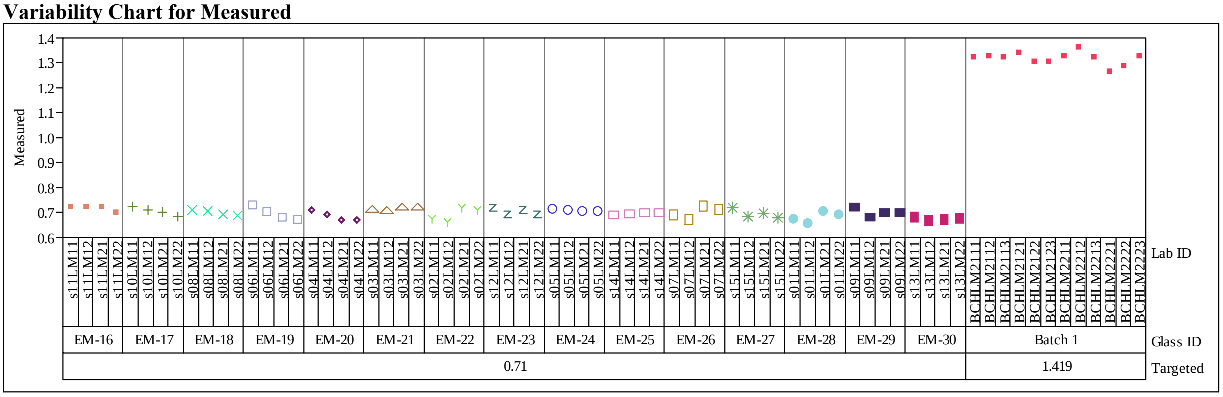
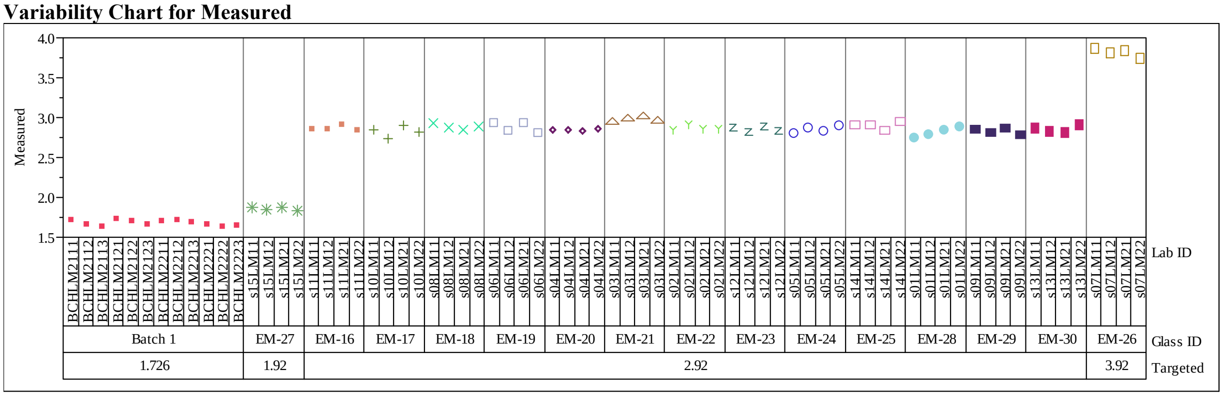


Exhibit D2. Matrix 2A Sample Measurements by Lab ID within Glass ID by Oxide by Analytical Block

Set=2, Oxide=MgO (wt%)
Variability Chart for Measured



Set=2, Oxide=MnO (wt%)
Variability Chart for Measured



Set=2, Oxide=Na2O (wt%)
Variability Chart for Measured

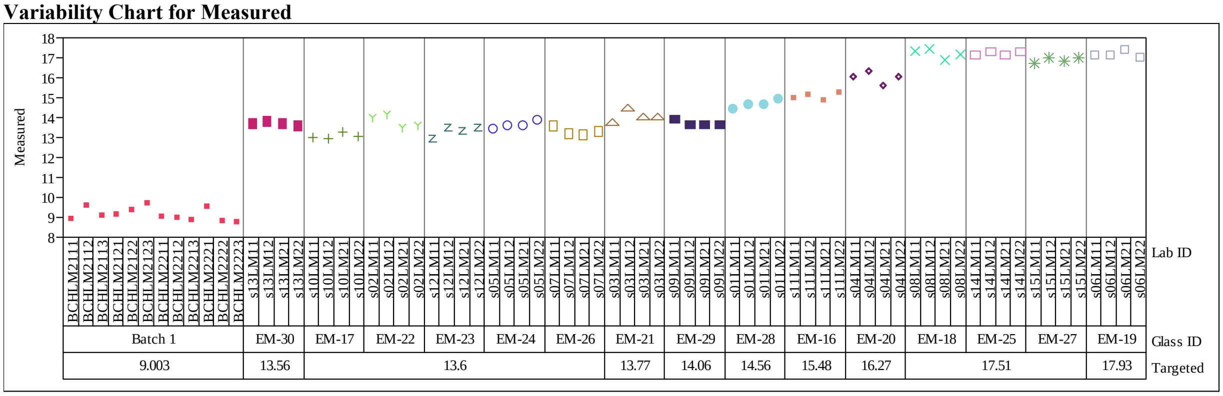
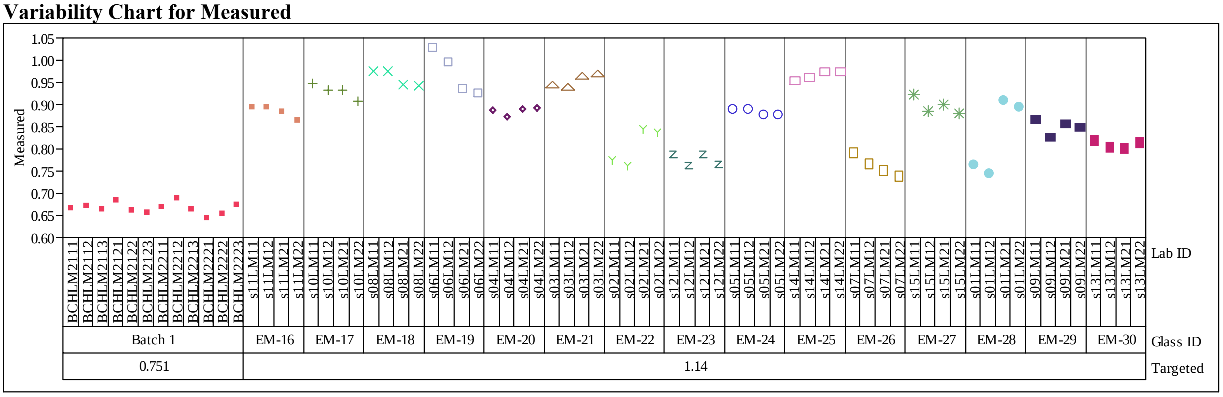
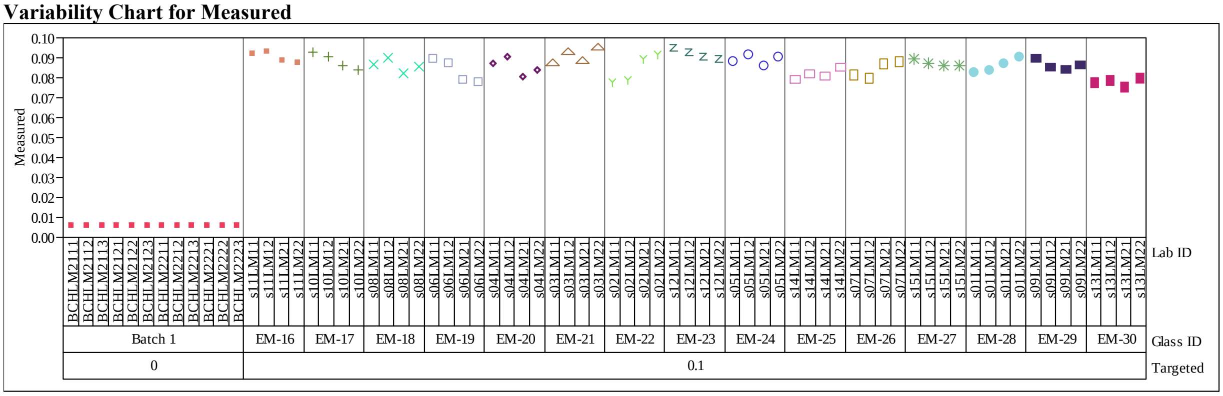


Exhibit D2. Matrix 2A Sample Measurements by Lab ID within Glass ID by Oxide by Analytical Block

Set=2, Oxide=NiO (wt%)
Variability Chart for Measured



Set=2, Oxide=PbO (wt%)
Variability Chart for Measured



Set=2, Oxide=SiO2 (wt%)
Variability Chart for Measured

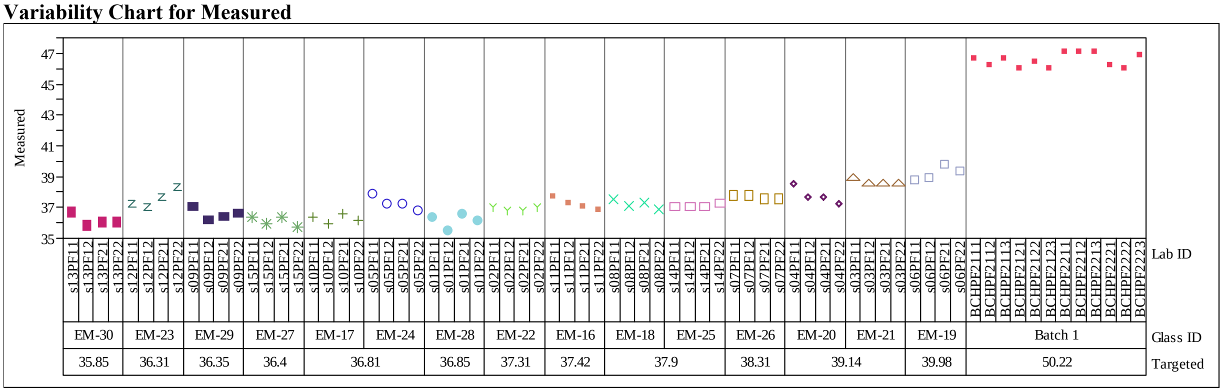
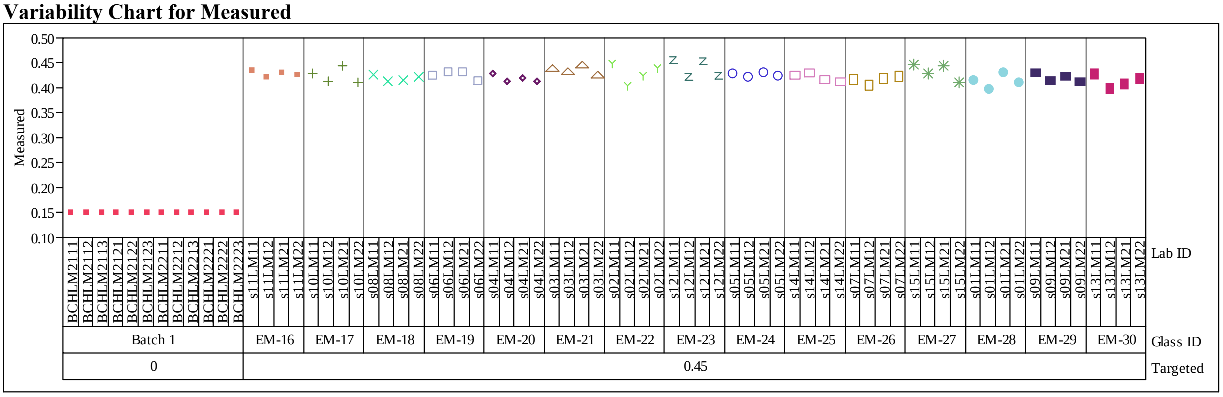
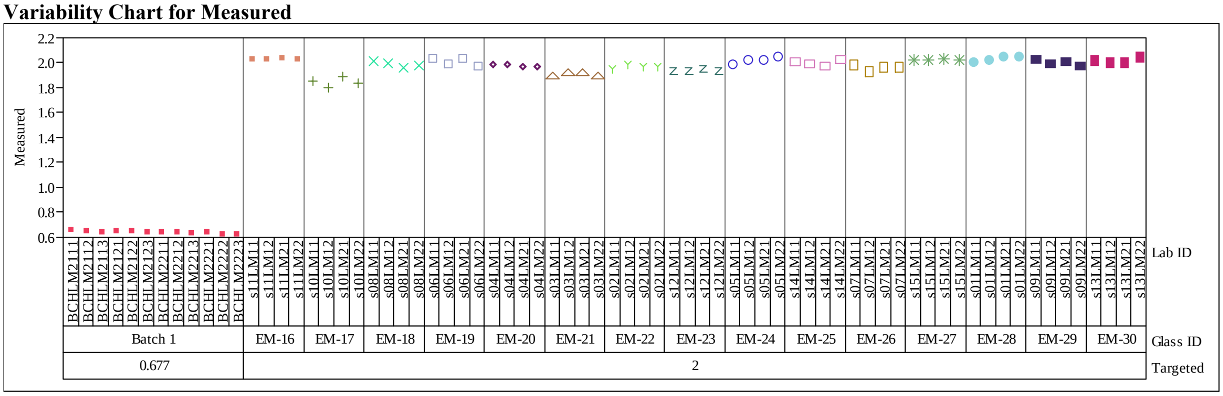


Exhibit D2. Matrix 2A Sample Measurements by Lab ID within Glass ID by Oxide by Analytical Block

Set=2, Oxide=SO4 (wt%)
Variability Chart for Measured



Set=2, Oxide=TiO2 (wt%)
Variability Chart for Measured



Set=2, Oxide=ZnO (wt%)
Variability Chart for Measured

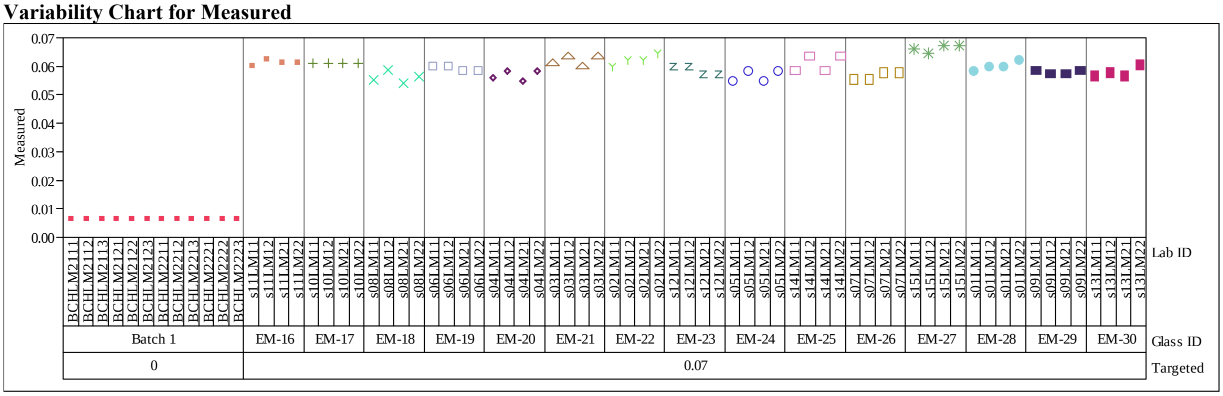


Exhibit D2. Matrix 2A Sample Measurements by Lab ID within Glass ID by Oxide by Analytical Block

Set=2, Oxide=ZrO2 (wt%)
Variability Chart for Measured

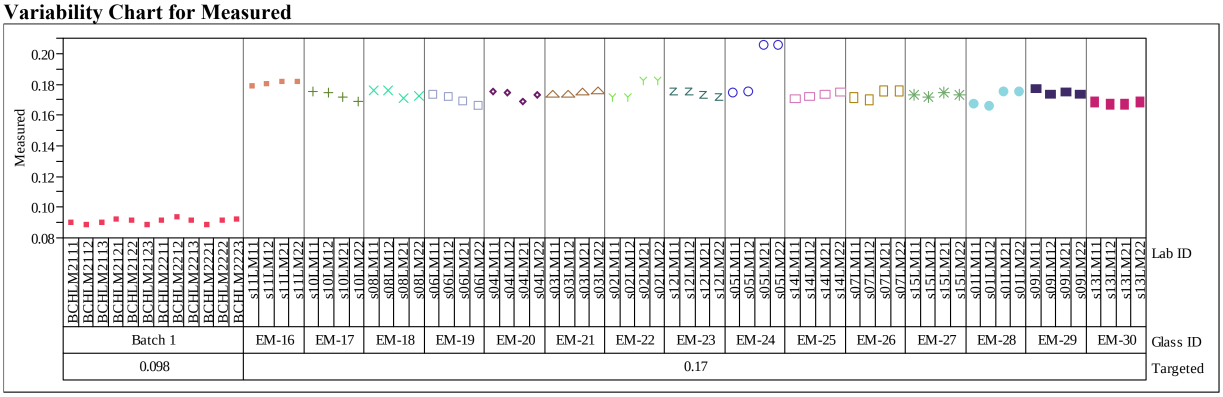
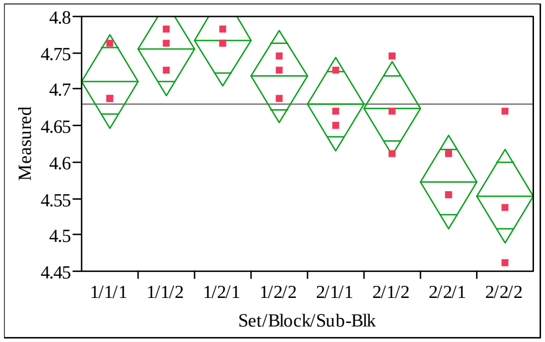


Exhibit D3. Batch 1 Sample Measurements by Block and Sub-Block by Oxide for Both Preparation Methods for the Matrix 2A Study

Oneway Analysis of Measured By Set/Block/Sub-Blk
Oxide=Al2O3 (wt%)
Reference Value = 4.877 wt%



Oneway Anova
Summary of Fit

Rsquare	0.748777
Adj Rsquare	0.638867
Root Mean Square Error	0.052176
Mean of Response	4.678874
Observations (or Sum Wgts)	24

Analysis of Variance

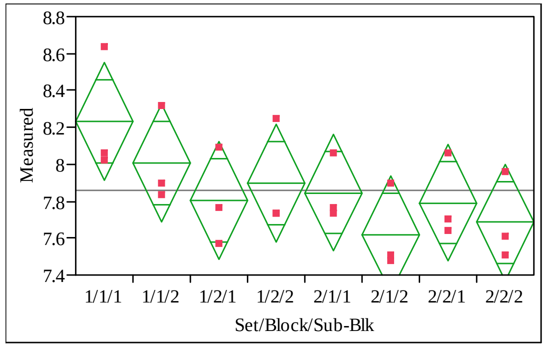
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Blk	7	0.12982177	0.018546	6.8126	0.0008
Error	16	0.04355657	0.002722		
C. Total	23	0.17337834			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1/1	3	4.71115	0.03012	4.6473	4.7750
1/1/2	3	4.75524	0.03012	4.6914	4.8191
1/2/1	3	4.76784	0.03012	4.7040	4.8317
1/2/2	3	4.71745	0.03012	4.6536	4.7813
2/1/1	3	4.67966	0.03012	4.6158	4.7435
2/1/2	3	4.67336	0.03012	4.6095	4.7372
2/2/1	3	4.57259	0.03012	4.5087	4.6364
2/2/2	3	4.55370	0.03012	4.4898	4.6176

Std Error uses a pooled estimate of error variance

Oneway Analysis of Measured By Set/Block/Sub-Blk
Oxide=B2O3 (wt%)
Reference Value = 7.777 wt%



Oneway Anova
Summary of Fit

Rsquare	0.418931
Adj Rsquare	0.164713
Root Mean Square Error	0.25893
Mean of Response	7.860581
Observations (or Sum Wgts)	24

Analysis of Variance

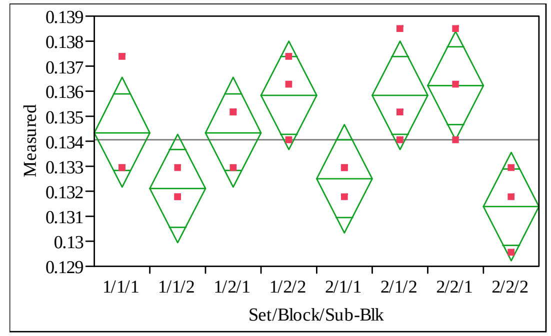
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Blk	7	0.7733914	0.110484	1.6479	0.1928
Error	16	1.0727172	0.067045		
C. Total	23	1.8461086			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1/1	3	8.23221	0.14949	7.9153	8.5491
1/1/2	3	8.00682	0.14949	7.6899	8.3237
1/2/1	3	7.80289	0.14949	7.4860	8.1198
1/2/2	3	7.89949	0.14949	7.5826	8.2164
2/1/1	3	7.84582	0.14949	7.5289	8.1627
2/1/2	3	7.62043	0.14949	7.3035	7.9373
2/2/1	3	7.79216	0.14949	7.4752	8.1091
2/2/2	3	7.68483	0.14949	7.3679	8.0017

Std Error uses a pooled estimate of error variance

Oneway Analysis of Measured By Set/Block/Sub-Blk
Oxide=BaO (wt%)
Reference Value = 0.151 wt%



Oneway Anova
Summary of Fit

Rsquare	0.592654
Adj Rsquare	0.414441
Root Mean Square Error	0.00178
Mean of Response	0.134073
Observations (or Sum Wgts)	24

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Blk	7	0.00007376	0.000011	3.3255	0.0220
Error	16	0.00005069	3.168e-6		
C. Total	23	0.00012445			

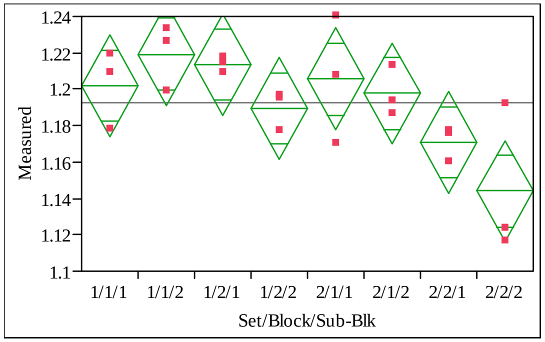
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1/1	3	0.134352	0.00103	0.13217	0.13653
1/1/2	3	0.132119	0.00103	0.12994	0.13430
1/2/1	3	0.134352	0.00103	0.13217	0.13653
1/2/2	3	0.135841	0.00103	0.13366	0.13802
2/1/1	3	0.132491	0.00103	0.13031	0.13467
2/1/2	3	0.135841	0.00103	0.13366	0.13802
2/2/1	3	0.136213	0.00103	0.13403	0.13839
2/2/2	3	0.131375	0.00103	0.12920	0.13355

Std Error uses a pooled estimate of error variance

Exhibit D3. Batch 1 Sample Measurements by Block and Sub-Block by Oxide for Both Preparation Methods for the Matrix 2A Study

Oneway Analysis of Measured By Set/Block/Sub-Blk
Oxide=CaO (wt%)
Reference Value = 1.220 wt%



Oneway Anova
Summary of Fit

Rsquare	0.607329
Adj Rsquare	0.435535
Root Mean Square Error	0.022765
Mean of Response	1.19276
Observations (or Sum Wgts)	24

Analysis of Variance

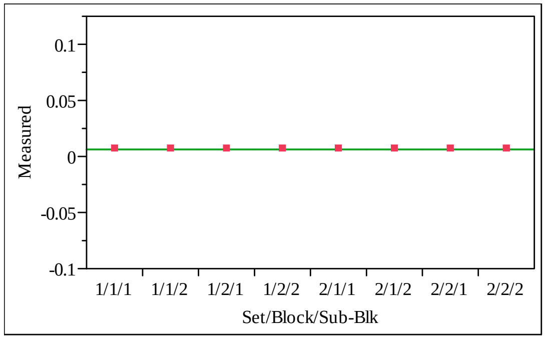
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Blk	7	0.01282456	0.001832	3.5352	0.0173
Error	16	0.00829177	0.000518		
C. Total	23	0.02111632			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1/1	3	1.20191	0.01314	1.1741	1.2298
1/1/2	3	1.21917	0.01314	1.1913	1.2470
1/2/1	3	1.21357	0.01314	1.1857	1.2414
1/2/2	3	1.18932	0.01314	1.1615	1.2172
2/1/1	3	1.20564	0.01314	1.1778	1.2335
2/1/2	3	1.19772	0.01314	1.1699	1.2256
2/2/1	3	1.17066	0.01314	1.1428	1.1985
2/2/2	3	1.14408	0.01314	1.1162	1.1719

Std Error uses a pooled estimate of error variance

Oneway Analysis of Measured By Set/Block/Sub-Blk
Oxide=Ce2O3 (wt%)
Reference Value = 0.0 wt%



Oneway Anova
Summary of Fit

Rsquare	.
Adj Rsquare	.
Root Mean Square Error	0
Mean of Response	0.005857
Observations (or Sum Wgts)	24

Analysis of Variance

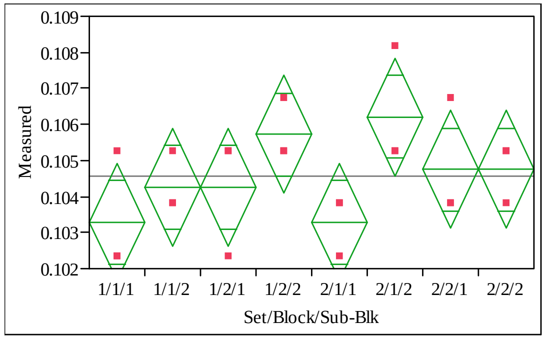
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Blk	7	0	0	.	.
Error	16	0	0		
C. Total	23	0			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1/1	3	0.005857	0	0.00586	0.00586
1/1/2	3	0.005857	0	0.00586	0.00586
1/2/1	3	0.005857	0	0.00586	0.00586
1/2/2	3	0.005857	0	0.00586	0.00586
2/1/1	3	0.005857	0	0.00586	0.00586
2/1/2	3	0.005857	0	0.00586	0.00586
2/2/1	3	0.005857	0	0.00586	0.00586
2/2/2	3	0.005857	0	0.00586	0.00586

Std Error uses a pooled estimate of error variance

Oneway Analysis of Measured By Set/Block/Sub-Blk
Oxide=Cr2O3 (wt%)
Reference Value = 0.107 wt%



Oneway Anova
Summary of Fit

Rsquare	0.443478
Adj Rsquare	0.2
Root Mean Square Error	0.001334
Mean of Response	0.104565
Observations (or Sum Wgts)	24

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Blk	7	0.00002270	3.2426e-6	1.8214	0.1517
Error	16	0.00002848	1.7802e-6		
C. Total	23	0.00005118			

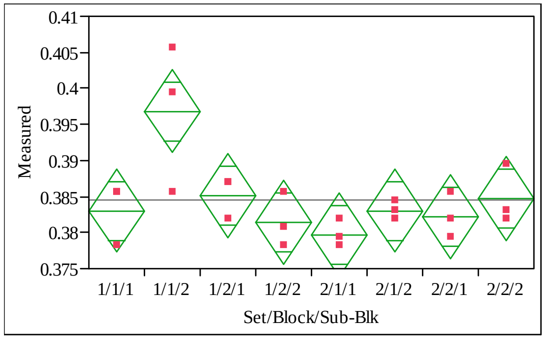
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1/1	3	0.103286	0.00077	0.10165	0.10492
1/1/2	3	0.104261	0.00077	0.10263	0.10589
1/2/1	3	0.104261	0.00077	0.10263	0.10589
1/2/2	3	0.105722	0.00077	0.10409	0.10736
2/1/1	3	0.103286	0.00077	0.10165	0.10492
2/1/2	3	0.106210	0.00077	0.10458	0.10784
2/2/1	3	0.104748	0.00077	0.10311	0.10638
2/2/2	3	0.104748	0.00077	0.10311	0.10638

Std Error uses a pooled estimate of error variance

Exhibit D3. Batch 1 Sample Measurements by Block and Sub-Block by Oxide for Both Preparation Methods for the Matrix 2A Study

Oneway Analysis of Measured By Set/Block/Sub-Blk
Oxide=CuO (wt%)
Reference Value = 0.399 wt%



Oneway Anova
Summary of Fit

Rsquare	0.62069
Adj Rsquare	0.454741
Root Mean Square Error	0.004719
Mean of Response	0.384511
Observations (or Sum Wgts)	24

Analysis of Variance

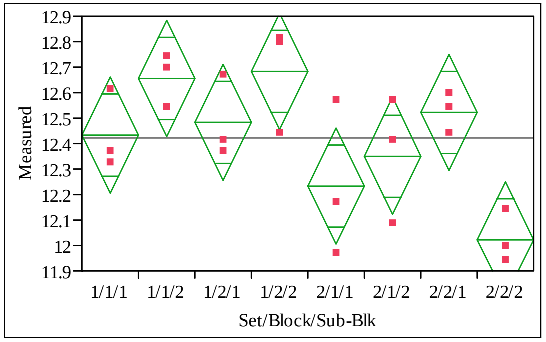
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Blk	7	0.00058293	0.000083	3.7403	0.0137
Error	16	0.00035623	0.000022		
C. Total	23	0.00093916			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1/1	3	0.383051	0.00272	0.37728	0.38883
1/1/2	3	0.396821	0.00272	0.39105	0.40260
1/2/1	3	0.385137	0.00272	0.37936	0.39091
1/2/2	3	0.381382	0.00272	0.37561	0.38716
2/1/1	3	0.379713	0.00272	0.37394	0.38549
2/1/2	3	0.383051	0.00272	0.37728	0.38883
2/2/1	3	0.382216	0.00272	0.37644	0.38799
2/2/2	3	0.384720	0.00272	0.37894	0.39050

Std Error uses a pooled estimate of error variance

Oneway Analysis of Measured By Set/Block/Sub-Blk
Oxide=Fe2O3 (wt%)
Reference Value = 12.839 wt%



Oneway Anova
Summary of Fit

Rsquare	0.644733
Adj Rsquare	0.489304
Root Mean Square Error	0.186273
Mean of Response	12.4235
Observations (or Sum Wgts)	24

Analysis of Variance

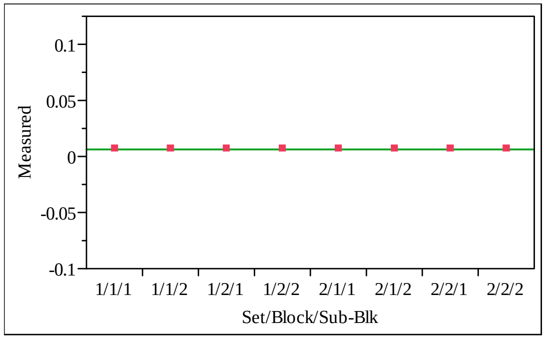
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Blk	7	1.0074998	0.143929	4.1481	0.0088
Error	16	0.5551618	0.034698		
C. Total	23	1.5626617			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1/1	3	12.4336	0.10754	12.206	12.662
1/1/2	3	12.6576	0.10754	12.430	12.886
1/2/1	3	12.4813	0.10754	12.253	12.709
1/2/2	3	12.6814	0.10754	12.453	12.909
2/1/1	3	12.2335	0.10754	12.005	12.461
2/1/2	3	12.3526	0.10754	12.125	12.581
2/2/1	3	12.5242	0.10754	12.296	12.752
2/2/2	3	12.0238	0.10754	11.796	12.252

Std Error uses a pooled estimate of error variance

Oneway Analysis of Measured By Set/Block/Sub-Blk
Oxide=La2O3 (wt%)
Reference Value = 0.0 wt%



Oneway Anova
Summary of Fit

Rsquare	.
Adj Rsquare	.
Root Mean Square Error	0
Mean of Response	0.005864
Observations (or Sum Wgts)	24

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Blk	7	0	0	.	.
Error	16	0	0		
C. Total	23	0			

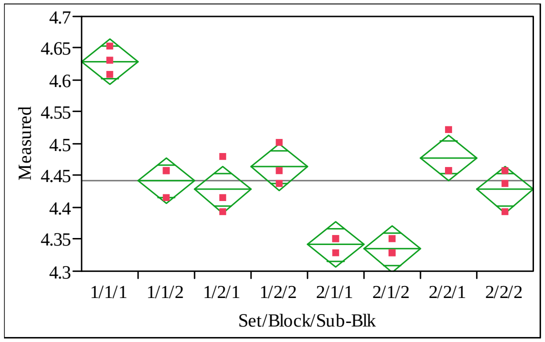
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1/1	3	0.005864	0	0.00586	0.00586
1/1/2	3	0.005864	0	0.00586	0.00586
1/2/1	3	0.005864	0	0.00586	0.00586
1/2/2	3	0.005864	0	0.00586	0.00586
2/1/1	3	0.005864	0	0.00586	0.00586
2/1/2	3	0.005864	0	0.00586	0.00586
2/2/1	3	0.005864	0	0.00586	0.00586
2/2/2	3	0.005864	0	0.00586	0.00586

Std Error uses a pooled estimate of error variance

Exhibit D3. Batch 1 Sample Measurements by Block and Sub-Block by Oxide for Both Preparation Methods for the Matrix 2A Study

Oneway Analysis of Measured By Set/Block/Sub-Blk
Oxide=Li2O (wt%)
Reference Value = 4.429 wt%



Oneway Anova
Summary of Fit

Rsquare	0.926762
Adj Rsquare	0.894721
Root Mean Square Error	0.02948
Mean of Response	4.443047
Observations (or Sum Wgts)	24

Analysis of Variance

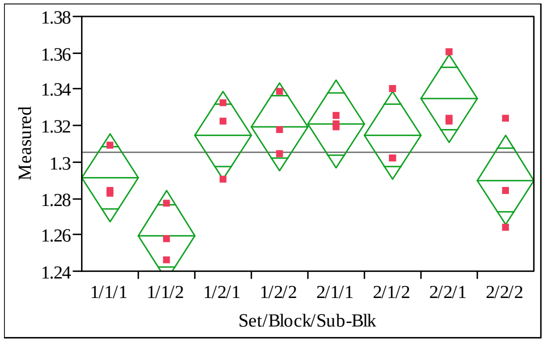
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Blk	7	0.17595537	0.025136	28.9238	<.0001
Error	16	0.01390494	0.000869		
C. Total	23	0.18986030			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1/1	3	4.62874	0.01702	4.5927	4.6648
1/1/2	3	4.44215	0.01702	4.4061	4.4782
1/2/1	3	4.42780	0.01702	4.3917	4.4639
1/2/2	3	4.46368	0.01702	4.4276	4.4998
2/1/1	3	4.34168	0.01702	4.3056	4.3778
2/1/2	3	4.33451	0.01702	4.2984	4.3706
2/2/1	3	4.47803	0.01702	4.4420	4.5141
2/2/2	3	4.42780	0.01702	4.3917	4.4639

Std Error uses a pooled estimate of error variance

Oneway Analysis of Measured By Set/Block/Sub-Blk
Oxide=MgO (wt%)
Reference Value = 1.419 wt%



Oneway Anova
Summary of Fit

Rsquare	0.656409
Adj Rsquare	0.506088
Root Mean Square Error	0.019804
Mean of Response	1.305704
Observations (or Sum Wgts)	24

Analysis of Variance

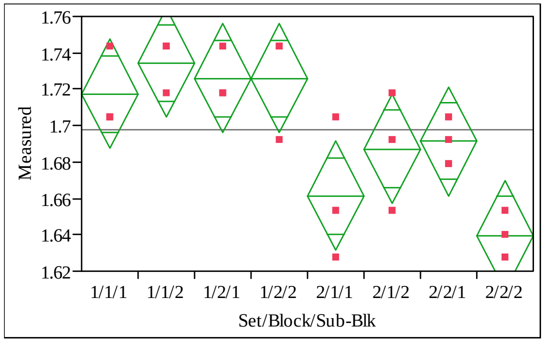
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Blk	7	0.01198879	0.001713	4.3667	0.0070
Error	16	0.00627541	0.000392		
C. Total	23	0.01826420			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1/1	3	1.29126	0.01143	1.2670	1.3155
1/1/2	3	1.25976	0.01143	1.2355	1.2840
1/2/1	3	1.31448	0.01143	1.2902	1.3387
1/2/2	3	1.31945	0.01143	1.2952	1.3437
2/1/1	3	1.32111	0.01143	1.2969	1.3454
2/1/2	3	1.31448	0.01143	1.2902	1.3387
2/2/1	3	1.33493	0.01143	1.3107	1.3592
2/2/2	3	1.29016	0.01143	1.2659	1.3144

Std Error uses a pooled estimate of error variance

Oneway Analysis of Measured By Set/Block/Sub-Blk
Oxide=MnO (wt%)
Reference Value = 1.726 wt%



Oneway Anova
Summary of Fit

Rsquare	0.718954
Adj Rsquare	0.595997
Root Mean Square Error	0.024442
Mean of Response	1.697928
Observations (or Sum Wgts)	24

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Blk	7	0.02445223	0.003493	5.8472	0.0017
Error	16	0.00955860	0.000597		
C. Total	23	0.03401083			

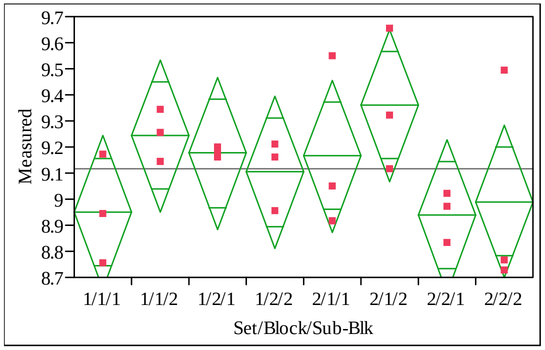
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1/1	3	1.71730	0.01411	1.6874	1.7472
1/1/2	3	1.73451	0.01411	1.7046	1.7644
1/2/1	3	1.72590	0.01411	1.6960	1.7558
1/2/2	3	1.72590	0.01411	1.6960	1.7558
2/1/1	3	1.66134	0.01411	1.6314	1.6913
2/1/2	3	1.68717	0.01411	1.6573	1.7171
2/2/1	3	1.69147	0.01411	1.6616	1.7214
2/2/2	3	1.63982	0.01411	1.6099	1.6697

Std Error uses a pooled estimate of error variance

Exhibit D3. Batch 1 Sample Measurements by Block and Sub-Block by Oxide for Both Preparation Methods for the Matrix 2A Study

Oneway Analysis of Measured By Set/Block/Sub-Blk
Oxide=Na2O (wt%)
Reference Value = 9.003 wt%



Oneway Anova
Summary of Fit

Rsquare	0.340493
Adj Rsquare	0.051959
Root Mean Square Error	0.238406
Mean of Response	9.11585
Observations (or Sum Wgts)	24

Analysis of Variance

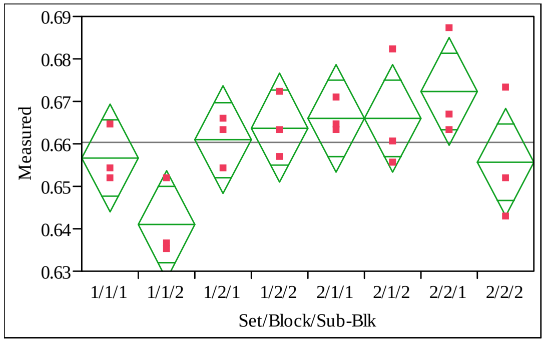
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Blk	7	0.4695094	0.067073	1.1801	0.3671
Error	16	0.9094000	0.056837		
C. Total	23	1.3789094			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1/1	3	8.95072	0.13764	8.6589	9.2425
1/1/2	3	9.24279	0.13764	8.9510	9.5346
1/2/1	3	9.17539	0.13764	8.8836	9.4672
1/2/2	3	9.10349	0.13764	8.8117	9.3953
2/1/1	3	9.16640	0.13764	8.8746	9.4582
2/1/2	3	9.35961	0.13764	9.0678	9.6514
2/2/1	3	8.93724	0.13764	8.6454	9.2290
2/2/2	3	8.99116	0.13764	8.6994	9.2830

Std Error uses a pooled estimate of error variance

Oneway Analysis of Measured By Set/Block/Sub-Blk
Oxide=NiO (wt%)
Reference Value = 0.751 wt%



Oneway Anova
Summary of Fit

Rsquare	0.524071
Adj Rsquare	0.315852
Root Mean Square Error	0.010361
Mean of Response	0.660268
Observations (or Sum Wgts)	24

Analysis of Variance

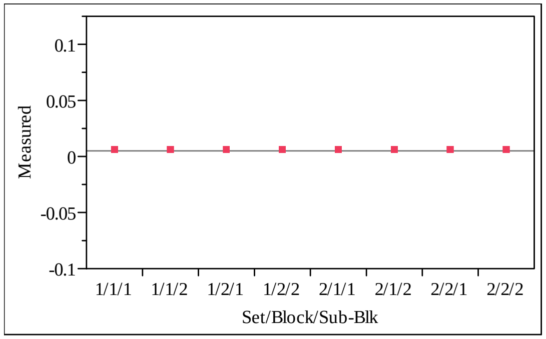
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Blk	7	0.00189122	0.000270	2.5169	0.0599
Error	16	0.00171749	0.000107		
C. Total	23	0.00360871			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1/1	3	0.656610	0.00598	0.64393	0.66929
1/1/2	3	0.640916	0.00598	0.62824	0.65360
1/2/1	3	0.660852	0.00598	0.64817	0.67353
1/2/2	3	0.663821	0.00598	0.65114	0.67650
2/1/1	3	0.665942	0.00598	0.65326	0.67862
2/1/2	3	0.665942	0.00598	0.65326	0.67862
2/2/1	3	0.672304	0.00598	0.65962	0.68498
2/2/2	3	0.655762	0.00598	0.64308	0.66844

Std Error uses a pooled estimate of error variance

Oneway Analysis of Measured By Set/Block/Sub-Blk
Oxide=PbO (wt%)
Reference Value = 0.0 wt%



Oneway Anova
Summary of Fit

Rsquare	4
Adj Rsquare	5.3125
Root Mean Square Error	.
Mean of Response	0.005386
Observations (or Sum Wgts)	24

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Blk	7	7.2222e-35	1.032e-35	-3.0476	0.0000
Error	16	-5.417e-35	-3.39e-36		
C. Total	23	1.8056e-35			

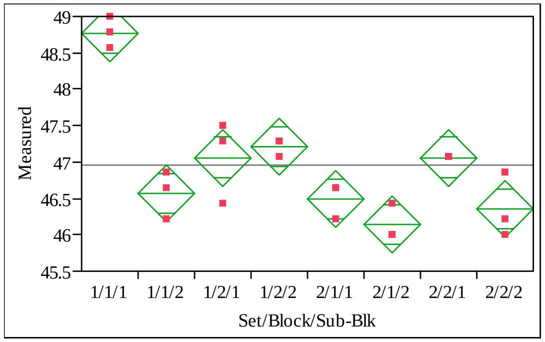
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1/1	3	0.005386	.	.	.
1/1/2	3	0.005386	.	.	.
1/2/1	3	0.005386	.	.	.
1/2/2	3	0.005386	.	.	.
2/1/1	3	0.005386	.	.	.
2/1/2	3	0.005386	.	.	.
2/2/1	3	0.005386	.	.	.
2/2/2	3	0.005386	.	.	.

Std Error uses a pooled estimate of error variance

Exhibit D3. Batch 1 Sample Measurements by Block and Sub-Block by Oxide for Both Preparation Methods for the Matrix 2A Study

Oneway Analysis of Measured By Set/Block/Sub-Blk
Oxide=SiO2 (wt%)
Reference Value = 50.22 wt%



Oneway Anova
Summary of Fit

Rsquare	0.899048
Adj Rsquare	0.854881
Root Mean Square Error	0.31791
Mean of Response	46.95764
Observations (or Sum Wgts)	24

Analysis of Variance

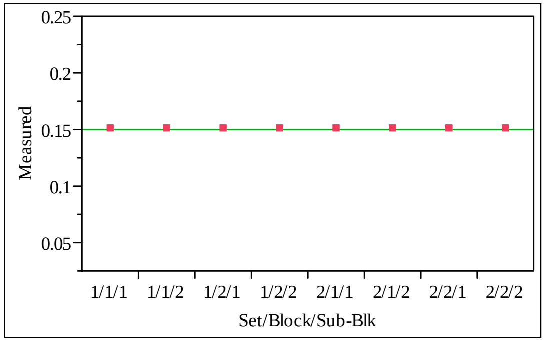
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Blk	7	14.401049	2.05729	20.3558	<.0001
Error	16	1.617067	0.10107		
C. Total	23	16.018116			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1/1	3	48.7760	0.18355	48.387	49.165
1/1/2	3	46.5654	0.18355	46.176	46.955
1/2/1	3	47.0646	0.18355	46.676	47.454
1/2/2	3	47.2072	0.18355	46.818	47.596
2/1/1	3	46.4941	0.18355	46.105	46.883
2/1/2	3	46.1376	0.18355	45.748	46.527
2/2/1	3	47.0646	0.18355	46.676	47.454
2/2/2	3	46.3515	0.18355	45.962	46.741

Std Error uses a pooled estimate of error variance

Oneway Analysis of Measured By Set/Block/Sub-Blk
Oxide=SO4 (wt%)
Reference Value = 0.0 wt%



Oneway Anova
Summary of Fit

Rsquare	.
Adj Rsquare	.
Root Mean Square Error	0
Mean of Response	0.149795
Observations (or Sum Wgts)	24

Analysis of Variance

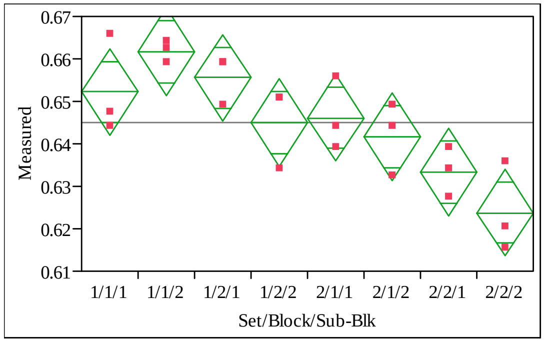
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Blk	7	0	0	.	.
Error	16	0	0		
C. Total	23	0			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1/1	3	0.149795	0	0.14980	0.14980
1/1/2	3	0.149795	0	0.14980	0.14980
1/2/1	3	0.149795	0	0.14980	0.14980
1/2/2	3	0.149795	0	0.14980	0.14980
2/1/1	3	0.149795	0	0.14980	0.14980
2/1/2	3	0.149795	0	0.14980	0.14980
2/2/1	3	0.149795	0	0.14980	0.14980
2/2/2	3	0.149795	0	0.14980	0.14980

Std Error uses a pooled estimate of error variance

Oneway Analysis of Measured By Set/Block/Sub-Blk
Oxide=TiO2 (wt%)
Reference Value = 0.677 wt%



Oneway Anova
Summary of Fit

Rsquare	0.7359
Adj Rsquare	0.620356
Root Mean Square Error	0.008354
Mean of Response	0.644891
Observations (or Sum Wgts)	24

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Blk	7	0.00311134	0.000444	6.3690	0.0011
Error	16	0.00111660	0.000070		
C. Total	23	0.00422794			

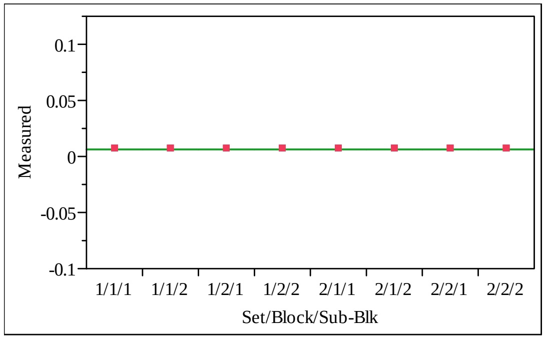
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1/1	3	0.652188	0.00482	0.64196	0.66241
1/1/2	3	0.661640	0.00482	0.65142	0.67186
1/2/1	3	0.655524	0.00482	0.64530	0.66575
1/2/2	3	0.644960	0.00482	0.63474	0.65518
2/1/1	3	0.646072	0.00482	0.63585	0.65630
2/1/2	3	0.641624	0.00482	0.63140	0.65185
2/2/1	3	0.633284	0.00482	0.62306	0.64351
2/2/2	3	0.623832	0.00482	0.61361	0.63406

Std Error uses a pooled estimate of error variance

Exhibit D3. Batch 1 Sample Measurements by Block and Sub-Block by Oxide for Both Preparation Methods for the Matrix 2A Study

Oneway Analysis of Measured By Set/Block/Sub-Blk
Oxide=ZnO (wt%)
Reference Value = 0.0 wt%



Oneway Anova
Summary of Fit

Rsquare	.
Adj Rsquare	.
Root Mean Square Error	0
Mean of Response	0.006224
Observations (or Sum Wgts)	24

Analysis of Variance

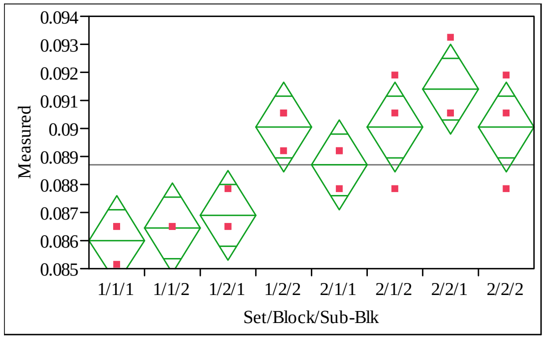
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Blk	7	0	0	.	.
Error	16	0	0		
C. Total	23	0			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1/1	3	0.006224	0	0.00622	0.00622
1/1/2	3	0.006224	0	0.00622	0.00622
1/2/1	3	0.006224	0	0.00622	0.00622
1/2/2	3	0.006224	0	0.00622	0.00622
2/1/1	3	0.006224	0	0.00622	0.00622
2/1/2	3	0.006224	0	0.00622	0.00622
2/2/1	3	0.006224	0	0.00622	0.00622
2/2/2	3	0.006224	0	0.00622	0.00622

Std Error uses a pooled estimate of error variance

Oneway Analysis of Measured By Set/Block/Sub-Blk
Oxide=ZrO2 (wt%)
Reference Value = 0.098 wt%



Oneway Anova
Summary of Fit

Rsquare	0.76087
Adj Rsquare	0.65625
Root Mean Square Error	0.001293
Mean of Response	0.088703
Observations (or Sum Wgts)	24

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Blk	7	0.00008515	0.000012	7.2727	0.0005
Error	16	0.00002676	1.673e-6		
C. Total	23	0.00011191			

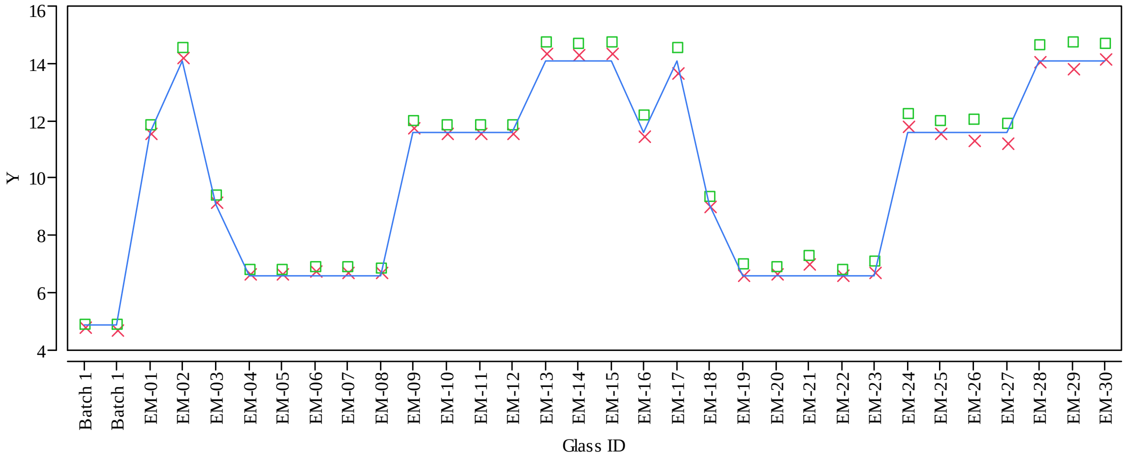
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1/1	3	0.086001	0.00075	0.08442	0.08758
1/1/2	3	0.086451	0.00075	0.08487	0.08803
1/2/1	3	0.086901	0.00075	0.08532	0.08848
1/2/2	3	0.090053	0.00075	0.08847	0.09164
2/1/1	3	0.088703	0.00075	0.08712	0.09029
2/1/2	3	0.090053	0.00075	0.08847	0.09164
2/2/1	3	0.091404	0.00075	0.08982	0.09299
2/2/2	3	0.090053	0.00075	0.08847	0.09164

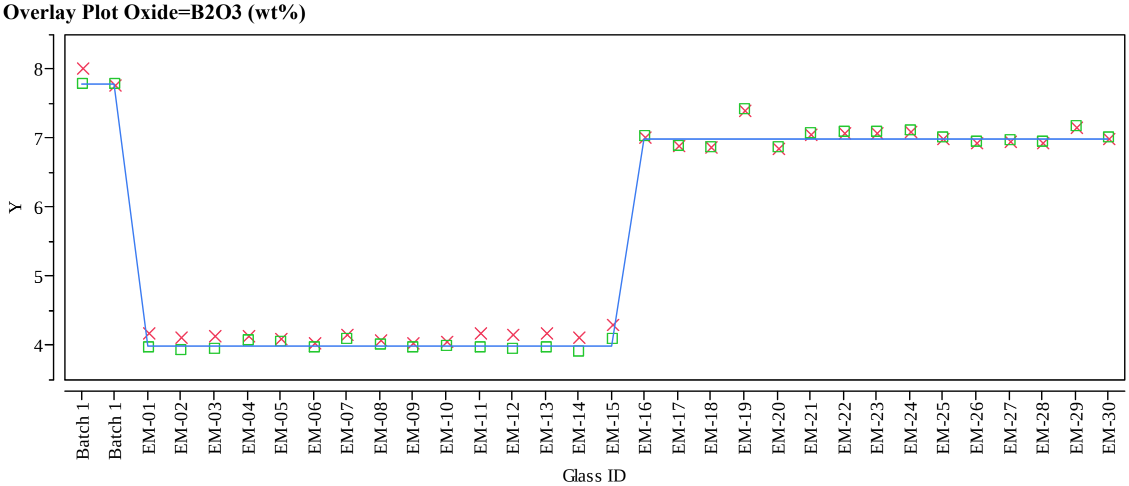
Std Error uses a pooled estimate of error variance

Exhibit D4. Average Measured and Bias-Corrected (bc) Versus Targeted Compositions by Glass ID by Oxide for the Matrix 2A Study

Overlay Plot Oxide=Al2O3 (wt%)



Overlay Plot Oxide=B2O3 (wt%)



Overlay Plot Oxide=BaO (wt%)

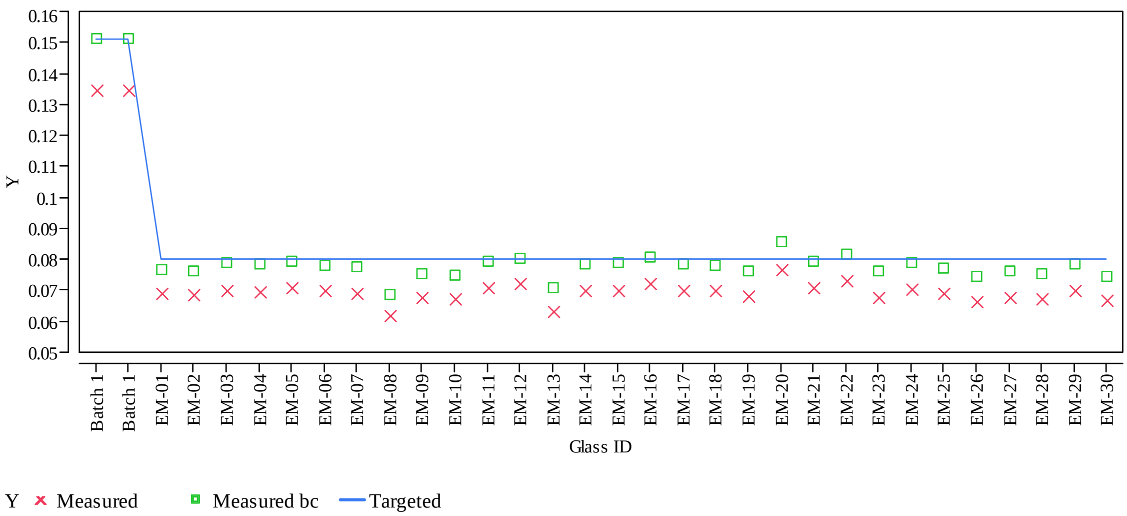
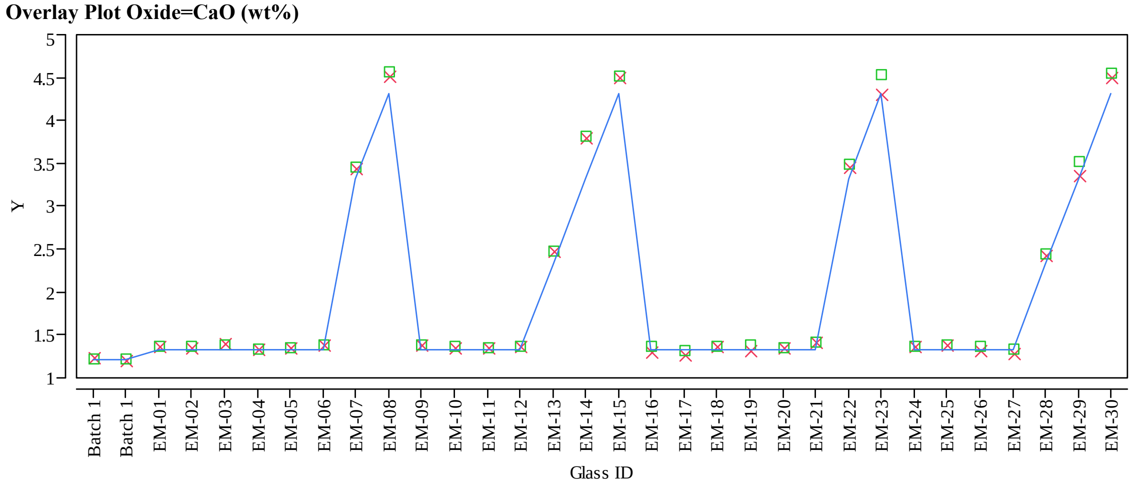
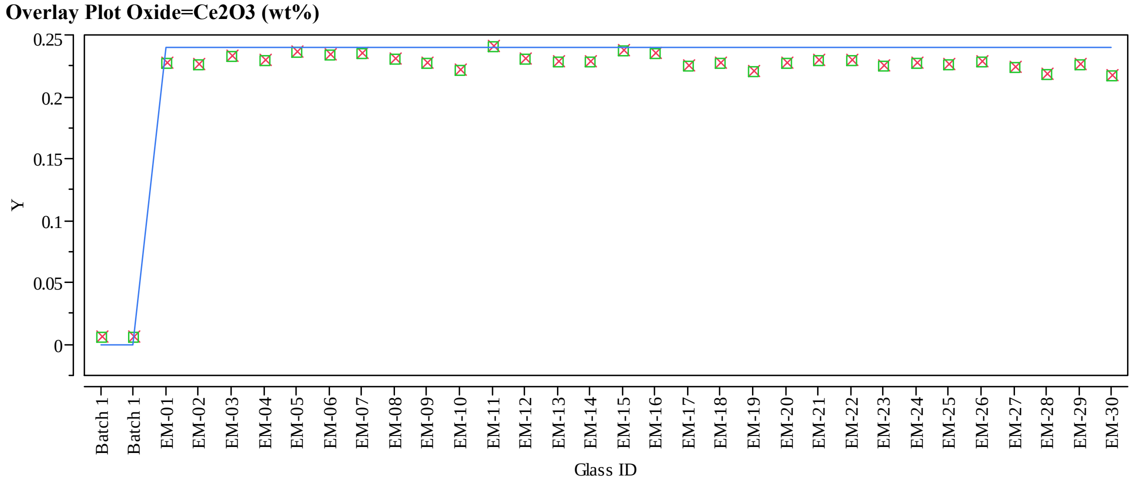


Exhibit D4. Average Measured and Bias-Corrected (bc) Versus Targeted Compositions by Glass ID by Oxide for the Matrix 2A Study





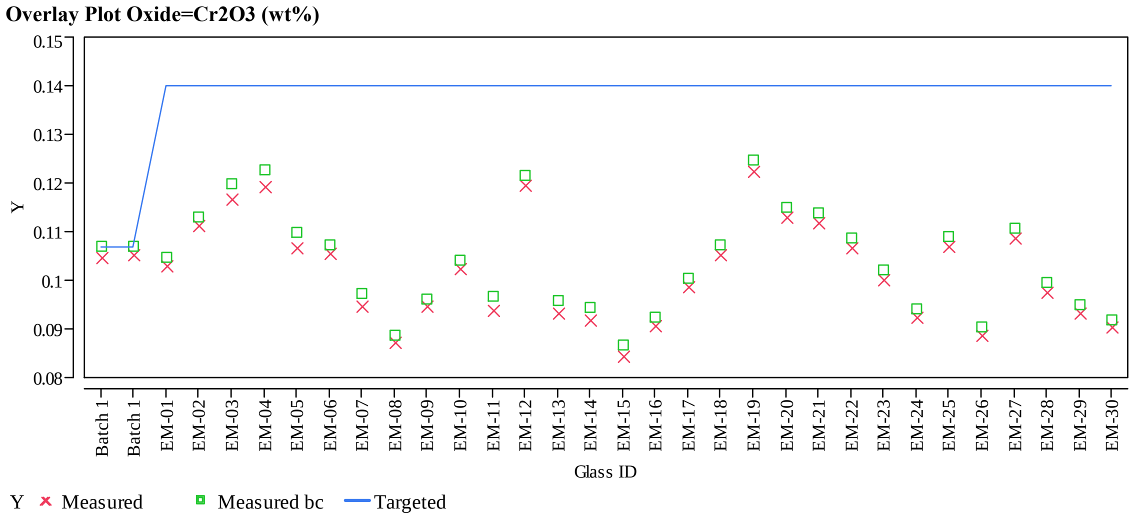
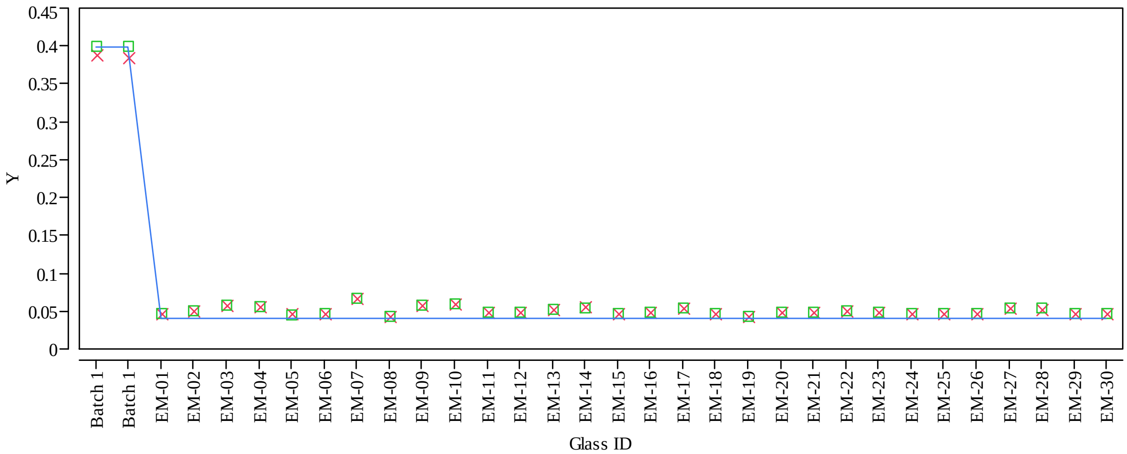
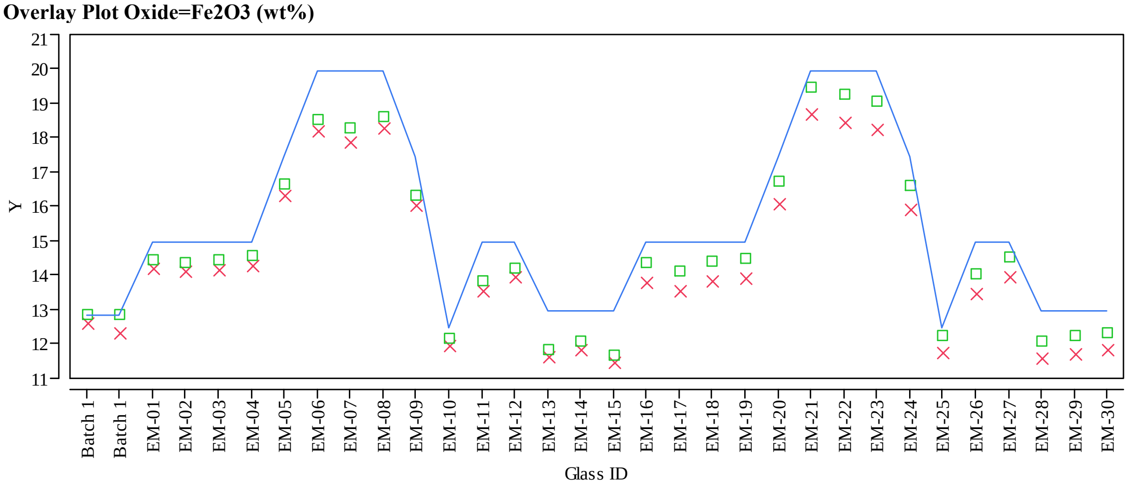


Exhibit D4. Average Measured and Bias-Corrected (bc) Versus Targeted Compositions by Glass ID by Oxide for the Matrix 2A Study

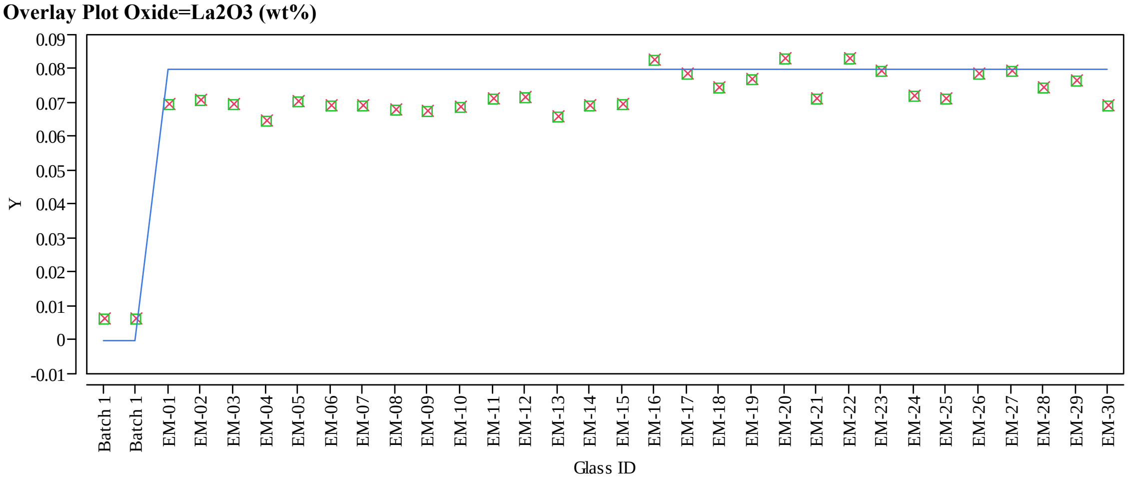
Overlay Plot Oxide=CuO (wt%)



Overlay Plot Oxide=Fe2O3 (wt%)

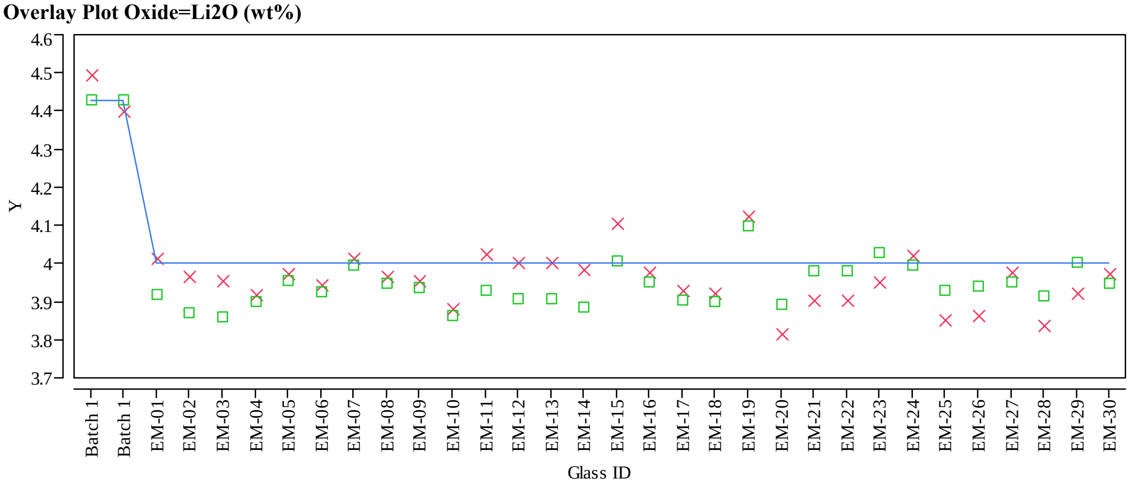


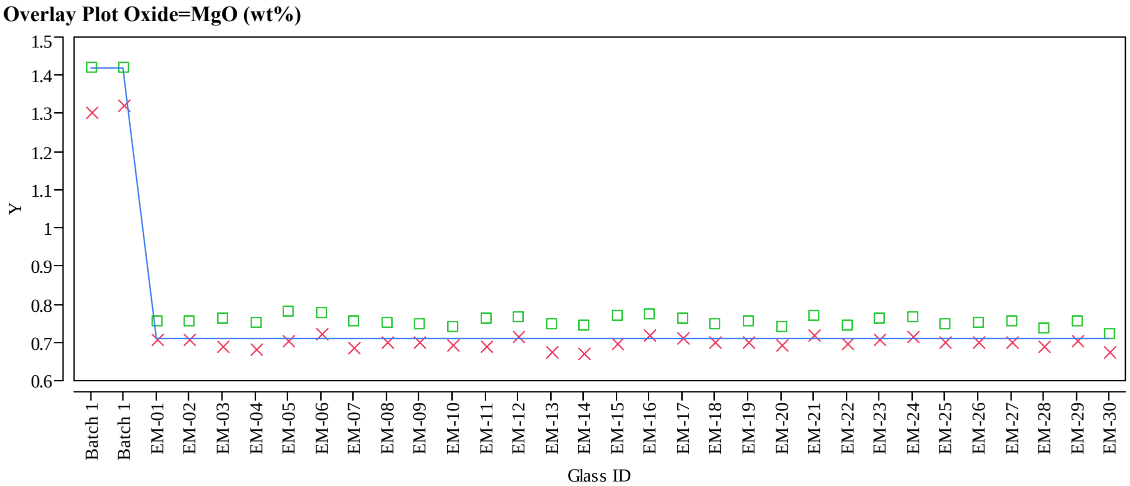
Overlay Plot Oxide=La2O3 (wt%)



Y × Measured ▫ Measured bc — Targeted

Exhibit D4. Average Measured and Bias-Corrected (bc) Versus Targeted Compositions by Glass ID by Oxide for the Matrix 2A Study





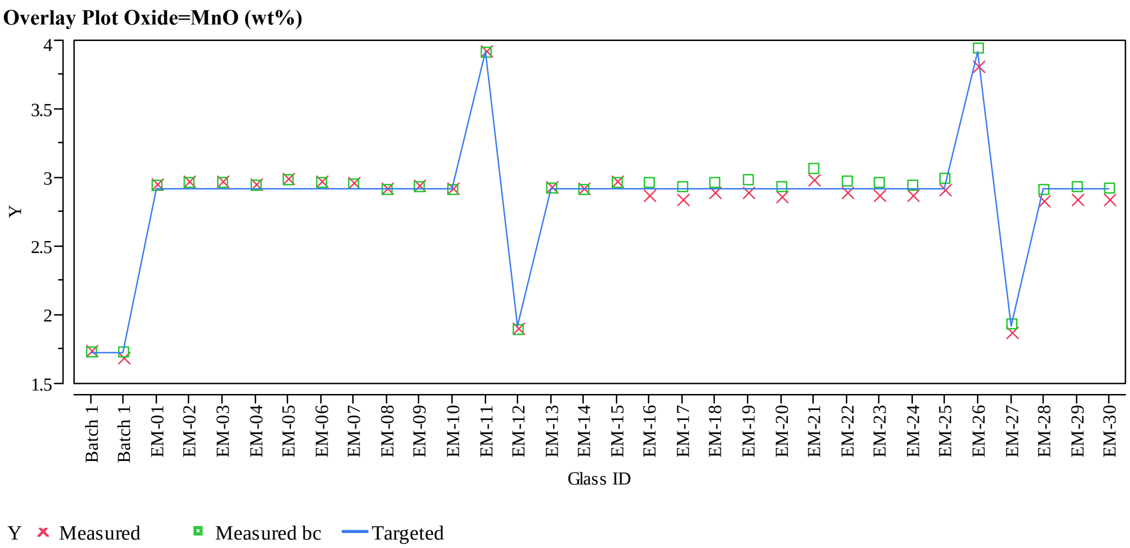
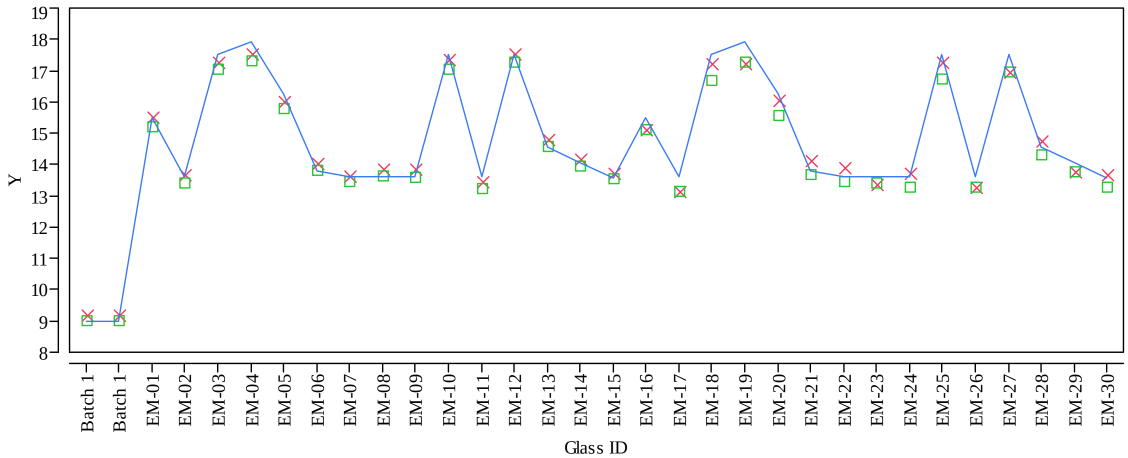
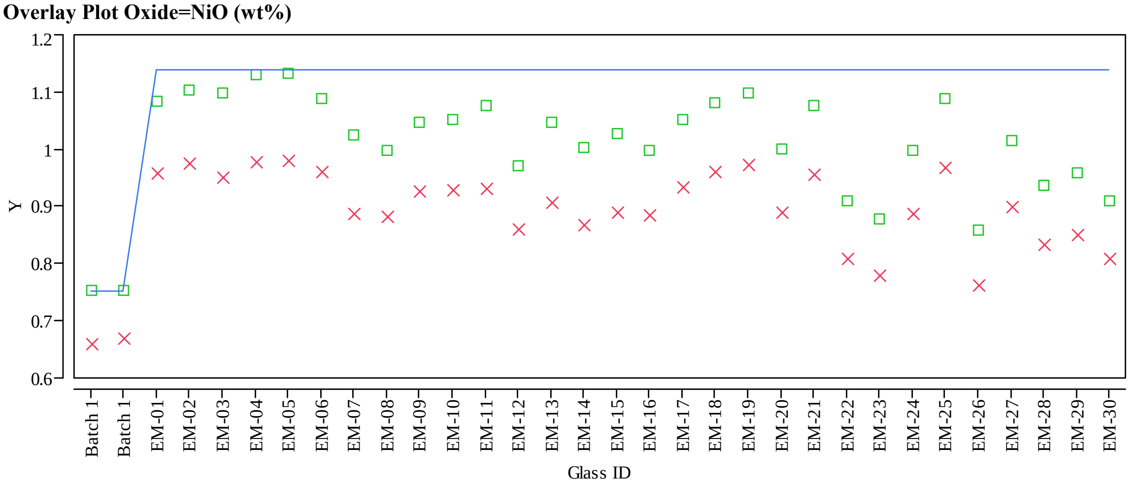


Exhibit D4. Average Measured and Bias-Corrected (bc) Versus Targeted Compositions by Glass ID by Oxide for the Matrix 2A Study

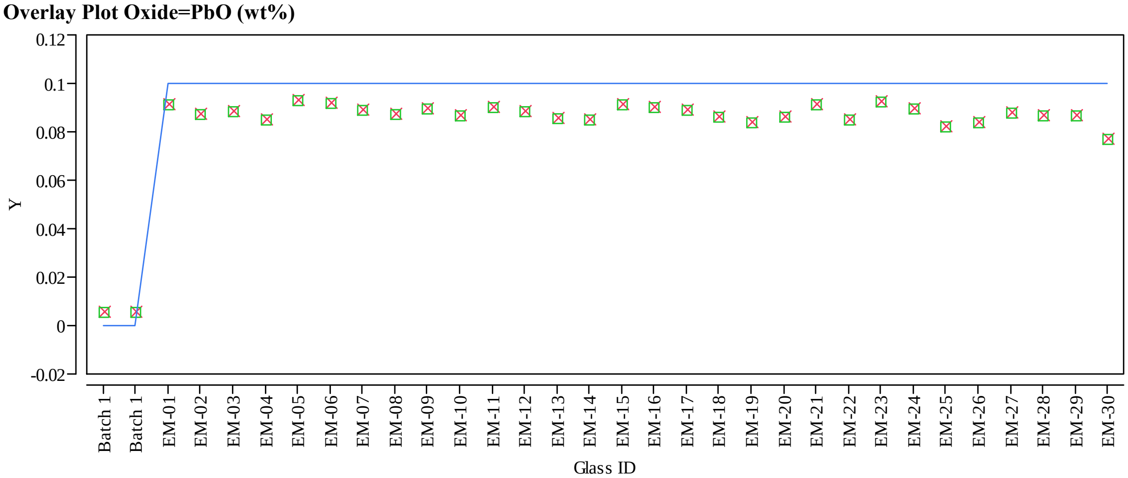
Overlay Plot Oxide=Na_2O (wt%)



Overlay Plot Oxide=NiO (wt%)



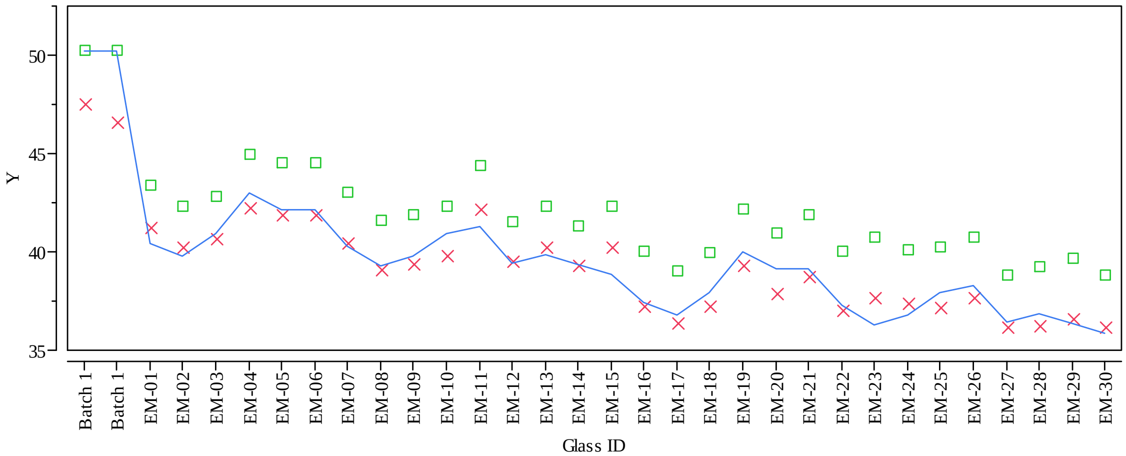
Overlay Plot Oxide=PbO (wt%)



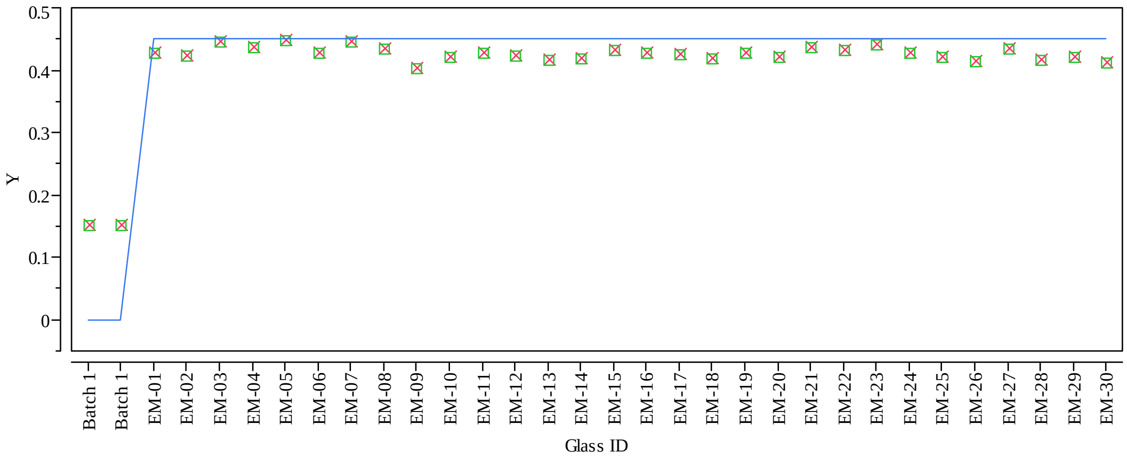
Y × Measured ▫ Measured bc — Targeted

Exhibit D4. Average Measured and Bias-Corrected (bc) Versus Targeted Compositions by Glass ID by Oxide for the Matrix 2A Study

Overlay Plot Oxide=SiO2 (wt%)



Overlay Plot Oxide=SO4 (wt%)



Overlay Plot Oxide=TiO2 (wt%)

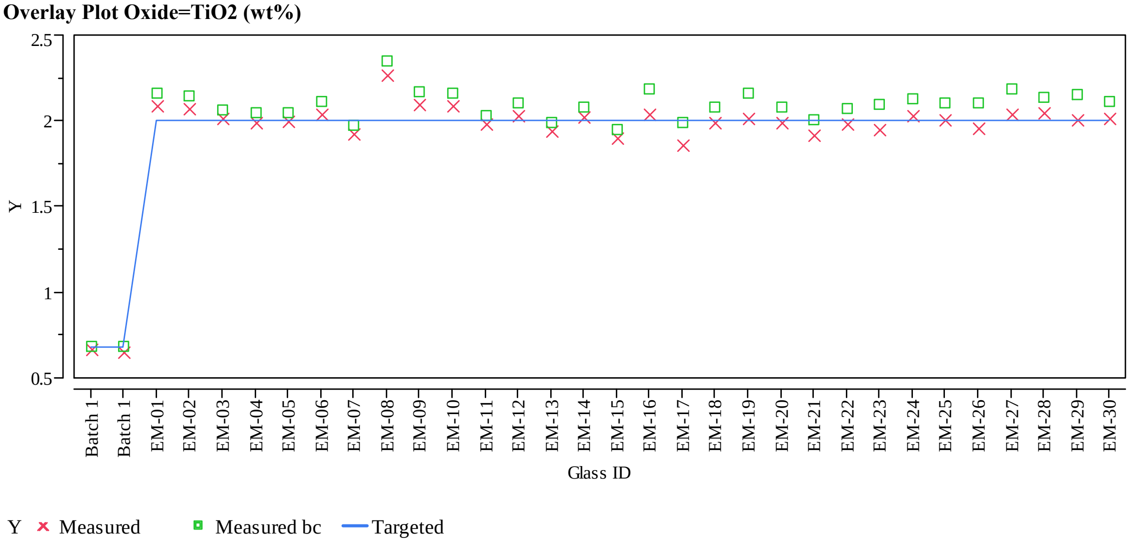
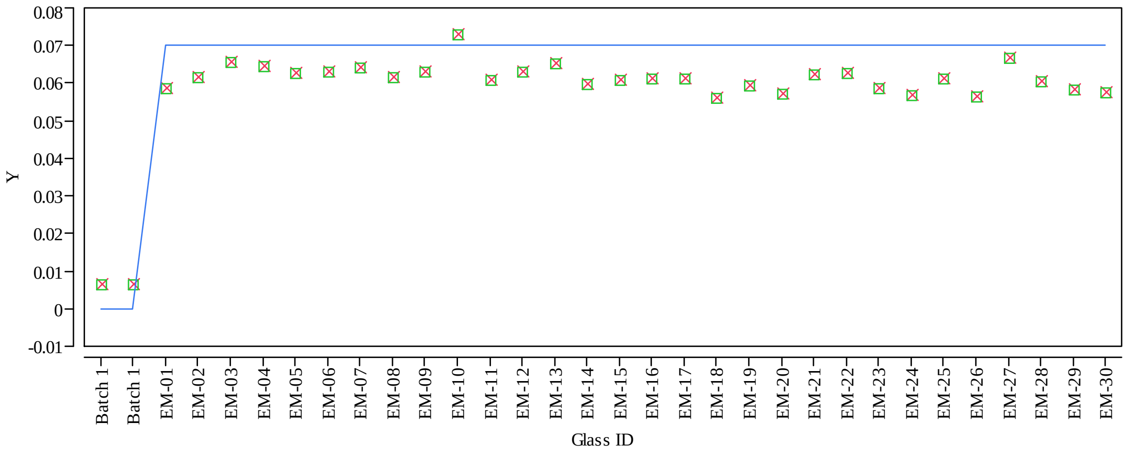
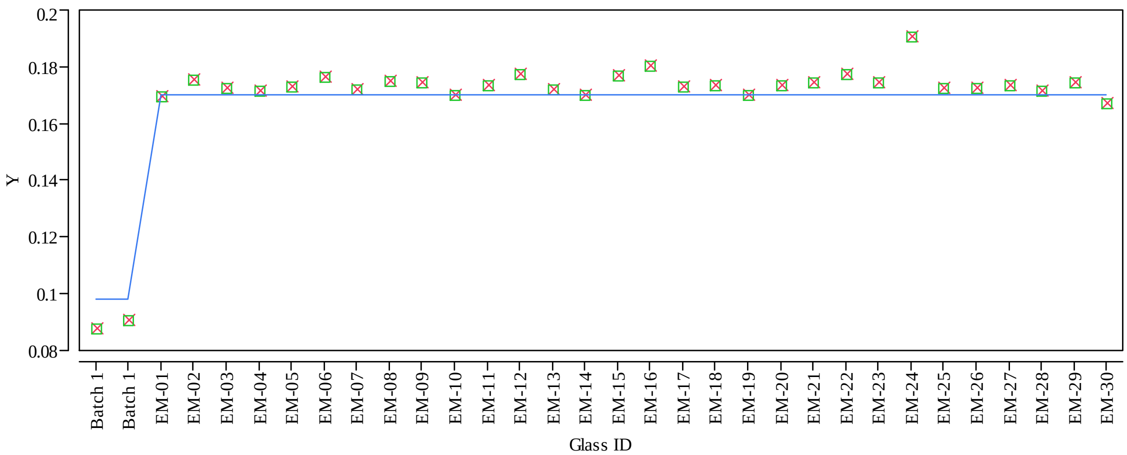


Exhibit D4. Average Measured and Bias-Corrected (bc) Versus Targeted Compositions by Glass ID by Oxide for the Matrix 2A Study

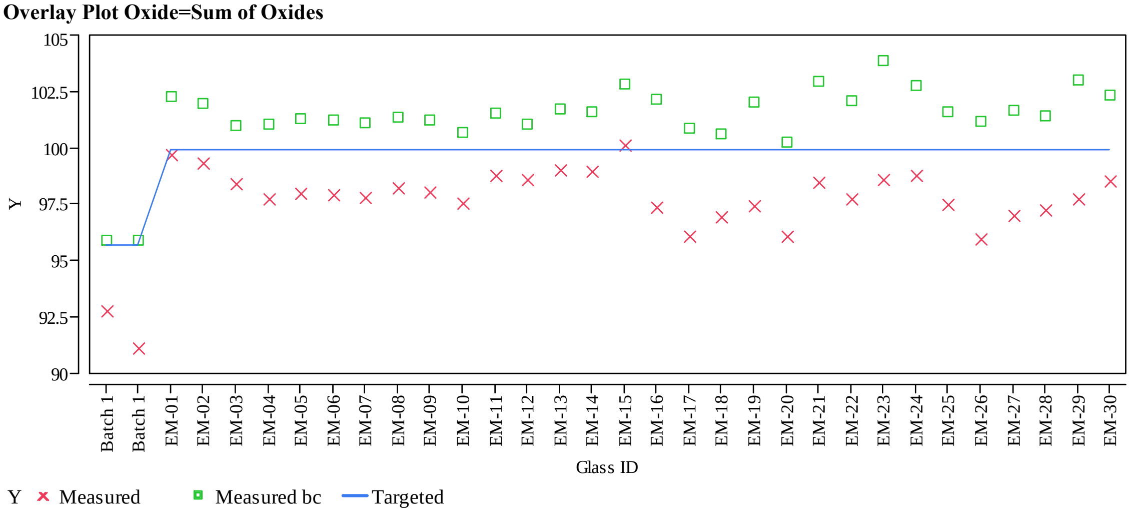
Overlay Plot Oxide=ZnO (wt%)



Overlay Plot Oxide=ZrO2 (wt%)



Overlay Plot Oxide=Sum of Oxides



Appendix E:

Tables and Exhibits Supporting the Analysis of the PCT Results for the Matrix 2A Study Glasses

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Table E1. PSAL's Measurements of the Matrix 2A PCT Solutions As-Received (ar) and After Appropriate Adjustments (in ppm)

Set	Glass ID	Heat Treatment	Block	Seq	Lab ID	B ar	Li ar	Na ar	Si ar	B (ppm)	Li (ppm)	Na (ppm)	Si (ppm)
1	Soln Std	ref	1	1	std-11-1	21.0	9.95	80.6	53.3	21.00	9.95	80.60	53.30
1	EM-06	ccc	1	2	n16	6.52	9.48	63.8	70.8	10.87	15.80	106.34	118.00
1	EM-07	ccc	1	3	n21	6.93	11.0	68.9	65.1	11.55	18.33	114.84	108.50
1	EM-01	ccc	1	4	n17	6.85	9.33	70.4	67.6	11.42	15.55	117.34	112.67
1	EM-10	ccc	1	5	n34	86.8	98.2	452	309	144.67	163.67	753.35	515.01
1	EM-05	quenched	1	6	n31	10.0	12.2	101	88.4	16.67	20.33	168.34	147.34
1	EM-06	quenched	1	7	n13	8.54	11.2	6.89	75.6	14.23	18.67	11.48	126.00
1	blank	ref	1	8	n51	<0.100	<0.100	<0.100	<0.100	0.08	0.08	0.08	0.08
1	EM-03	quenched	1	9	n60	8.48	10.6	107	80.3	14.13	17.67	178.34	133.84
1	EM-08	ccc	1	10	n37	6.73	12.2	72.3	61.0	11.22	20.33	120.50	101.67
1	EM-08	quenched	1	11	n25	11.3	15.7	94.7	74.0	18.83	26.17	157.84	123.34
1	EM-03	ccc	1	12	n63	7.65	11.9	114	89.3	12.75	19.83	190.00	148.84
1	ARM-1	ref	1	13	n01	9.24	7.40	18.8	34.7	15.40	12.33	31.33	57.83
1	Soln Std	ref	1	14	std-11-2	19.7	9.50	79.0	50.7	19.70	9.50	79.00	50.70
1	EM-09	quenched	1	15	n29	5.98	8.14	51.2	55.8	9.97	13.57	85.34	93.00
1	EM-10	quenched	1	16	n10	6.75	8.64	91.1	68.0	11.25	14.40	151.84	113.34
1	EM-05	ccc	1	17	n65	8.87	12.7	102	97.8	14.78	21.17	170.00	163.00
1	EA	ref	1	18	n68	34.9	10.3	92.5	52.3	581.67	171.67	1541.67	871.67
1	EM-01	quenched	1	19	n07	7.12	8.73	69.6	63.0	11.87	14.55	116.00	105.00
1	EM-04	ccc	1	20	n64	8.84	12.6	120	100	14.73	21.00	200.00	166.67
1	EM-02	ccc	1	21	n12	17.6	24.2	77.0	85.4	29.33	40.33	128.34	142.34
1	EM-07	quenched	1	22	n22	11.3	14.7	87.3	77.8	18.83	24.50	145.50	129.67
1	EM-04	quenched	1	23	n41	10.4	12.7	126	104	17.33	21.17	210.00	173.34
1	EM-09	ccc	1	24	n48	6.08	9.86	52.4	60.3	10.13	16.43	87.34	100.50
1	EM-02	quenched	1	25	n14	4.71	7.12	43.5	50.1	7.85	11.87	72.50	83.50
1	Soln Std	ref	1	26	std-11-3	19.4	9.41	77.1	50.0	19.40	9.41	77.10	50.00
1	Soln Std	ref	2	1	std-12-1	21.0	10.0	81.0	52.2	21.00	10.00	81.00	52.20
1	EM-08	ccc	2	2	n53	7.33	12.5	74.2	61.2	12.22	20.83	123.67	102.00
1	EM-05	quenched	2	3	n19	10.0	12.1	100	84.5	16.67	20.17	166.67	140.84
1	EM-02	ccc	2	4	n43	17.9	24.7	80.3	86.1	29.83	41.17	133.84	143.50
1	EM-03	quenched	2	5	n58	8.52	10.4	105	77.0	14.20	17.33	175.00	128.34
1	EM-09	quenched	2	6	n09	5.75	8.28	50.7	55.9	9.58	13.80	84.50	93.17
1	EM-01	quenched	2	7	n67	6.64	8.41	66.7	60.3	11.07	14.02	111.17	100.50
1	EM-10	quenched	2	8	n42	6.60	8.56	88.6	66.3	11.00	14.27	147.67	110.50
1	EM-08	quenched	2	9	n08	11.4	15.7	93.6	72.3	19.00	26.17	156.00	120.50
1	EM-07	ccc	2	10	n61	6.90	11.0	68.4	64.1	11.50	18.33	114.00	106.84
1	EM-04	ccc	2	11	n56	8.63	12.5	120	95.0	14.38	20.83	200.00	158.34
1	ARM-1	ref	2	12	n27	9.47	7.50	19.3	34.7	15.78	12.50	32.17	57.83
1	EM-09	ccc	2	13	n11	6.11	10.0	52.7	59.5	10.18	16.67	87.84	99.17
1	Soln Std	ref	2	14	std-12-2	19.6	9.52	76.8	50.1	19.60	9.52	76.80	50.10
1	EM-06	ccc	2	15	n05	6.96	9.75	63.2	73.0	11.60	16.25	105.34	121.67
1	EM-02	quenched	2	16	n57	4.95	7.18	43.3	49.2	8.25	11.97	72.17	82.00
1	EM-07	quenched	2	17	n40	11.5	14.7	88.2	76.2	19.17	24.50	147.00	127.00
1	EM-04	quenched	2	18	n38	10.2	12.4	126	95.0	17.00	20.67	210.00	158.34
1	EM-05	ccc	2	19	n59	8.58	12.4	98.8	89.5	14.30	20.67	164.67	149.17
1	EM-03	ccc	2	20	n62	7.73	11.9	114	86.6	12.88	19.83	190.00	144.34
1	EM-06	quenched	2	21	n04	8.40	11.2	68.6	73.7	14.00	18.67	114.34	122.84
1	EA	ref	2	22	n36	33.0	10.3	91.0	50.8	550.00	171.67	1516.67	846.67
1	EM-10	ccc	2	23	n02	85.5	95.0	443	289	142.50	158.34	738.35	481.68
1	EM-01	ccc	2	24	n15	6.76	9.10	67.0	63.5	11.27	15.17	111.67	105.84
1	Soln Std	ref	2	25	std-12-3	19.5	9.54	77.5	50.0	19.50	9.54	77.50	50.00
1	Soln Std	ref	3	1	std-13-1	20.4	9.67	81.2	50.4	20.40	9.67	81.20	50.40
1	blank	ref	3	2	n47	0.432	0.256	<0.100	<0.100	0.72	0.43	0.08	0.08
1	EM-08	quenched	3	3	n50	11.0	15.3	94.1	69.1	18.33	25.50	156.84	115.17
1	EM-02	ccc	3	4	n28	17.6	24.4	81.5	84.9	29.33	40.67	135.84	141.50
1	EM-10	ccc	3	5	n20	83.1	94.1	451	288.0	138.50	156.84	751.68	480.01
1	EM-06	ccc	3	6	n33	6.27	9.49	64.9	72.0	10.45	15.82	108.17	120.00
1	EM-01	ccc	3	7	n49	6.46	9.16	70.9	62.9	10.77	15.27	118.17	104.84
1	EM-04	ccc	3	8	n55	8.46	12.4	123	98.0	14.10	20.67	205.00	163.34
1	EM-05	ccc	3	9	n18	8.40	12.4	102	90.3	14.00	20.67	170.00	150.50
1	EM-03	ccc	3	10	n32	7.87	12.3	121	89.3	13.12	20.50	201.67	148.84
1	EM-04	quenched	3	11	n45	9.86	12.2	126	97.3	16.43	20.33	210.00	162.17
1	EM-09	quenched	3	12	n46	5.53	8.28	52.3	55.8	9.22	13.80	87.17	93.00
1	EM-06	quenched	3	13	n39	8.38	11.3	71.0	75.7	13.97	18.83	118.34	126.17
1	Soln Std	ref	3	14	std-13-2	19.5	9.55	79.9	50.3	19.50	9.55	79.90	50.30
1	EM-08	ccc	3	15	n66	7.66	12.3	76.4	60.1	12.77	20.50	127.34	100.17
1	EM-01	quenched	3	16	n52	6.83	8.26	68.5	60.6	11.38	13.77	114.17	101.00
1	EA	ref	3	17	n35	33.6	10.6	92.1	52.6	560.00	176.67	1535.00	876.67
1	EM-10	quenched	3	18	n44	6.89	8.57	91.0	66.9	11.48	14.28	151.67	111.50
1	EM-05	quenched	3	19	n23	9.75	12.0	102	89.8	16.25	20.00	170.00	149.67
1	EM-07	quenched	3	20	n54	11.6	15.1	95.6	77.3	19.33	25.17	159.34	128.84

Table E1. PSAL's Measurements of the Matrix 2A PCT Solutions As-Received (ar) and After Appropriate Adjustments (in ppm)

Set	Glass ID	Heat Treatment	Block	Seq	Lab ID	B ar	Li ar	Na ar	Si ar	B (ppm)	Li (ppm)	Na (ppm)	Si (ppm)
1	EM-09	ccc	3	21	n06	6.02	9.80	54.1	58.3	10.03	16.33	90.17	97.17
1	EM-07	ccc	3	22	n26	6.78	11.1	71.6	64.6	11.30	18.50	119.34	107.67
1	ARM-1	ref	3	23	n24	9.44	7.64	20.3	35.1	15.73	12.73	33.83	58.50
1	EM-02	quenched	3	24	n03	4.82	7.30	45.3	51.0	8.03	12.17	75.50	85.00
1	EM-03	quenched	3	25	n30	8.45	10.7	110	79.5	14.08	17.83	183.34	132.50
1	Soln Std	ref	3	26	std-13-3	19.5	9.68	81.0	50.3	19.50	9.68	81.00	50.30
2	Soln Std	ref	1	1	STD-21-1	20.8	10.0	81.5	51.7	20.80	10.00	81.50	51.70
2	EM-16	ccc	1	2	P14	23.4	17.3	97.6	74.7	39.00	28.83	162.67	124.50
2	EM-18	quenched	1	3	P40	17.6	12.0	115	73.1	29.33	20.00	191.67	121.84
2	EM-20	ccc	1	4	P65	17.6	13.6	101	81.5	29.33	22.67	168.34	135.84
2	EM-13	ccc	1	5	P05	16.6	30.1	96.0	93.9	27.67	50.17	160.00	156.50
2	EM-15	ccc	1	6	P29	4.61	15.3	46.5	39.0	7.68	25.50	77.50	65.00
2	EM-11	ccc	1	7	P22	4.52	7.31	48.7	53.4	7.53	12.18	81.17	89.00
2	EM-12	quenched	1	8	P64	7.47	9.32	107	72.1	12.45	15.53	178.34	120.17
2	EM-14	quenched	1	9	P06	4.89	7.78	52.6	43.4	8.15	12.97	87.67	72.33
2	EM-12	ccc	1	10	P04	73.6	83.3	420	270	122.67	138.84	700.01	450.01
2	EM-15	quenched	1	11	P15	5.27	8.26	52.4	39.4	8.78	13.77	87.34	65.67
2	EM-19	quenched	1	12	P30	20.9	14.0	135	90.7	34.83	23.33	225.00	151.17
2	EM-18	ccc	1	13	P02	42.4	28.9	196	113	70.67	48.17	326.67	188.34
2	Soln Std	ref	1	14	STD-21-2	20.3	9.91	81.0	50.9	20.30	9.91	81.00	50.90
2	EM-17	quenched	1	15	P21	10.3	8.60	49.8	48.6	17.17	14.33	83.00	81.00
2	EA	ref	1	16	P17	31.1	10.2	85.2	50.5	518.33	170.00	1420.00	841.67
2	EM-11	quenched	1	17	P37	5.87	8.17	48.2	54.6	9.78	13.62	80.33	91.00
2	EM-19	ccc	1	18	P10	16.4	12.6	117	84.4	27.33	21.00	195.00	140.67
2	EM-13	quenched	1	19	P23	5.15	7.42	55.5	47.8	8.58	12.37	92.50	79.67
2	blank	ref	1	20	P35	<0.100	<1.00	<0.100	<0.100	0.08	0.83	0.08	0.08
2	ARM-1	ref	1	21	P27	9.44	7.56	19.8	35.0	15.73	12.60	33.00	58.33
2	EM-20	quenched	1	22	P31	22.0	15.4	121	86.6	36.67	25.67	201.67	144.34
2	EM-16	quenched	1	23	P66	12.9	9.86	75.6	57.2	21.50	16.43	126.00	95.34
2	EM-17	ccc	1	24	P28	39.7	29.2	98.2	83.5	66.17	48.67	163.67	139.17
2	EM-14	ccc	1	25	P50	5.95	14.2	52.0	46.4	9.92	23.67	86.67	77.33
2	Soln Std	ref	1	26	STD21-3	19.8	9.63	80.0	49.6	19.80	9.63	80.00	49.60
2	Soln Std	ref	2	1	STD-22-1	21.0	9.73	82.4	50.8	21.00	9.73	82.40	50.80
2	ARM-1	ref	2	2	P62	10.0	7.58	20.5	36.0	16.67	12.63	34.17	60.00
2	EM-16	ccc	2	3	P67	24.0	17.1	99.1	73.9	40.00	28.50	165.17	123.17
2	EM-13	quenched	2	4	P43	5.19	7.51	59.6	49.3	8.65	12.52	99.34	82.17
2	EM-15	quenched	2	5	P36	4.40	7.93	51.7	38.6	7.33	13.22	86.17	64.33
2	EM-16	quenched	2	6	P09	12.7	9.68	76.0	56.6	21.17	16.13	126.67	94.34
2	EA	ref	2	7	P38	34.0	10.7	95.2	52.6	566.67	178.33	1586.67	876.67
2	EM-15	ccc	2	8	P54	4.19	15.3	46.6	38.1	6.98	25.50	77.67	63.50
2	EM-14	ccc	2	9	P11	5.25	14.7	55.9	46.5	8.75	24.50	93.17	77.50
2	EM-17	ccc	2	10	P32	39.9	28.7	100	81.0	66.50	47.83	166.67	135.00
2	EM-12	quenched	2	11	P53	7.14	8.76	104	67.9	11.90	14.60	173.34	113.17
2	EM-18	ccc	2	12	P08	42.6	28.9	193	113	71.00	48.17	321.67	188.34
2	EM-11	ccc	2	13	P52	4.40	6.94	48.5	51.5	7.33	11.57	80.83	85.84
2	Soln Std	ref	2	14	STD-22-2	20.1	9.47	82.4	49.0	20.10	9.47	82.40	49.00
2	EM-20	quenched	2	15	P13	20.8	14.0	113	78.2	34.67	23.33	188.34	130.34
2	EM-19	ccc	2	16	P03	16.5	12.2	119	80.6	27.50	20.33	198.34	134.34
2	EM-20	ccc	2	17	P18	17.5	13.2	102	78.5	29.17	22.00	170.00	130.84
2	EM-19	quenched	2	18	P20	19.1	12.6	128	81.5	31.83	21.00	213.34	135.84
2	EM-18	quenched	2	19	P25	17.7	11.7	119	71.2	29.50	19.50	198.34	118.67
2	EM-13	ccc	2	20	P19	15.7	27.8	91.6	86.5	26.17	46.33	152.67	144.17
2	EM-12	ccc	2	21	P60	72.2	81.0	423	257	120.34	135.00	705.01	428.34
2	EM-14	quenched	2	22	P55	5.41	7.64	54.3	43.0	9.02	12.73	90.50	71.67
2	EM-17	quenched	2	23	P48	9.45	7.85	48.1	44.5	15.75	13.08	80.17	74.17
2	EM-11	quenched	2	24	P51	5.22	7.67	48.6	51.4	8.70	12.78	81.00	85.67
2	Soln Std	ref	2	25	STD-22-3	19.7	9.62	82.0	49.4	19.70	9.62	82.00	49.40
2	Soln Std	ref	3	1	STD-23-1	21.0	9.93	81.6	50.3	21.00	9.93	81.60	50.30
2	EM-15	quenched	3	2	P26	5.30	8.24	51.5	38.8	8.83	13.73	85.84	64.67
2	EM-20	quenched	3	3	P59	21.5	14.5	111	78.2	35.83	24.17	185.00	130.34
2	EM-13	quenched	3	4	P63	5.71	7.58	55.5	48.5	9.52	12.63	92.50	80.83
2	EM-12	quenched	3	5	P07	7.97	9.29	105	70.7	13.28	15.48	175.00	117.84
2	EM-17	ccc	3	6	P46	40.4	28.9	97.7	81.2	67.33	48.17	162.84	135.34
2	EA	ref	3	7	P45	32.7	10.4	87.7	51.0	545.00	173.33	1461.67	850.00
2	EM-12	ccc	3	8	P16	72.1	82.1	443	262	120.17	136.84	738.35	436.68
2	EM-19	ccc	3	9	P47	17.7	12.8	117	83.6	29.50	21.33	195.00	139.34
2	blank	ref	3	10	P24	0.703	<1.00	<0.100	<0.100	1.17	0.83	0.08	0.08
2	EM-14	ccc	3	11	P42	6.22	15.3	57.2	47.9	10.37	25.50	95.34	79.83
2	EM-11	quenched	3	12	P41	6.02	8.21	50.2	54.4	10.03	13.68	83.67	90.67
2	EM-15	ccc	3	13	P57	4.68	15.5	46.5	38.2	7.80	25.83	77.50	63.67
2	Soln Std	ref	3	14	STD-23-2	20.8	10.2	83.8	51.3	20.80	10.20	83.80	51.30

Table E1. PSAL's Measurements of the Matrix 2A PCT Solutions As-Received (ar) and After Appropriate Adjustments (in ppm)

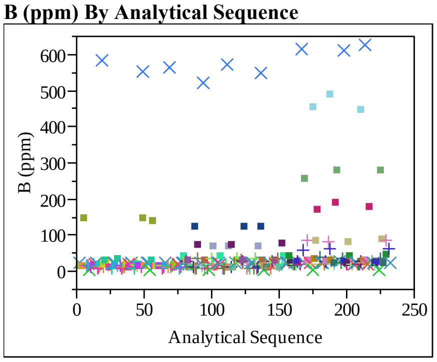
Set	Glass ID	Heat Treatment	Block	Seq	Lab ID	B ar	Li ar	Na ar	Si ar	B (ppm)	Li (ppm)	Na (ppm)	Si (ppm)
2	EM-14	quenched	3	15	P69	5.78	8.14	53.6	44.3	9.63	13.57	89.34	73.83
2	EM-18	quenched	3	16	P49	17.7	11.8	111	70.3	29.50	19.67	185.00	117.17
2	EM-20	ccc	3	17	P33	17.5	13.4	98.3	78.2	29.17	22.33	163.84	130.34
2	ARM-1	ref	3	18	P34	10.1	7.68	20.2	35.1	16.83	12.80	33.67	58.50
2	EM-13	ccc	3	19	P56	16.3	28.9	89.9	88.9	27.17	48.17	149.84	148.17
2	EM-19	quenched	3	20	P12	20.5	13.6	128	85.7	34.17	22.67	213.34	142.84
2	EM-17	quenched	3	21	P39	10.0	8.33	48.0	46.4	16.67	13.88	80.00	77.33
2	EM-11	ccc	3	22	P58	4.89	7.44	49.7	53.1	8.15	12.40	82.83	88.50
2	EM-16	quenched	3	23	P61	13.0	9.93	74.2	56.3	21.67	16.55	123.67	93.84
2	EM-18	ccc	3	24	P01	43.6	29.8	195	116	72.67	49.67	325.01	193.34
2	EM-16	ccc	3	25	P44	23.0	16.8	92.9	72.4	38.33	28.00	154.84	120.67
2	Soln Std	ref	3	26	STD-23-3	20.6	10.0	80.3	50.7	20.60	10.00	80.30	50.70
3	Soln Std	ref	1	1	STD-31-1	21.3	9.90	83.3	50.8	21.30	9.90	83.30	50.80
3	EM-25	quenched	1	2	Q01	14.6	9.82	103	63.5	24.33	16.37	171.67	105.84
3	EM-30	ccc	1	3	Q38	23.9	20.3	70.6	46.3	39.83	33.83	117.67	77.17
3	EM-27	ccc	1	4	Q53	11.2	9.85	51.3	55.6	18.67	16.42	85.50	92.67
3	EM-24	quenched	1	5	Q47	12.1	9.69	56.3	51.8	20.17	16.15	93.84	86.34
3	EM-30	quenched	1	6	Q26	12.8	11.4	67.8	43.2	21.33	19.00	113.00	72.00
3	EM-26	quenched	1	7	Q27	12.1	9.53	56.2	52.8	20.17	15.88	93.67	88.00
3	EM-27	quenched	1	8	Q62	16.6	11.0	117	67.1	27.67	18.33	195.00	111.84
3	EM-21	ccc	1	9	Q02	11.2	9.45	57.5	60.1	18.67	15.75	95.84	100.17
3	EM-22	ccc	1	10	Q19	14.0	12.2	72.3	60.5	23.33	20.33	120.50	100.84
3	EM-28	quenched	1	11	Q18	12.4	9.60	67.6	49.5	20.67	16.00	112.67	82.50
3	EA	ref	1	12	Q07	36.6	10.7	95.8	52.8	610.00	178.33	1596.67	880.00
3	EM-22	quenched	1	13	Q10	36.1	24.6	135	86.9	60.17	41.00	225.00	144.84
3	Soln Std	ref	1	14	STD-31-2	20.8	9.88	82.6	51.0	20.80	9.88	82.60	51.00
3	EM-25	ccc	1	15	Q44	151	102	469	240	251.67	170.00	781.68	400.01
3	EM-23	quenched	1	16	Q43	52.6	35.9	195	99.2	87.67	59.83	325.01	165.34
3	EM-23	ccc	1	17	Q09	17.1	14.2	83.5	62.4	28.50	23.67	139.17	104.00
3	ARM-1	ref	1	18	Q05	11.0	8.07	20.3	35.9	18.33	13.45	33.83	59.83
3	EM-29	quenched	1	19	Q36	12.9	10.5	66.4	46.0	21.50	17.50	110.67	76.67
3	blank	ref	1	20	Q34	0.465	<1.00	<0.100	<0.100	0.78	0.83	0.08	0.08
3	EM-26	ccc	1	21	Q64	271	163	771	283	451.68	271.67	1285.03	471.68
3	EM-24	ccc	1	22	Q55	18.2	12.6	60.7	60.6	30.33	21.00	101.17	101.00
3	EM-29	ccc	1	23	Q08	48.5	34.7	115	73.0	80.83	57.83	191.67	121.67
3	EM-28	ccc	1	24	Q21	99.9	69.2	220	115	166.50	115.34	366.67	191.67
3	EM-21	quenched	1	25	Q59	22.5	14.8	85.5	74.0	37.50	24.67	142.50	123.34
3	Soln Std	ref	1	26	STD31-3	21.0	9.69	80.0	49.8	21.00	9.69	80.00	49.80
3	Soln Std	ref	2	1	STD-32-1	20.9	10.1	81.5	50.5	20.90	10.10	81.50	50.50
3	EM-24	quenched	2	2	Q31	12.2	10.0	57.7	52.0	20.33	16.67	96.17	86.67
3	EM-27	quenched	2	3	Q49	15.9	11.0	114	66.6	26.50	18.33	190.00	111.00
3	EM-23	ccc	2	4	Q54	15.3	14.1	82.8	61.2	25.50	23.50	138.00	102.00
3	EM-23	quenched	2	5	Q28	49.8	35.4	238	97.9	83.00	59.00	396.67	163.17
3	EM-22	quenched	2	6	Q37	36.7	25.6	144	88.1	61.17	42.67	240.00	146.84
3	EM-26	ccc	2	7	Q46	292	176	858	306	486.68	293.34	1430.03	510.01
3	EM-25	quenched	2	8	Q14	17.0	10.1	102	63.2	28.33	16.83	170.00	105.34
3	EM-24	ccc	2	9	Q16	16.6	13.0	64.6	61.1	27.67	21.67	107.67	101.84
3	EM-26	quenched	2	10	Q13	12.9	10.1	58.5	53.8	21.50	16.83	97.50	89.67
3	EM-21	ccc	2	11	Q12	11.4	9.80	57.9	60.8	19.00	16.33	96.50	101.34
3	EM-28	ccc	2	12	Q56	112	71.7	246	128	186.67	119.50	410.01	213.34
3	EM-25	ccc	2	13	Q63	167	108	543	269	278.34	180.00	905.02	448.34
3	Soln Std	ref	2	14	STD-32-2	22.6	10.3	84.4	51.4	22.60	10.30	84.40	51.40
3	EM-30	quenched	2	15	Q35	13.5	11.8	70.8	43.7	22.50	19.67	118.00	72.83
3	EM-21	quenched	2	16	Q51	20.7	15.1	87.4	73.3	34.50	25.17	145.67	122.17
3	EA	ref	2	17	Q20	36.5	11.3	102	52.8	608.33	188.33	1700.00	880.00
3	EM-22	ccc	2	18	Q30	14.5	12.8	74.2	61.4	24.17	21.33	123.67	102.34
3	EM-28	quenched	2	19	Q25	12.7	10.2	69.9	50.5	21.17	17.00	116.50	84.17
3	EM-27	ccc	2	20	Q04	11.6	10.6	56.6	57.3	19.33	17.67	94.34	95.50
3	EM-29	ccc	2	21	Q67	47.1	36.2	120.7	73.4	78.50	60.33	201.17	122.34
3	EM-30	ccc	2	22	Q29	23.9	20.7	73.4	46.5	39.83	34.50	122.34	77.50
3	EM-29	quenched	2	23	Q68	12.9	11.0	69.3	46.4	21.50	18.33	115.50	77.33
3	ARM-1	ref	2	24	Q57	10.5	8.48	22.2	36.4	17.50	14.13	37.00	60.67
3	Soln Std	ref	2	25	STD-32-3	20.5	10.2	84.1	50.7	20.50	10.20	84.10	50.70
3	Soln Std	ref	3	1	STD-33-1	21.2	9.91	82.2	51.0	21.20	9.91	82.20	51.00
3	EM-30	quenched	3	2	Q03	12.1	11.1	67.8	41.6	20.17	18.50	113.00	69.33
3	EM-28	quenched	3	3	Q06	12.3	9.76	68.1	50.1	20.50	16.27	113.50	83.50
3	EM-27	quenched	3	4	Q40	16.1	11.0	118.1	66.0	26.83	18.33	196.84	110.00
3	EM-26	ccc	3	5	Q42	266	164	766	281	443.34	273.34	1276.69	468.34
3	EM-29	quenched	3	6	Q50	15.2	10.4	67.0	45.6	25.33	17.33	111.67	76.00
3	EM-24	ccc	3	7	Q66	16.6	12.5	63.6	60.8	27.67	20.83	106.00	101.34
3	EA	ref	3	8	Q58	37.4	10.8	97.5	52.7	623.33	180.00	1625.00	878.34

Table E1. PSAL's Measurements of the Matrix 2A PCT Solutions As-Received (ar) and After Appropriate Adjustments (in ppm)

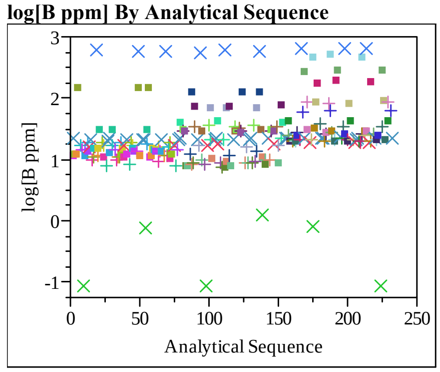
Set	Glass ID	Heat Treatment	Block	Seq	Lab ID	B ar	Li ar	Na ar	Si ar	B (ppm)	Li (ppm)	Na (ppm)	Si (ppm)
3	EM-23	ccc	3	9	Q17	16.2	14.1	83.8	61.4	27.00	23.50	139.67	102.34
3	ARM-1	ref	3	10	Q45	10.7	8.25	21.5	36.5	17.83	13.75	35.83	60.83
3	EM-24	quenched	3	11	Q24	12.3	9.92	58.9	52.6	20.50	16.53	98.17	87.67
3	EM-28	ccc	3	12	Q33	106	74.4	219	119	176.67	124.00	365.01	198.34
3	EM-25	quenched	3	13	Q65	15.6	10.1	107	64.3	26.00	16.83	178.34	107.17
3	Soln Std	ref	3	14	STD-33-2	21.5	10.1	84.0	51.2	21.50	10.10	84.00	51.20
3	EM-26	quenched	3	15	Q15	12.7	9.77	59.9	53.3	21.17	16.28	99.84	88.84
3	EM-27	ccc	3	16	Q11	11.8	10.3	56.1	57.1	19.67	17.17	93.50	95.17
3	EM-22	ccc	3	17	Q48	13.9	12.2	73.2	60.3	23.17	20.33	122.00	100.50
3	blank	ref	3	18	Q60	<0.100	<1.00	<0.100	<0.100	0.08	0.83	0.08	0.08
3	EM-21	quenched	3	19	Q23	20.4	14.4	86.8	71.1	34.00	24.00	144.67	118.50
3	EM-25	ccc	3	20	Q32	166	106	517	268	276.67	176.67	861.68	446.68
3	EM-29	ccc	3	21	Q52	50.8	35.8	124	73.7	84.67	59.67	206.67	122.84
3	EM-21	ccc	3	22	Q39	12.3	9.55	59.2	61.5	20.50	15.92	98.67	102.50
3	EM-23	quenched	3	23	Q22	52.7	35.8	226	110	87.84	59.67	376.67	183.34
3	EM-30	ccc	3	24	Q41	24.9	20.1	70.7	45.4	41.50	33.50	117.84	75.67
3	EM-22	quenched	3	25	Q61	36.5	24.7	139	86.8	60.83	41.17	231.67	144.67
3	Soln Std	ref	3	26	STD-33-3	21.1	9.78	83.0	50.5	21.10	9.78	83.00	50.50

Exhibit E1. PCT Measurements in Analytical Sequence over All of the Analytical Plans for the Matrix 2A Study

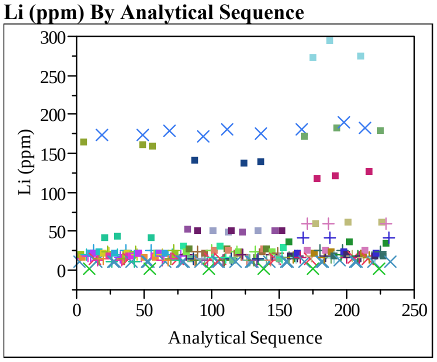
B (ppm) By Analytical Sequence



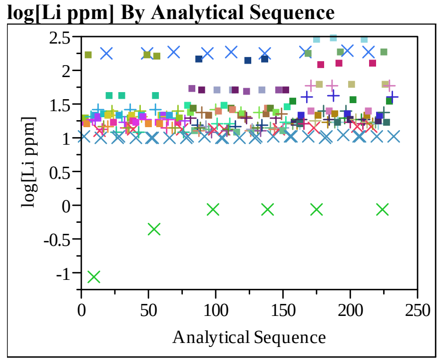
log[B ppm] By Analytical Sequence



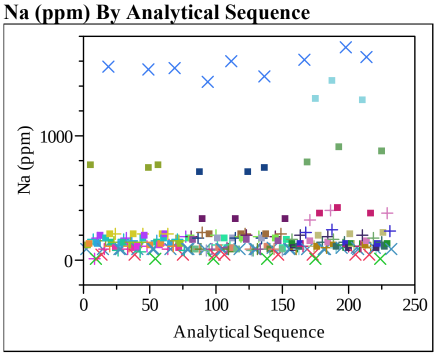
Li (ppm) By Analytical Sequence



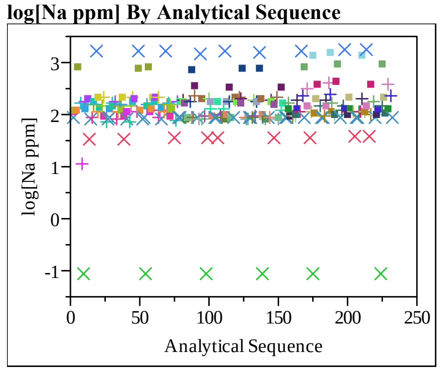
log[Li ppm] By Analytical Sequence



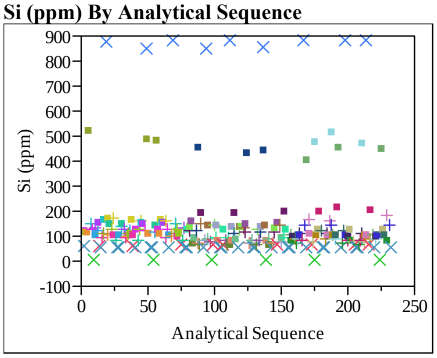
Na (ppm) By Analytical Sequence



log[Na ppm] By Analytical Sequence



Si (ppm) By Analytical Sequence



log[Si ppm] By Analytical Sequence

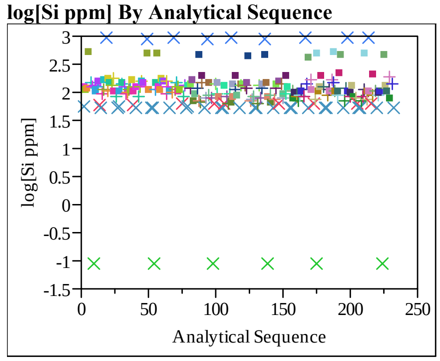
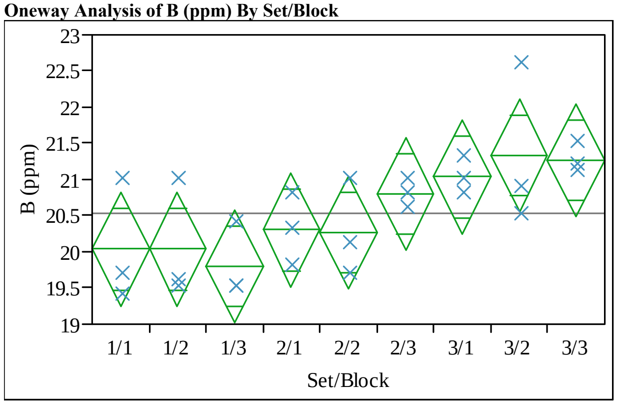


Exhibit E2. Measurements of the Multi-Element Solution Standard by ICP Block for the Matrix 2A Study

Oneway Analysis of B (ppm) By Set/Block



Oneway Anova
Summary of Fit

Rsquare	0.513676
Adj Rsquare	0.297532
Root Mean Square Error	0.648074
Mean of Response	20.54074
Observations (or Sum Wgts)	27

Analysis of Variance

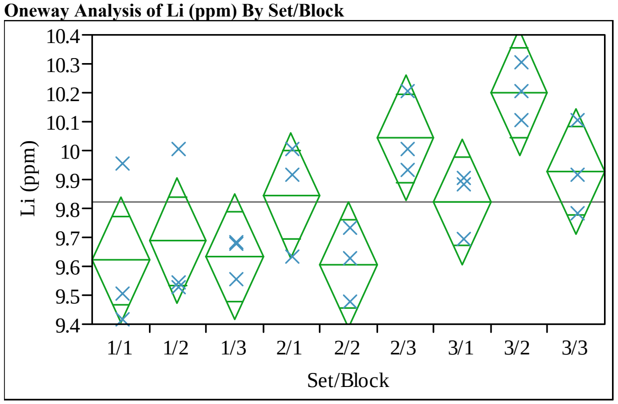
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block	8	7.985185	0.998148	2.3765	0.0607
Error	18	7.560000	0.420000		
C. Total	26	15.545185			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1	3	20.0333	0.37417	19.247	20.819
1/2	3	20.0333	0.37417	19.247	20.819
1/3	3	19.8000	0.37417	19.014	20.586
2/1	3	20.3000	0.37417	19.514	21.086
2/2	3	20.2667	0.37417	19.481	21.053
2/3	3	20.8000	0.37417	20.014	21.586
3/1	3	21.0333	0.37417	20.247	21.819
3/2	3	21.3333	0.37417	20.547	22.119
3/3	3	21.2667	0.37417	20.481	22.053

Std Error uses a pooled estimate of error variance

Oneway Analysis of Li (ppm) By Set/Block



Oneway Anova
Summary of Fit

Rsquare	0.644285
Adj Rsquare	0.486189
Root Mean Square Error	0.178232
Mean of Response	9.821111
Observations (or Sum Wgts)	27

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block	8	1.0356667	0.129458	4.0753	0.0063
Error	18	0.5718000	0.031767		
C. Total	26	1.6074667			

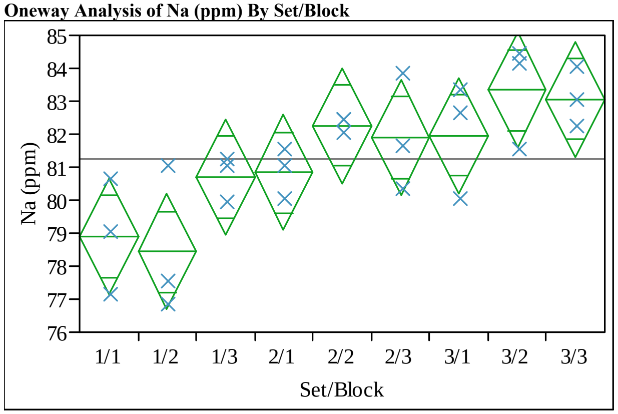
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1	3	9.6200	0.10290	9.4038	9.836
1/2	3	9.6867	0.10290	9.4705	9.903
1/3	3	9.6333	0.10290	9.4171	9.850
2/1	3	9.8467	0.10290	9.6305	10.063
2/2	3	9.6067	0.10290	9.3905	9.823
2/3	3	10.0433	0.10290	9.8271	10.260
3/1	3	9.8233	0.10290	9.6071	10.040
3/2	3	10.2000	0.10290	9.9838	10.416
3/3	3	9.9300	0.10290	9.7138	10.146

Std Error uses a pooled estimate of error variance

Exhibit E2. Measurements of the Multi-Element Solution Standard by ICP Block for the Matrix 2A Study

Oneway Analysis of Na (ppm) By Set/Block



Oneway Anova
Summary of Fit

Rsquare	0.652922
Adj Rsquare	0.498665
Root Mean Square Error	1.444145
Mean of Response	81.26667
Observations (or Sum Wgts)	27

Analysis of Variance

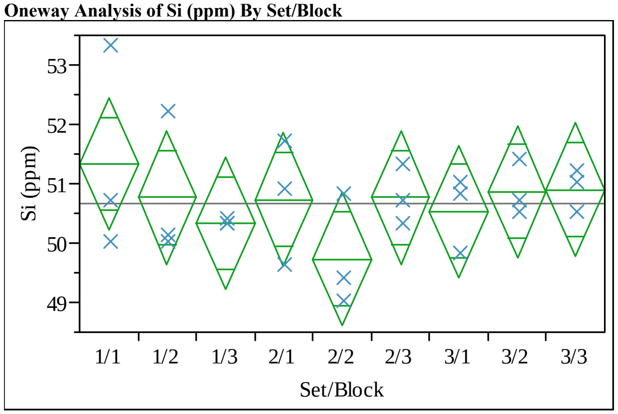
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block	8	70.62000	8.82750	4.2327	0.0053
Error	18	37.54000	2.08556		
C. Total	26	108.16000			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1	3	78.9000	0.83378	77.148	80.652
1/2	3	78.4333	0.83378	76.682	80.185
1/3	3	80.7000	0.83378	78.948	82.452
2/1	3	80.8333	0.83378	79.082	82.585
2/2	3	82.2667	0.83378	80.515	84.018
2/3	3	81.9000	0.83378	80.148	83.652
3/1	3	81.9667	0.83378	80.215	83.718
3/2	3	83.3333	0.83378	81.582	85.085
3/3	3	83.0667	0.83378	81.315	84.818

Std Error uses a pooled estimate of error variance

Oneway Analysis of Si (ppm) By Set/Block



Oneway Anova
Summary of Fit

Rsquare	0.235625
Adj Rsquare	-0.1041
Root Mean Square Error	0.91934
Mean of Response	50.66296
Observations (or Sum Wgts)	27

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block	8	4.689630	0.586204	0.6936	0.6928
Error	18	15.213333	0.845185		
C. Total	26	19.902963			

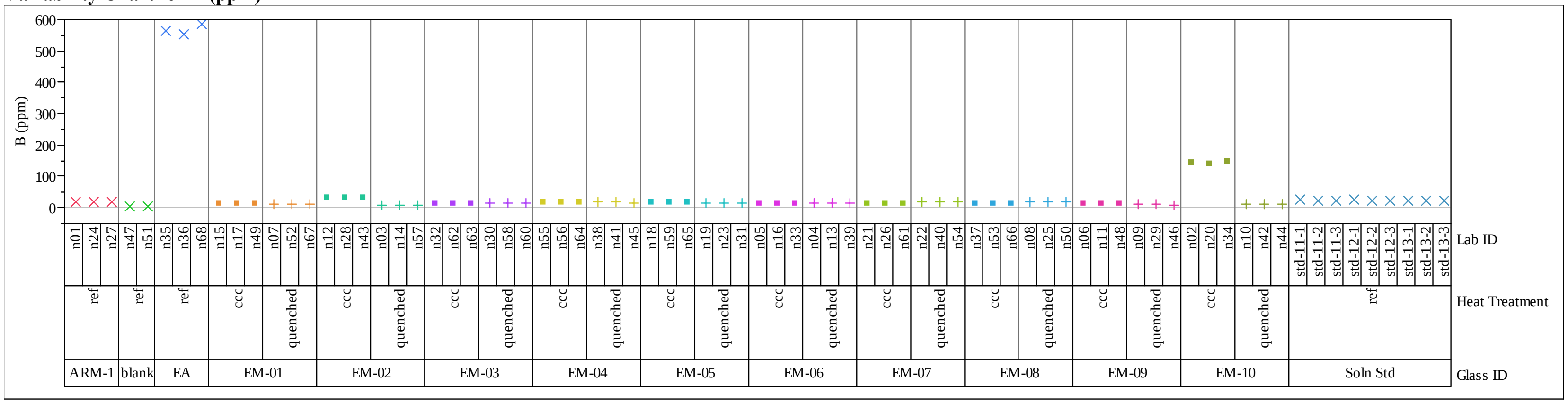
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1	3	51.3333	0.53078	50.218	52.448
1/2	3	50.7667	0.53078	49.652	51.882
1/3	3	50.3333	0.53078	49.218	51.448
2/1	3	50.7333	0.53078	49.618	51.848
2/2	3	49.7333	0.53078	48.618	50.848
2/3	3	50.7667	0.53078	49.652	51.882
3/1	3	50.5333	0.53078	49.418	51.648
3/2	3	50.8667	0.53078	49.752	51.982
3/3	3	50.9000	0.53078	49.785	52.015

Std Error uses a pooled estimate of error variance

Exhibit E3. PCT Measurements by Glass Identifier for the Matrix 2A Study Glasses and Standards

Set=1
Variability Chart for B (ppm)



Set=1
Variability Chart for Li (ppm)

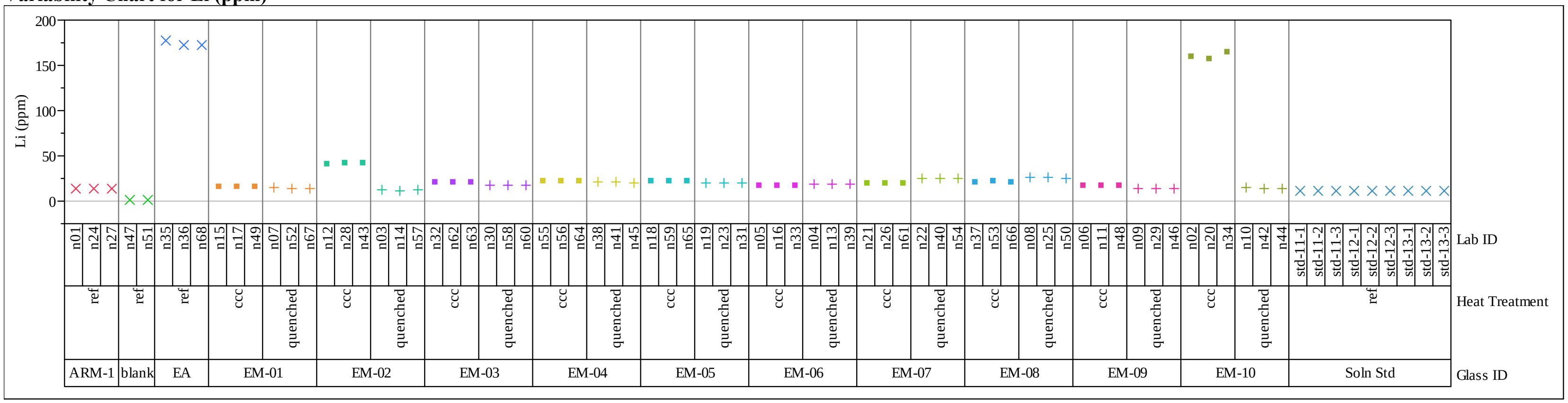
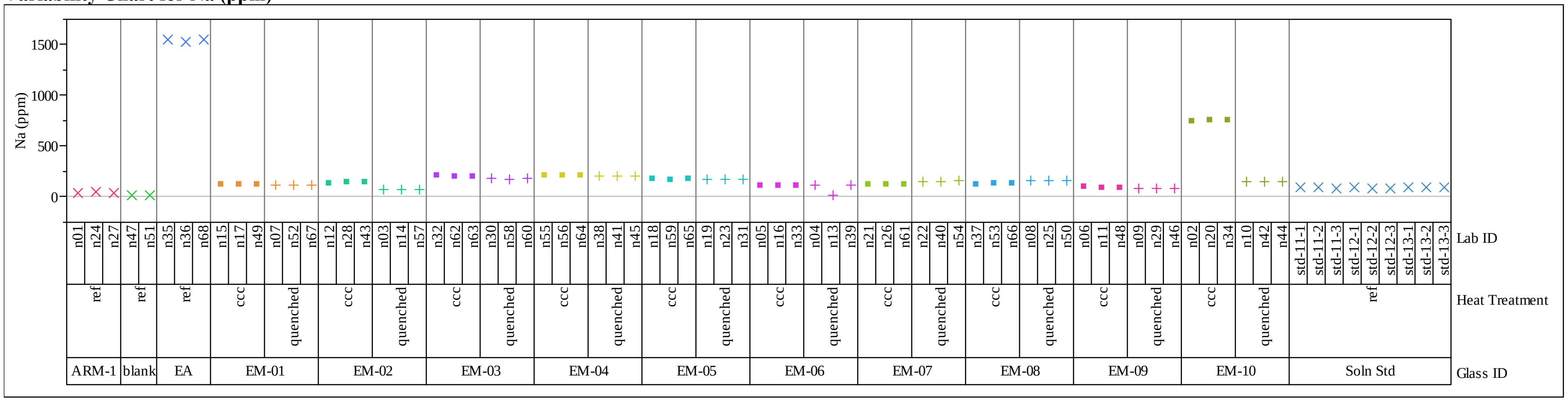


Exhibit E3. PCT Measurements by Glass Identifier for the Matrix 2A Study Glasses and Standards

Set=1
Variability Chart for Na (ppm)



Set=1
Variability Chart for Si (ppm)

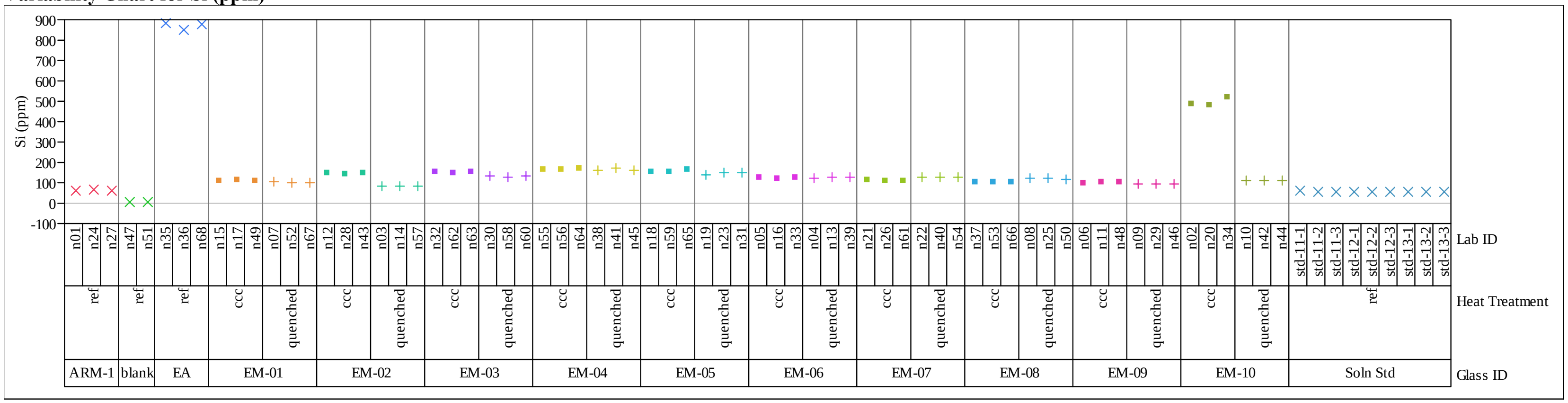
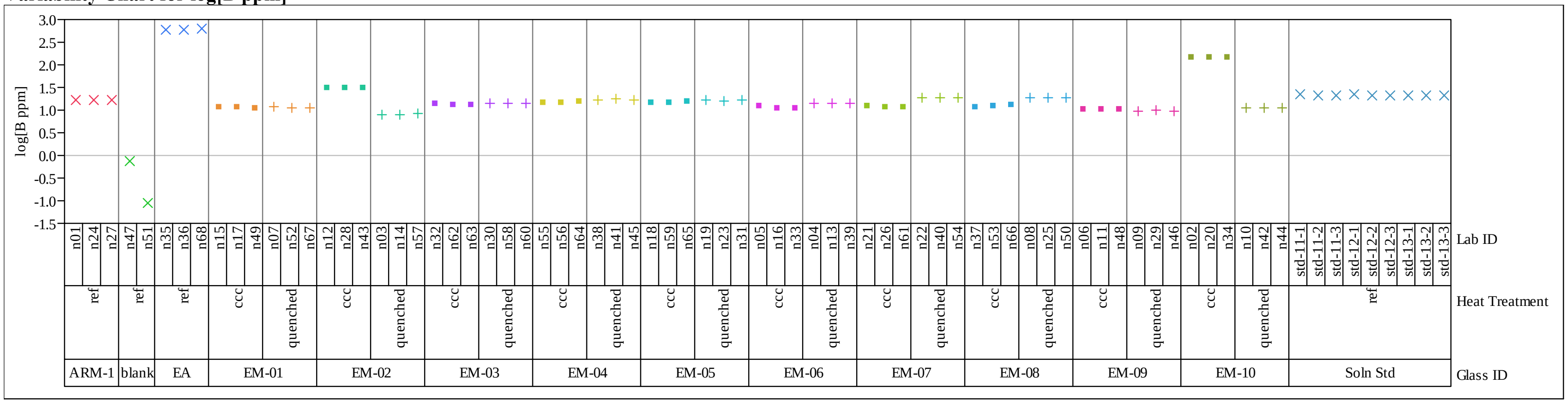


Exhibit E3. PCT Measurements by Glass Identifier for the Matrix 2A Study Glasses and Standards

Set=1
Variability Chart for log[B ppm]



Set=1
Variability Chart for log[Li ppm]

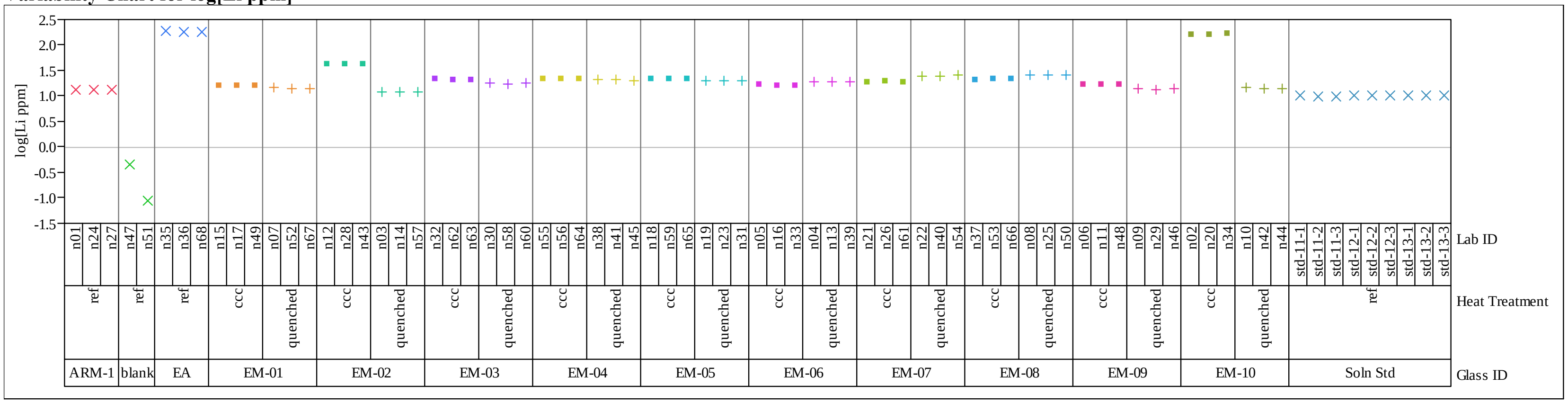
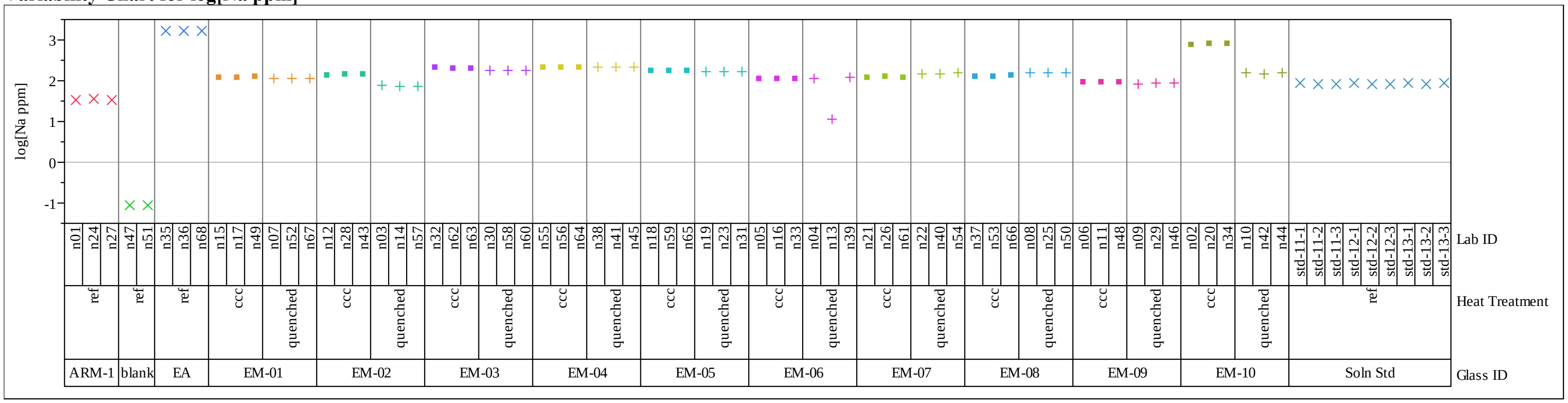


Exhibit E3. PCT Measurements by Glass Identifier for the Matrix 2A Study Glasses and Standards

Set=1
Variability Chart for log[Na ppm]



Set=1
Variability Chart for log[Si ppm]

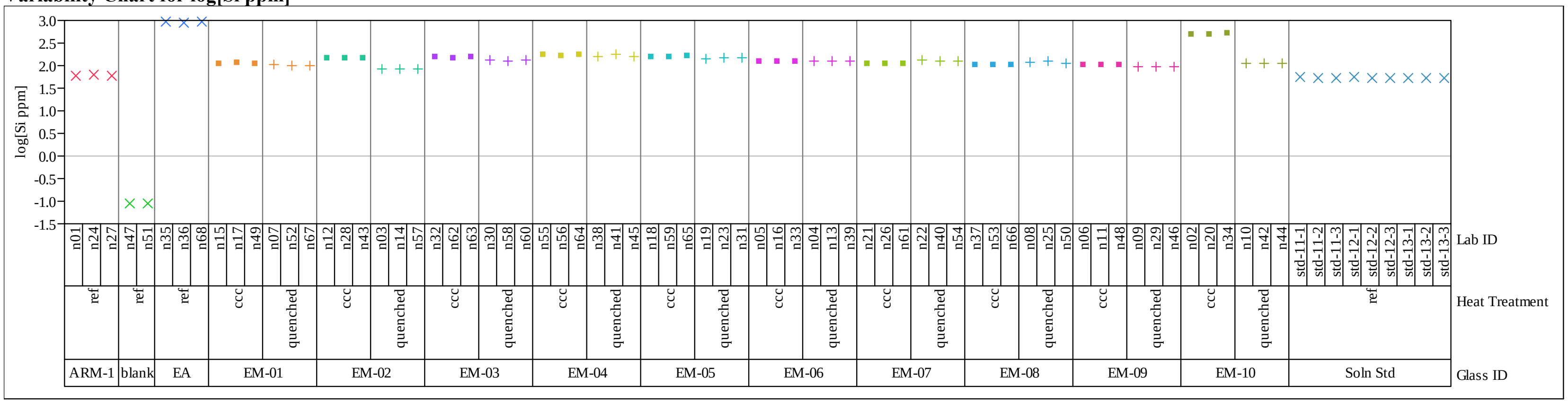
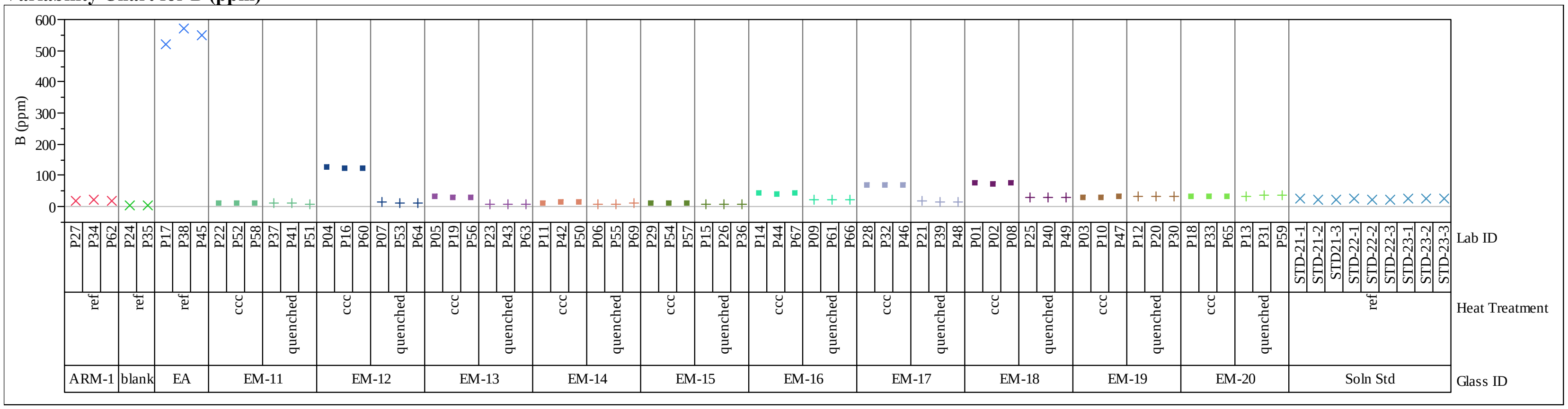


Exhibit E3. PCT Measurements by Glass Identifier for the Matrix 2A Study Glasses and Standards

Set=2
Variability Chart for B (ppm)



Set=2
Variability Chart for Li (ppm)

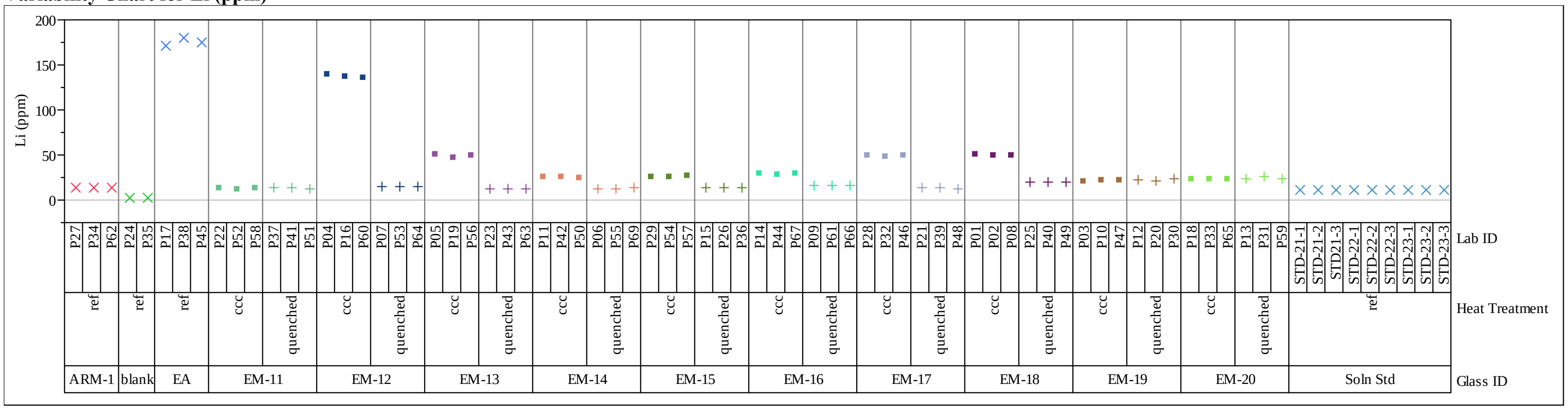
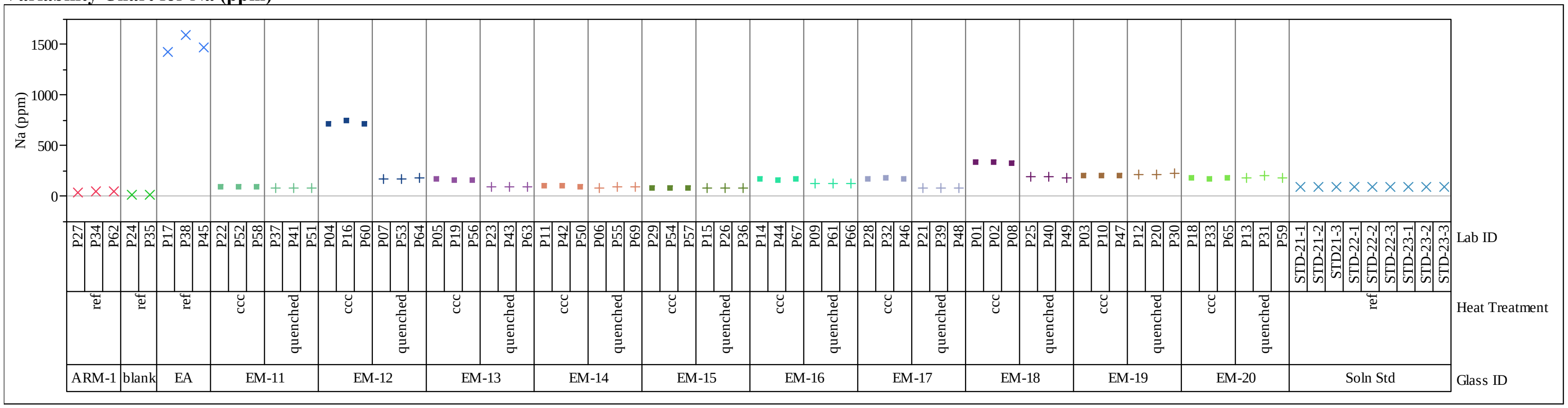


Exhibit E3. PCT Measurements by Glass Identifier for the Matrix 2A Study Glasses and Standards

Set=2
Variability Chart for Na (ppm)



Set=2
Variability Chart for Si (ppm)

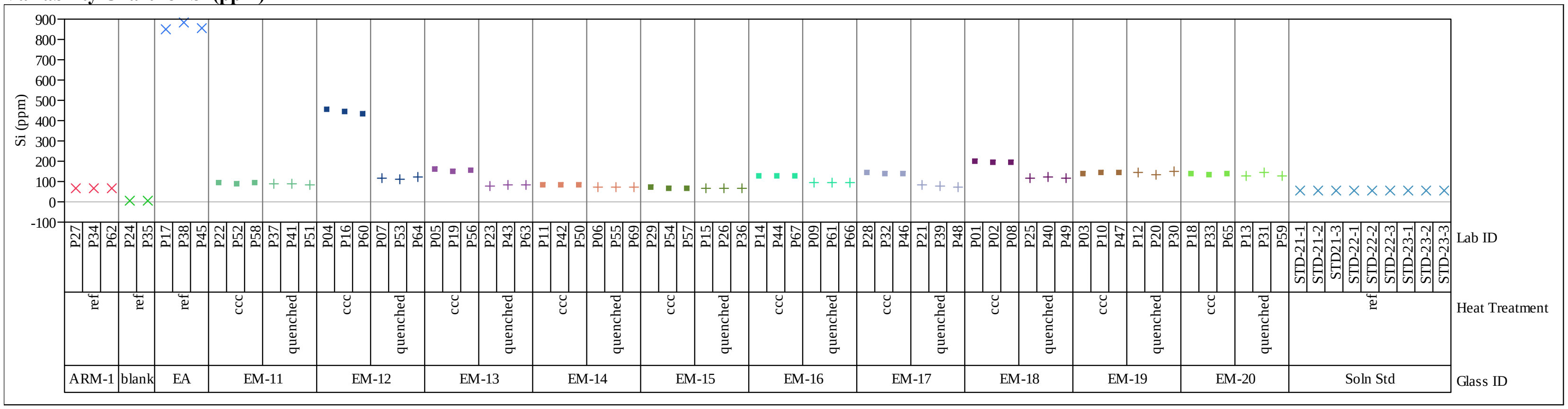
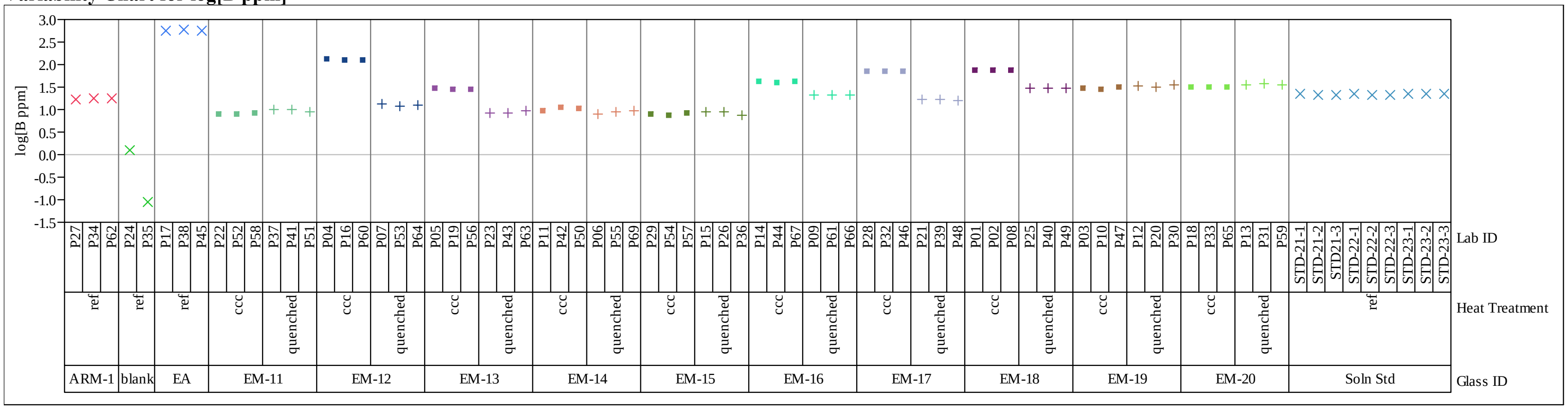


Exhibit E3. PCT Measurements by Glass Identifier for the Matrix 2A Study Glasses and Standards

Set=2
Variability Chart for log[B ppm]



Set=2
Variability Chart for log[Li ppm]

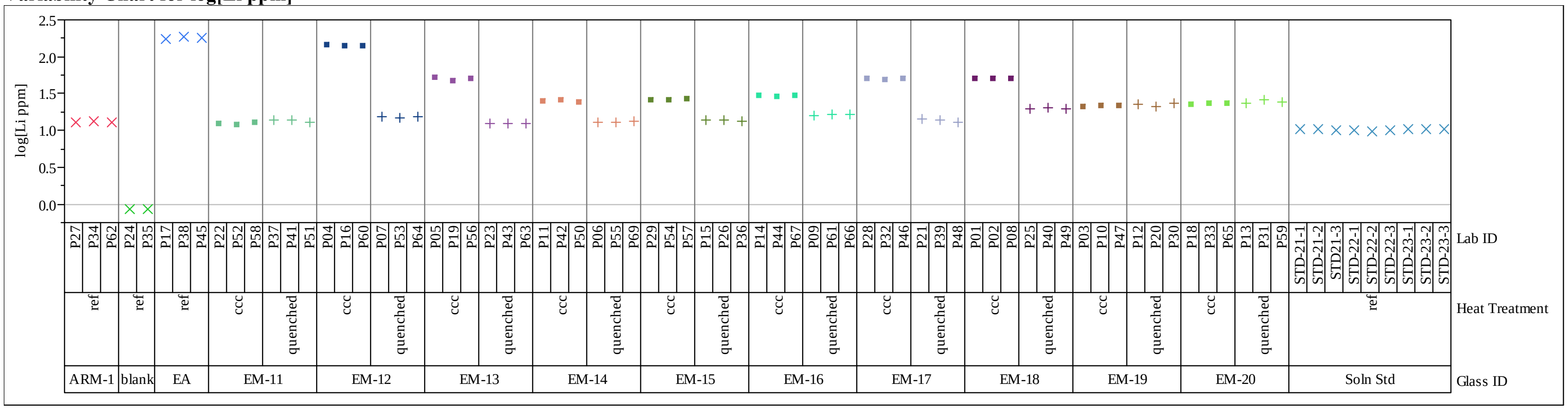
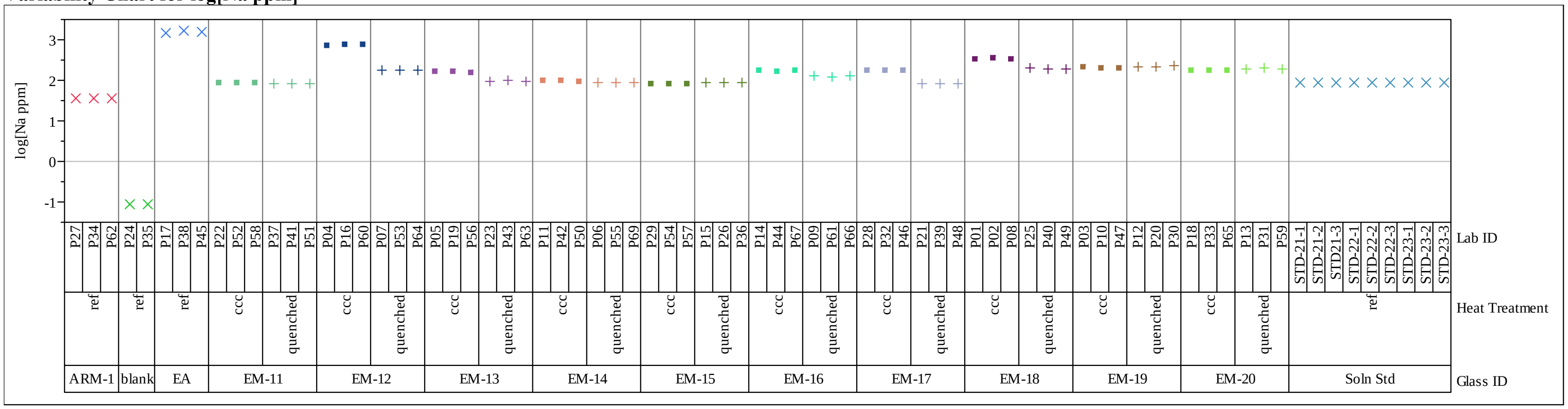


Exhibit E3. PCT Measurements by Glass Identifier for the Matrix 2A Study Glasses and Standards

Set=2
Variability Chart for log[Na ppm]



Set=2
Variability Chart for log[Si ppm]

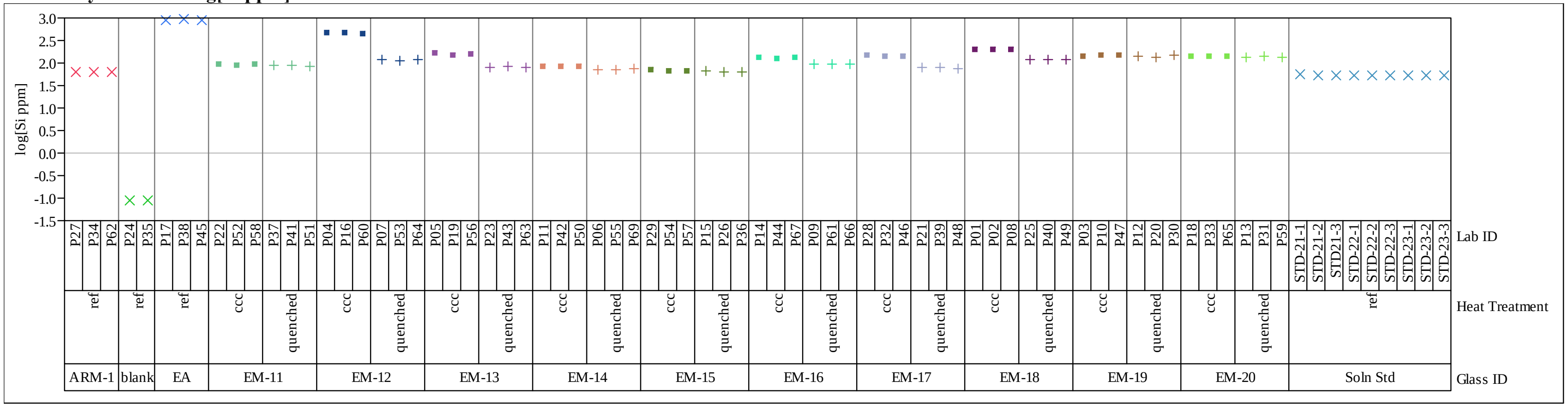
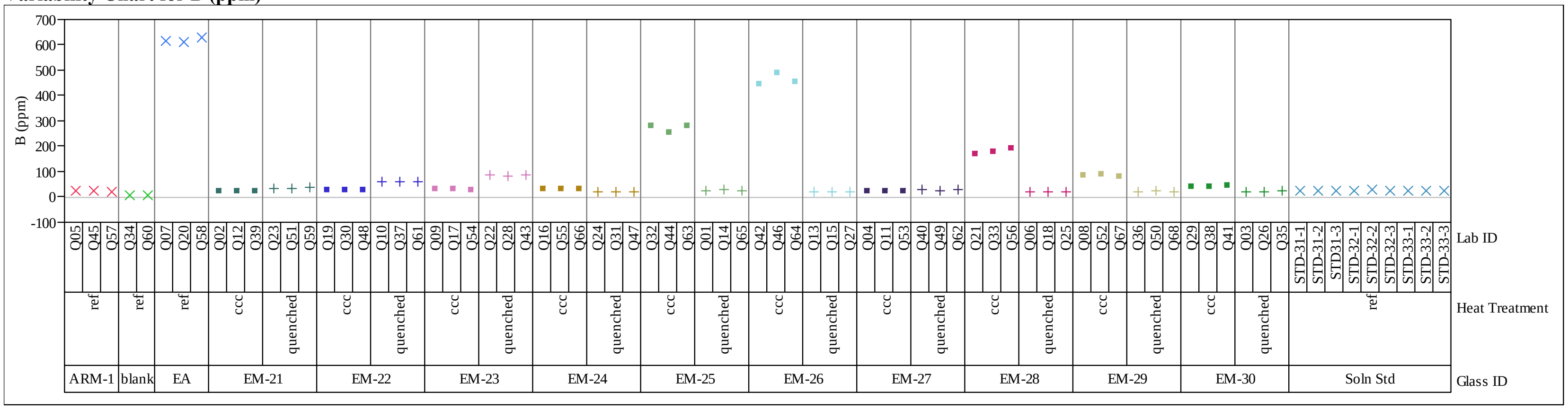


Exhibit E3. PCT Measurements by Glass Identifier for the Matrix 2A Study Glasses and Standards

Set=3
Variability Chart for B (ppm)



Set=3
Variability Chart for Li (ppm)

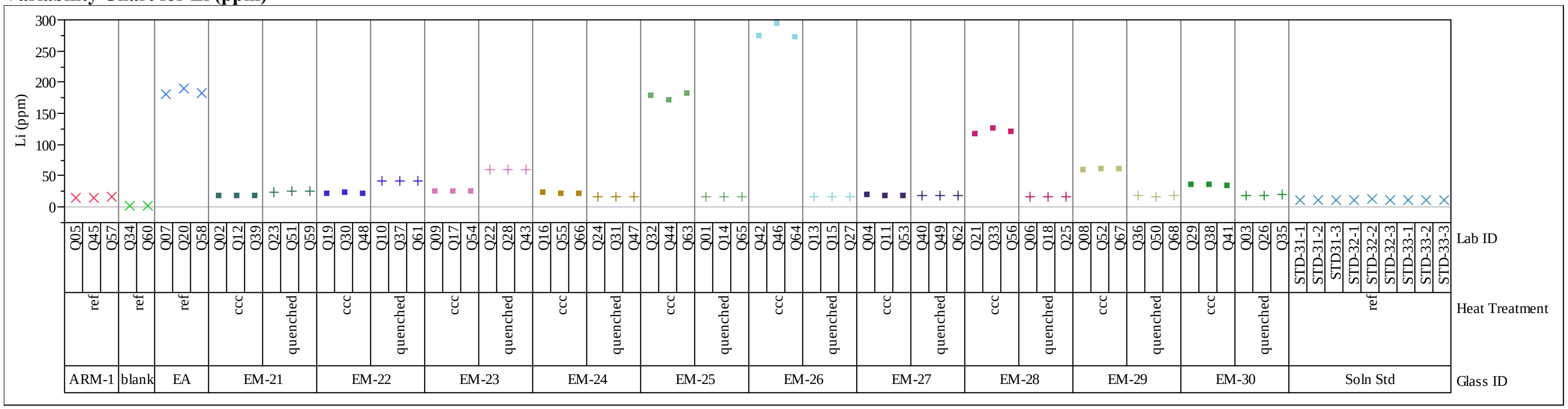
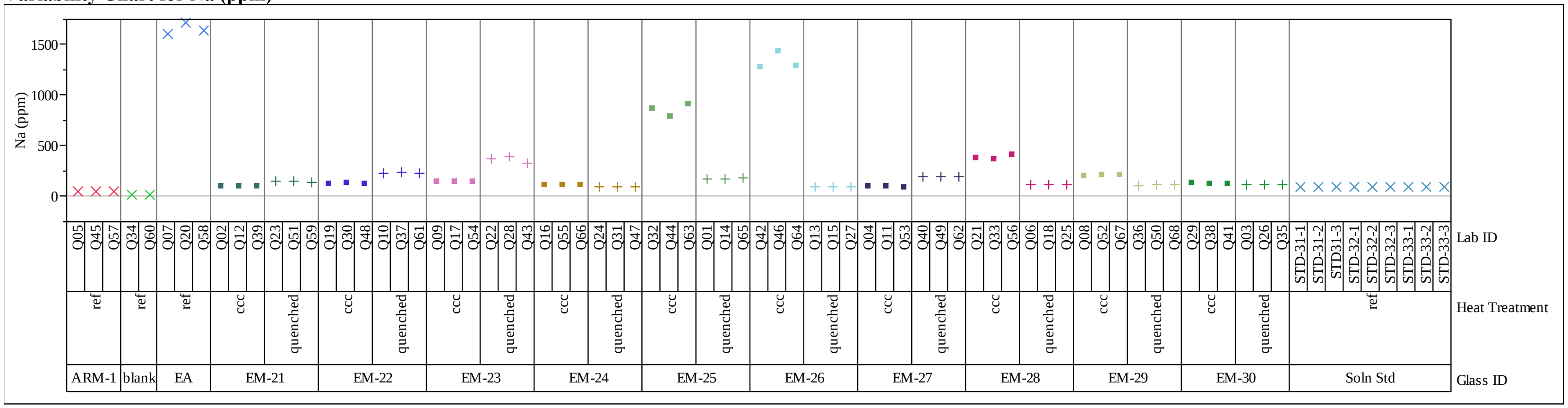


Exhibit E3. PCT Measurements by Glass Identifier for the Matrix 2A Study Glasses and Standards

Set=3
Variability Chart for Na (ppm)



Set=3
Variability Chart for Si (ppm)

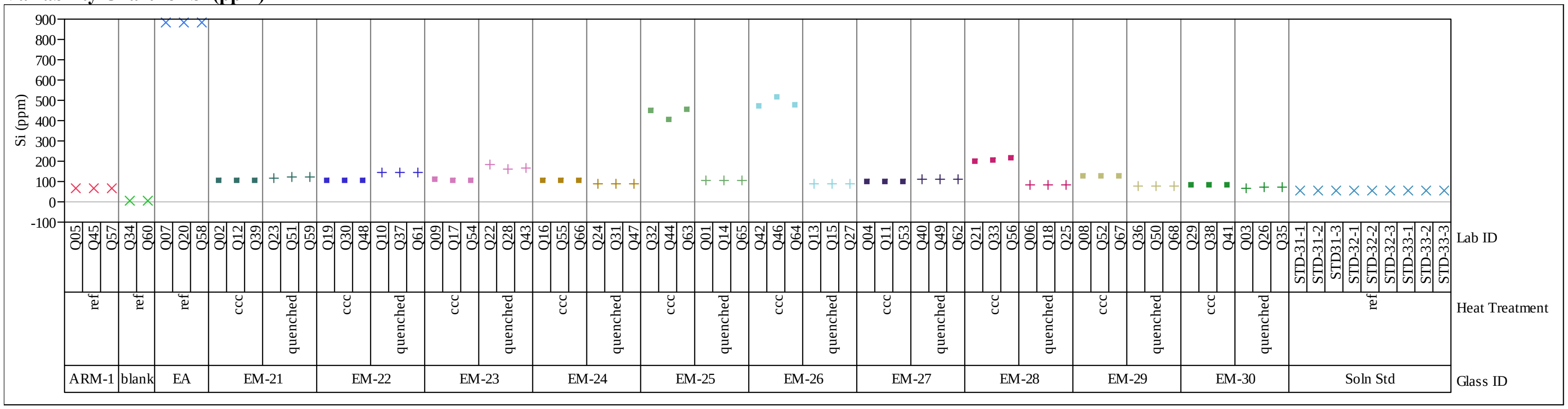
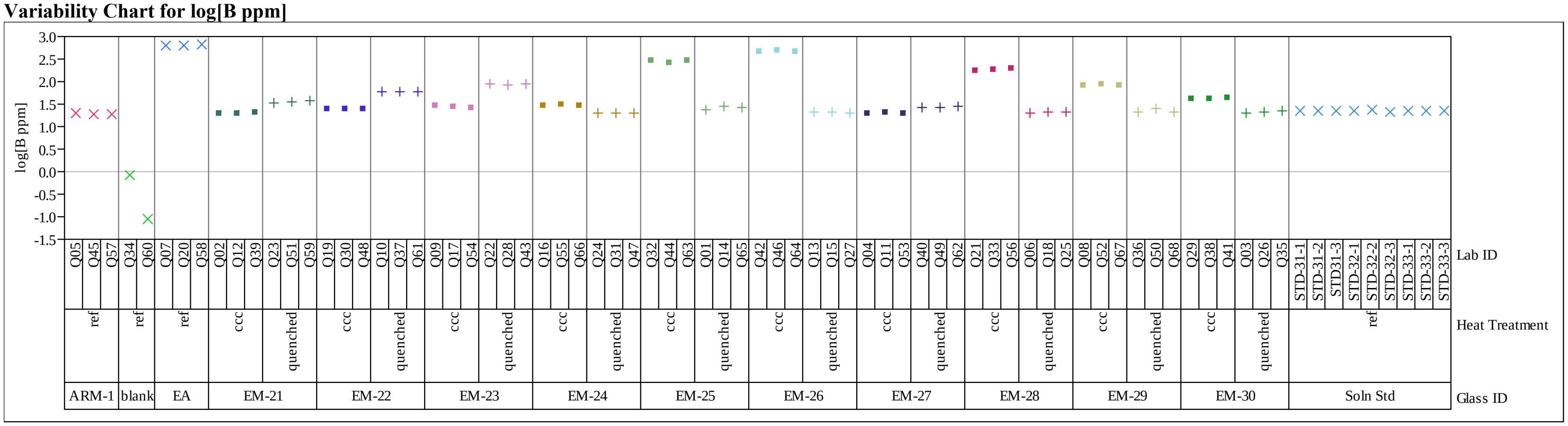


Exhibit E3. PCT Measurements by Glass Identifier for the Matrix 2A Study Glasses and Standards

Set=3
Variability Chart for log[B ppm]



Set=3
Variability Chart for log[Li ppm]

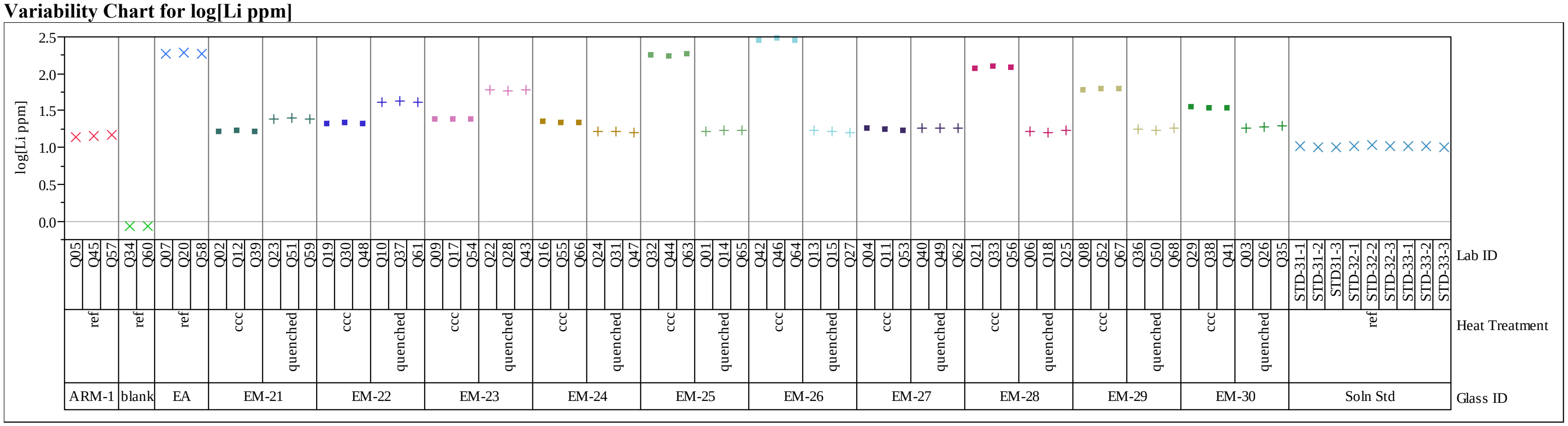
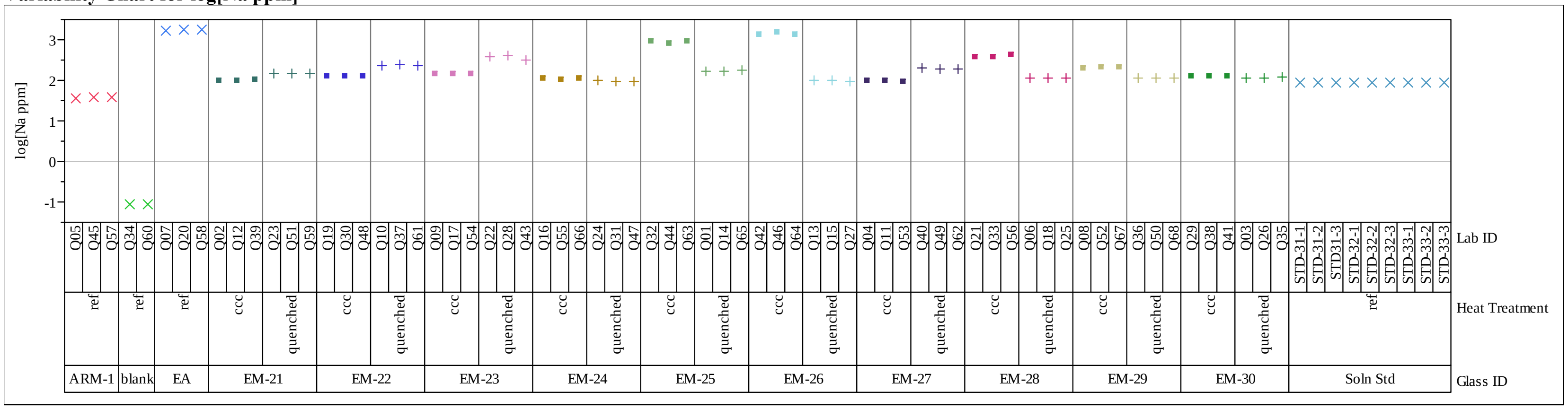


Exhibit E3. PCT Measurements by Glass Identifier for the Matrix 2A Study Glasses and Standards

Set=3
Variability Chart for log[Na ppm]



Set=3
Variability Chart for log[Si ppm]

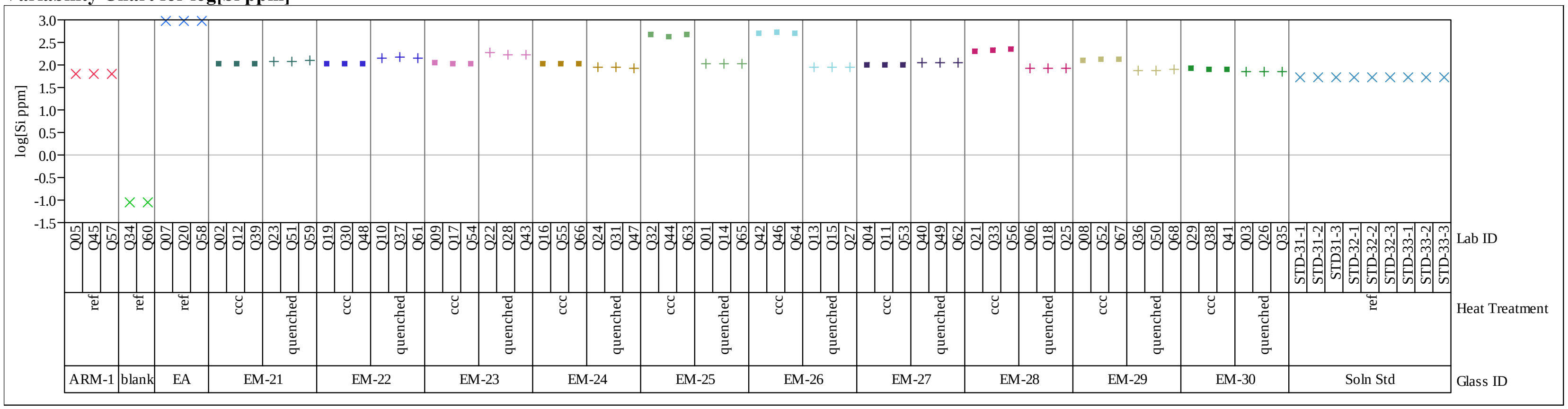


Exhibit E4. Correlations and Scatter Plots of Normalized PCTs Over All Compositional Views and Heat Treatments for the Matrix 2A Study

Multivariate Correlations

	log NL[B (g/L)]	log NL[Li(g/L)]	log NL[Na (g/L)]	log NL[Si (g/L)]
log NL[B (g/L)]	1.0000	0.9765	0.9476	0.9302
log NL[Li(g/L)]	0.9765	1.0000	0.9153	0.8868
log NL[Na (g/L)]	0.9476	0.9153	1.0000	0.9408
log NL[Si (g/L)]	0.9302	0.8868	0.9408	1.0000

Scatterplot Matrix

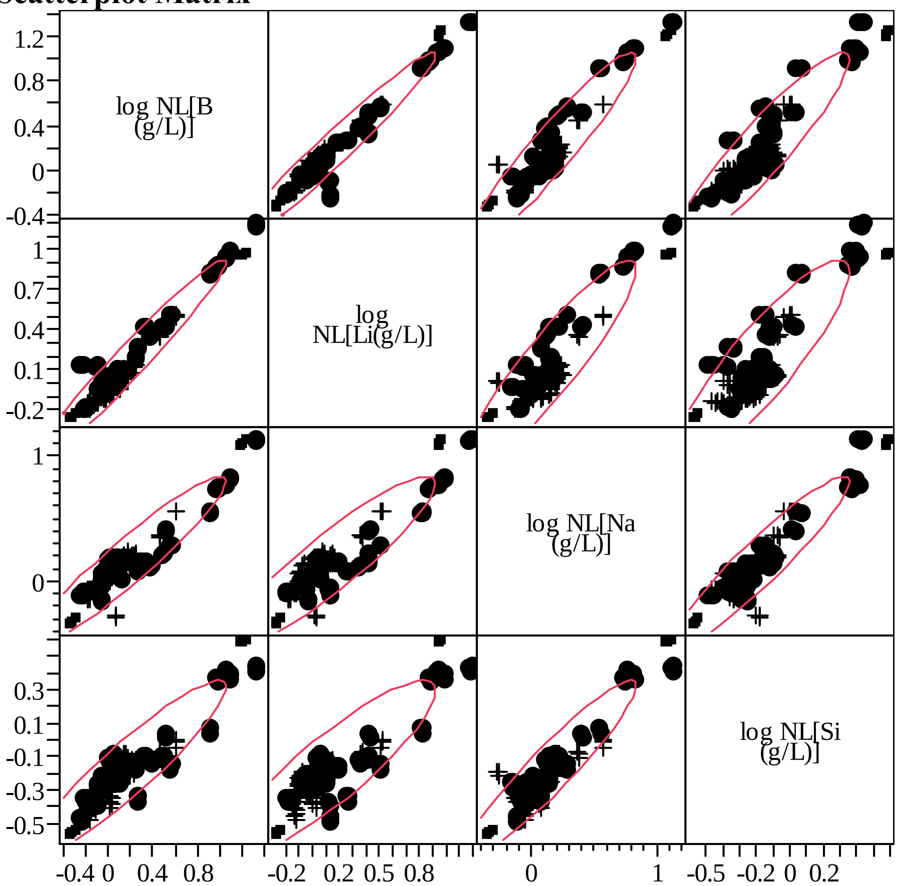
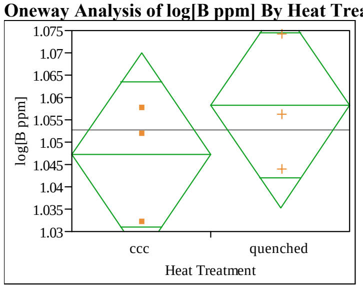


Exhibit E5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of the Matrix 2A Study Glasses

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=EM-01



Oneway Anova
Summary of Fit

Rsquare	0.182726
Adj Rsquare	-0.02159
Root Mean Square Error	0.014332
Mean of Response	1.052681
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.01107	t Ratio	0.945685
Std Err Dif	0.01170	DF	4
Upper CL Dif	0.04356	Prob > |t|	0.3979
Lower CL Dif	-0.02142	Prob > t	0.1989
Confidence	0.95	Prob < t	0.8011

Analysis of Variance

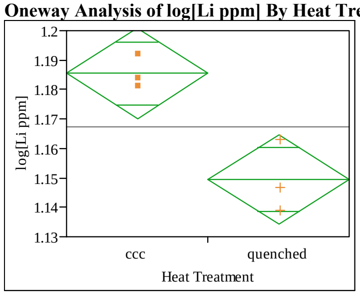
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00018370	0.000184	0.8943	0.3979
Error	4	0.00082161	0.000205		
C. Total	5	0.00100531			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.04715	0.00827	1.0242	1.0701
quenched	3	1.05821	0.00827	1.0352	1.0812

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=EM-01



Oneway Anova
Summary of Fit

Rsquare	0.842455
Adj Rsquare	0.803068
Root Mean Square Error	0.009536
Mean of Response	1.167459
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.03601	t Ratio	-4.62488
Std Err Dif	0.00779	DF	4
Upper CL Dif	-0.01439	Prob > |t|	0.0098
Lower CL Dif	-0.05763	Prob > t	0.9951
Confidence	0.95	Prob < t	0.0049

Analysis of Variance

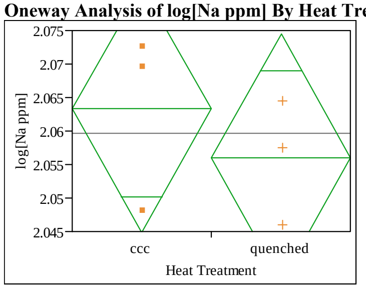
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00194502	0.001945	21.3895	0.0098
Error	4	0.00036373	0.000091		
C. Total	5	0.00230875			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.18546	0.00551	1.1702	1.2007
quenched	3	1.14945	0.00551	1.1342	1.1647

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=EM-01



Oneway Anova
Summary of Fit

Rsquare	0.130111
Adj Rsquare	-0.08736
Root Mean Square Error	0.011542
Mean of Response	2.059644
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.00729	t Ratio	-0.77349
Std Err Dif	0.00942	DF	4
Upper CL Dif	0.01888	Prob > |t|	0.4824
Lower CL Dif	-0.03345	Prob > t	0.7588
Confidence	0.95	Prob < t	0.2412

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00007970	0.000080	0.5983	0.4824
Error	4	0.00053287	0.000133		
C. Total	5	0.00061257			

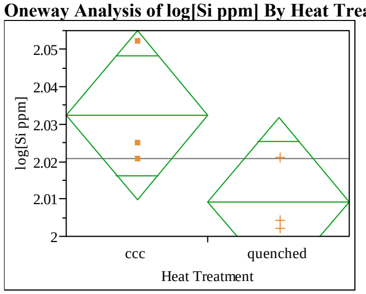
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.06329	0.00666	2.0448	2.0818
quenched	3	2.05600	0.00666	2.0375	2.0745

Std Error uses a pooled estimate of error variance

Exhibit E5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of the Matrix 2A Study Glasses

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=EM-01



Oneway Anova
Summary of Fit

Rsquare	0.501177
Adj Rsquare	0.376471
Root Mean Square Error	0.0141
Mean of Response	2.020774
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.02308	t Ratio	-2.00471
Std Err Dif	0.01151	DF	4
Upper CL Dif	0.00888	Prob > |t|	0.1155
Lower CL Dif	-0.05505	Prob > t	0.9423
Confidence	0.95	Prob < t	0.0577

Analysis of Variance

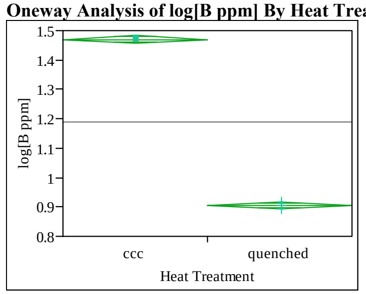
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00079904	0.000799	4.0189	0.1155
Error	4	0.00079529	0.000199		
C. Total	5	0.00159433			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.03231	0.00814	2.0097	2.0549
quenched	3	2.00923	0.00814	1.9866	2.0318

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=EM-02



Oneway Anova
Summary of Fit

Rsquare	0.999437
Adj Rsquare	0.999296
Root Mean Square Error	0.008204
Mean of Response	1.187616
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.56440	t Ratio	-84.2527
Std Err Dif	0.00670	DF	4
Upper CL Dif	-0.54580	Prob > |t|	<.0001
Lower CL Dif	-0.58300	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

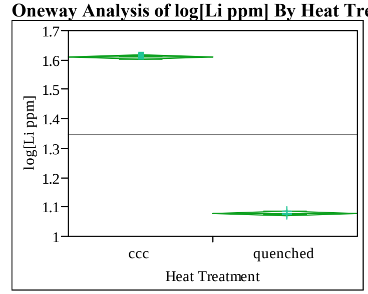
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.47782399	0.477824	7098.523	<.0001
Error	4	0.00026925	0.000067		
C. Total	5	0.47809324			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.46982	0.00474	1.4567	1.4830
quenched	3	0.90542	0.00474	0.8923	0.9186

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=EM-02



Oneway Anova
Summary of Fit

Rsquare	0.999761
Adj Rsquare	0.999702
Root Mean Square Error	0.005021
Mean of Response	1.344496
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.53066	t Ratio	-129.448
Std Err Dif	0.00410	DF	4
Upper CL Dif	-0.51928	Prob > |t|	<.0001
Lower CL Dif	-0.54204	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.42239732	0.422397	16756.70	<.0001
Error	4	0.00010083	0.000025		
C. Total	5	0.42249815			

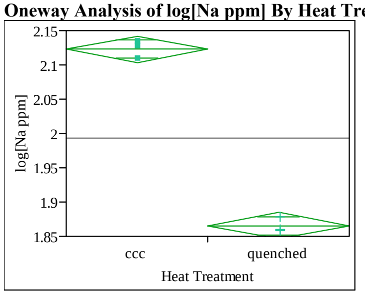
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.60982	0.00290	1.6018	1.6179
quenched	3	1.07917	0.00290	1.0711	1.0872

Std Error uses a pooled estimate of error variance

Exhibit E5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of the Matrix 2A Study Glasses

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=EM-02



Oneway Anova
Summary of Fit

Rsquare	0.994381
Adj Rsquare	0.992976
Root Mean Square Error	0.011835
Mean of Response	1.994097
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.25710	t Ratio	-26.6061
Std Err Dif	0.00966	DF	4
Upper CL Dif	-0.23027	Prob > |t|	<.0001
Lower CL Dif	-0.28393	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

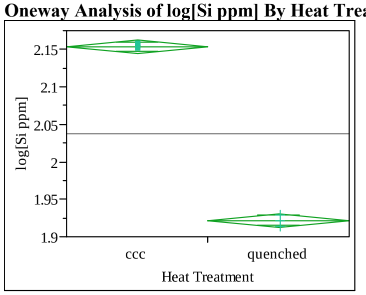
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.09914766	0.099148	707.8842	<.0001
Error	4	0.00056025	0.000140		
C. Total	5	0.09970791			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.12265	0.00683	2.1037	2.1416
quenched	3	1.86555	0.00683	1.8466	1.8845

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=EM-02



Oneway Anova
Summary of Fit

Rsquare	0.998263
Adj Rsquare	0.997828
Root Mean Square Error	0.005927
Mean of Response	2.037648
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.23200	t Ratio	-47.9419
Std Err Dif	0.00484	DF	4
Upper CL Dif	-0.21856	Prob > |t|	<.0001
Lower CL Dif	-0.24543	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

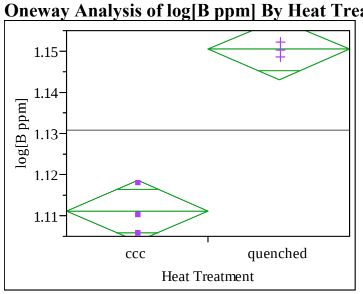
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.08073500	0.080735	2298.427	<.0001
Error	4	0.00014050	0.000035		
C. Total	5	0.08087551			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.15365	0.00342	2.1441	2.1631
quenched	3	1.92165	0.00342	1.9121	1.9311

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=EM-03



Oneway Anova
Summary of Fit

Rsquare	0.964973
Adj Rsquare	0.956217
Root Mean Square Error	0.004584
Mean of Response	1.130775
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.039292	t Ratio	10.49755
Std Err Dif	0.003743	DF	4
Upper CL Dif	0.049684	Prob > |t|	0.0005
Lower CL Dif	0.028900	Prob > t	0.0002
Confidence	0.95	Prob < t	0.9998

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00231581	0.002316	110.1985	0.0005
Error	4	0.00008406	0.000021		
C. Total	5	0.00239987			

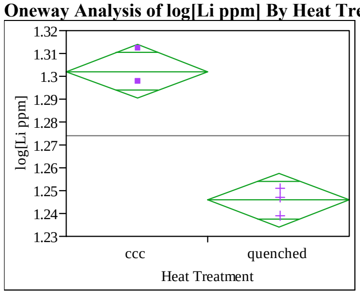
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.11113	0.00265	1.1038	1.1185
quenched	3	1.15042	0.00265	1.1431	1.1578

Std Error uses a pooled estimate of error variance

Exhibit E5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of the Matrix 2A Study Glasses

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=EM-03



Oneway Anova
Summary of Fit

Rsquare	0.956606
Adj Rsquare	0.945758
Root Mean Square Error	0.007359
Mean of Response	1.273978
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.05643	t Ratio	-9.39039
Std Err Dif	0.00601	DF	4
Upper CL Dif	-0.03974	Prob > |t|	0.0007
Lower CL Dif	-0.07311	Prob > t	0.9996
Confidence	0.95	Prob < t	0.0004

Analysis of Variance

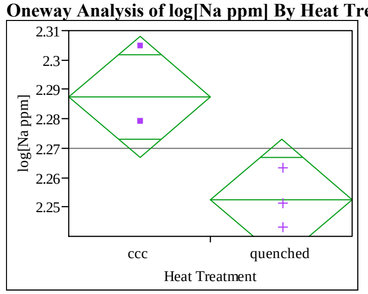
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00477573	0.004776	88.1795	0.0007
Error	4	0.00021664	0.000054		
C. Total	5	0.00499237			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.30219	0.00425	1.2904	1.3140
quenched	3	1.24577	0.00425	1.2340	1.2576

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=EM-03



Oneway Anova
Summary of Fit

Rsquare	0.736419
Adj Rsquare	0.670524
Root Mean Square Error	0.012777
Mean of Response	2.269951
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.03488	t Ratio	-3.34299
Std Err Dif	0.01043	DF	4
Upper CL Dif	-0.00591	Prob > |t|	0.0288
Lower CL Dif	-0.06384	Prob > t	0.9856
Confidence	0.95	Prob < t	0.0144

Analysis of Variance

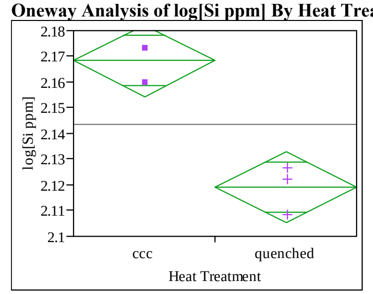
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00182455	0.001825	11.1756	0.0288
Error	4	0.00065305	0.000163		
C. Total	5	0.00247760			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.28739	0.00738	2.2669	2.3079
quenched	3	2.25251	0.00738	2.2320	2.2730

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=EM-03



Oneway Anova
Summary of Fit

Rsquare	0.923793
Adj Rsquare	0.904741
Root Mean Square Error	0.008656
Mean of Response	2.143656
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.04922	t Ratio	-6.96336
Std Err Dif	0.00707	DF	4
Upper CL Dif	-0.02959	Prob > |t|	0.0022
Lower CL Dif	-0.06884	Prob > t	0.9989
Confidence	0.95	Prob < t	0.0011

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00363329	0.003633	48.4883	0.0022
Error	4	0.00029973	0.000075		
C. Total	5	0.00393302			

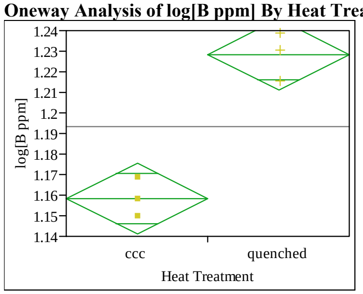
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.16826	0.00500	2.1544	2.1821
quenched	3	2.11905	0.00500	2.1052	2.1329

Std Error uses a pooled estimate of error variance

Exhibit E5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of the Matrix 2A Study Glasses

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=EM-04



Oneway Anova
Summary of Fit

Rsquare	0.941256
Adj Rsquare	0.92657
Root Mean Square Error	0.010692
Mean of Response	1.193415
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.069892	t Ratio	8.005759
Std Err Dif	0.008730	DF	4
Upper CL Dif	0.094131	Prob > |t|	0.0013
Lower CL Dif	0.045653	Prob > t	0.0007
Confidence	0.95	Prob < t	0.9993

Analysis of Variance

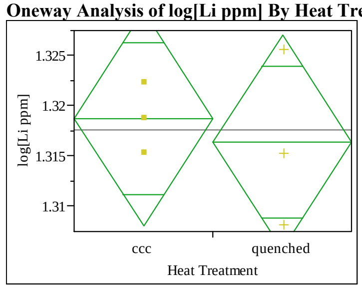
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00732741	0.007327	64.0922	0.0013
Error	4	0.00045730	0.000114		
C. Total	5	0.00778471			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.15847	0.00617	1.1413	1.1756
quenched	3	1.22836	0.00617	1.2112	1.2455

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=EM-04



Oneway Anova
Summary of Fit

Rsquare	0.045249
Adj Rsquare	-0.19344
Root Mean Square Error	0.006673
Mean of Response	1.317572
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.00237	t Ratio	-0.4354
Std Err Dif	0.00545	DF	4
Upper CL Dif	0.01276	Prob > |t|	0.6857
Lower CL Dif	-0.01750	Prob > t	0.6571
Confidence	0.95	Prob < t	0.3429

Analysis of Variance

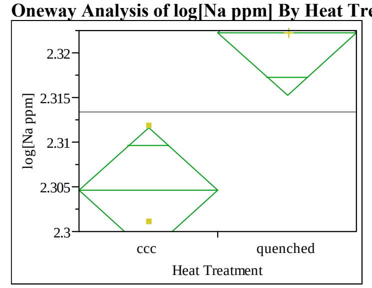
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00000844	8.442e-6	0.1896	0.6857
Error	4	0.00017813	0.000045		
C. Total	5	0.00018657			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.31876	0.00385	1.3081	1.3295
quenched	3	1.31639	0.00385	1.3057	1.3271

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=EM-04



Oneway Anova
Summary of Fit

Rsquare	0.858569
Adj Rsquare	0.823211
Root Mean Square Error	0.004378
Mean of Response	2.313421
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.017615	t Ratio	4.927704
Std Err Dif	0.003575	DF	4
Upper CL Dif	0.027539	Prob > |t|	0.0079
Lower CL Dif	0.007690	Prob > t	0.0039
Confidence	0.95	Prob < t	0.9961

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00046542	0.000465	24.2823	0.0079
Error	4	0.00007667	0.000019		
C. Total	5	0.00054208			

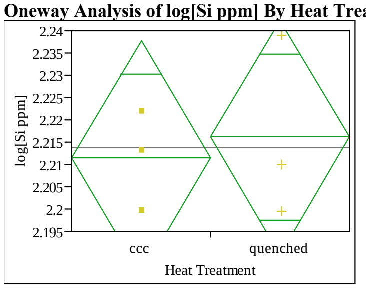
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.30461	0.00253	2.2976	2.3116
quenched	3	2.32223	0.00253	2.3152	2.3292

Std Error uses a pooled estimate of error variance

Exhibit E5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of the Matrix 2A Study Glasses

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=EM-04



Oneway Anova
Summary of Fit

Rsquare	0.02899
Adj Rsquare	-0.21376
Root Mean Square Error	0.016445
Mean of Response	2.213827
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.00464	t Ratio	0.345575
Std Err Dif	0.01343	DF	4
Upper CL Dif	0.04192	Prob > |t|	0.7471
Lower CL Dif	-0.03264	Prob > t	0.3735
Confidence	0.95	Prob < t	0.6265

Analysis of Variance

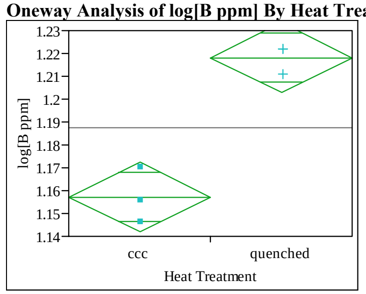
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00003229	0.000032	0.1194	0.7471
Error	4	0.00108171	0.000270		
C. Total	5	0.00111400			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.21151	0.00949	2.1851	2.2379
quenched	3	2.21615	0.00949	2.1898	2.2425

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=EM-05



Oneway Anova
Summary of Fit

Rsquare	0.938867
Adj Rsquare	0.923584
Root Mean Square Error	0.009548
Mean of Response	1.18764
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.061105	t Ratio	7.837792
Std Err Dif	0.007796	DF	4
Upper CL Dif	0.082750	Prob > |t|	0.0014
Lower CL Dif	0.039459	Prob > t	0.0007
Confidence	0.95	Prob < t	0.9993

Analysis of Variance

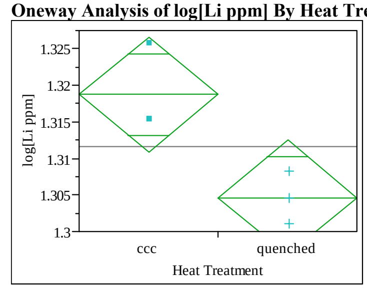
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00560070	0.005601	61.4310	0.0014
Error	4	0.00036468	0.000091		
C. Total	5	0.00596538			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.15709	0.00551	1.1418	1.1724
quenched	3	1.21819	0.00551	1.2029	1.2335

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=EM-05



Oneway Anova
Summary of Fit

Rsquare	0.753556
Adj Rsquare	0.691945
Root Mean Square Error	0.00494
Mean of Response	1.311686
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.01411	t Ratio	-3.49726
Std Err Dif	0.00403	DF	4
Upper CL Dif	-0.00291	Prob > |t|	0.0250
Lower CL Dif	-0.02531	Prob > t	0.9875
Confidence	0.95	Prob < t	0.0125

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00029851	0.000299	12.2309	0.0250
Error	4	0.00009762	0.000024		
C. Total	5	0.00039613			

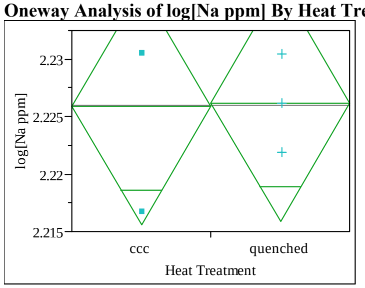
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.31874	0.00285	1.3108	1.3267
quenched	3	1.30463	0.00285	1.2967	1.3126

Std Error uses a pooled estimate of error variance

Exhibit E5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of the Matrix 2A Study Glasses

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=EM-05



Oneway Anova
Summary of Fit

Rsquare	0.00094
Adj Rsquare	-0.24883
Root Mean Square Error	0.006418
Mean of Response	2.226004
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.00032	t Ratio	0.061341
Std Err Dif	0.00524	DF	4
Upper CL Dif	0.01487	Prob > |t|	0.9540
Lower CL Dif	-0.01423	Prob > t	0.4770
Confidence	0.95	Prob < t	0.5230

Analysis of Variance

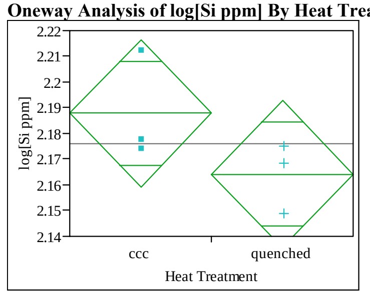
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00000015	1.55e-7	0.0038	0.9540
Error	4	0.00016474	0.000041		
C. Total	5	0.00016489			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.22584	0.00371	2.2156	2.2361
quenched	3	2.22616	0.00371	2.2159	2.2365

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=EM-05



Oneway Anova
Summary of Fit

Rsquare	0.398825
Adj Rsquare	0.248531
Root Mean Square Error	0.01786
Mean of Response	2.17593
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.02375	t Ratio	-1.629
Std Err Dif	0.01458	DF	4
Upper CL Dif	0.01673	Prob > |t|	0.1786
Lower CL Dif	-0.06424	Prob > t	0.9107
Confidence	0.95	Prob < t	0.0893

Analysis of Variance

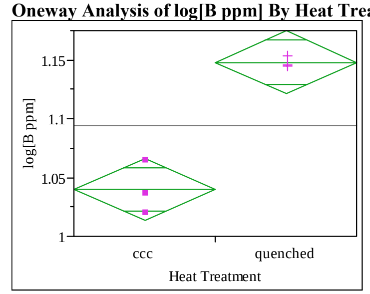
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00084643	0.000846	2.6536	0.1786
Error	4	0.00127588	0.000319		
C. Total	5	0.00212232			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.18781	0.01031	2.1592	2.2164
quenched	3	2.16405	0.01031	2.1354	2.1927

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=EM-06



Oneway Anova
Summary of Fit

Rsquare	0.941667
Adj Rsquare	0.927084
Root Mean Square Error	0.016504
Mean of Response	1.094042
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.108286	t Ratio	8.035687
Std Err Dif	0.013476	DF	4
Upper CL Dif	0.145700	Prob > |t|	0.0013
Lower CL Dif	0.070871	Prob > t	0.0007
Confidence	0.95	Prob < t	0.9993

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.01758866	0.017589	64.5723	0.0013
Error	4	0.00108955	0.000272		
C. Total	5	0.01867821			

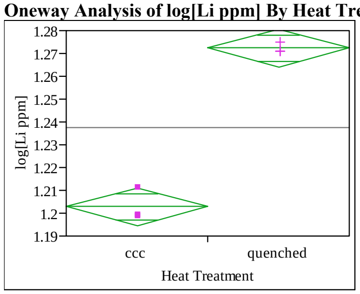
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.03990	0.00953	1.0134	1.0664
quenched	3	1.14818	0.00953	1.1217	1.1746

Std Error uses a pooled estimate of error variance

Exhibit E5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of the Matrix 2A Study Glasses

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=EM-06



Oneway Anova
Summary of Fit

Rsquare	0.985637
Adj Rsquare	0.982046
Root Mean Square Error	0.005136
Mean of Response	1.237623
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.069478	t Ratio	16.56769
Std Err Dif	0.004194	DF	4
Upper CL Dif	0.081122	Prob > |t|	<.0001
Lower CL Dif	0.057835	Prob > t	<.0001
Confidence	0.95	Prob < t	1.0000

Analysis of Variance

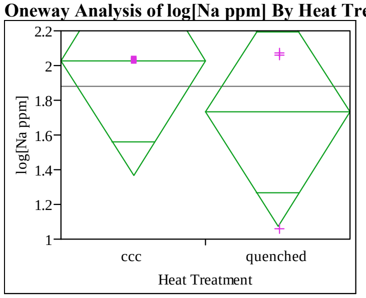
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00724088	0.007241	274.4884	<.0001
Error	4	0.00010552	0.000026		
C. Total	5	0.00734640			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.20288	0.00297	1.1947	1.2111
quenched	3	1.27236	0.00297	1.2641	1.2806

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=EM-06



Oneway Anova
Summary of Fit

Rsquare	0.164338
Adj Rsquare	-0.04458
Root Mean Square Error	0.410578
Mean of Response	1.879121
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.2973	t Ratio	-0.88692
Std Err Dif	0.3352	DF	4
Upper CL Dif	0.6334	Prob > |t|	0.4252
Lower CL Dif	-1.2281	Prob > t	0.7874
Confidence	0.95	Prob < t	0.2126

Analysis of Variance

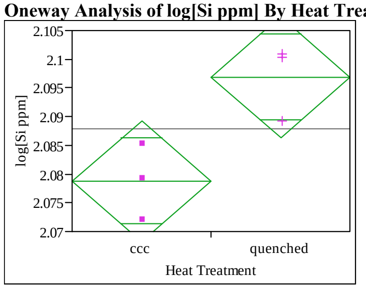
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.13260495	0.132605	0.7866	0.4252
Error	4	0.67429651	0.168574		
C. Total	5	0.80690146			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.02778	0.23705	1.3696	2.6859
quenched	3	1.73046	0.23705	1.0723	2.3886

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=EM-06



Oneway Anova
Summary of Fit

Rsquare	0.738632
Adj Rsquare	0.67329
Root Mean Square Error	0.006605
Mean of Response	2.08782
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.018132	t Ratio	3.362159
Std Err Dif	0.005393	DF	4
Upper CL Dif	0.033106	Prob > |t|	0.0282
Lower CL Dif	0.003159	Prob > t	0.0141
Confidence	0.95	Prob < t	0.9859

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00049316	0.000493	11.3041	0.0282
Error	4	0.00017451	0.000044		
C. Total	5	0.00066767			

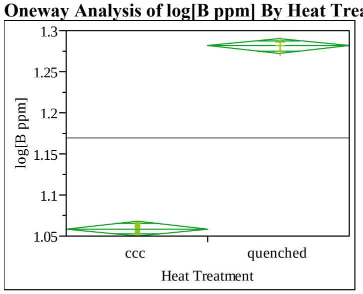
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.07875	0.00381	2.0682	2.0893
quenched	3	2.09689	0.00381	2.0863	2.1075

Std Error uses a pooled estimate of error variance

Exhibit E5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of the Matrix 2A Study Glasses

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=EM-07



Oneway Anova
Summary of Fit

Rsquare	0.998415
Adj Rsquare	0.998019
Root Mean Square Error	0.005428
Mean of Response	1.170032
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.222474	t Ratio	50.19415
Std Err Dif	0.004432	DF	4
Upper CL Dif	0.234780	Prob > |t|	<.0001
Lower CL Dif	0.210168	Prob > t	<.0001
Confidence	0.95	Prob < t	1.0000

Analysis of Variance

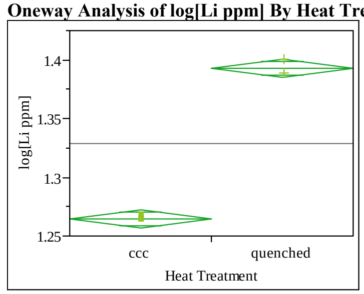
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.07424208	0.074242	2519.453	<.0001
Error	4	0.00011787	0.000029		
C. Total	5	0.07435995			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.05879	0.00313	1.0501	1.0675
quenched	3	1.28127	0.00313	1.2726	1.2900

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=EM-07



Oneway Anova
Summary of Fit

Rsquare	0.995942
Adj Rsquare	0.994927
Root Mean Square Error	0.005023
Mean of Response	1.328811
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.128501	t Ratio	31.33099
Std Err Dif	0.004101	DF	4
Upper CL Dif	0.139888	Prob > |t|	<.0001
Lower CL Dif	0.117114	Prob > t	<.0001
Confidence	0.95	Prob < t	1.0000

Analysis of Variance

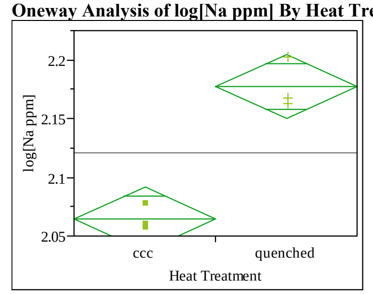
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.02476879	0.024769	981.6307	<.0001
Error	4	0.00010093	0.000025		
C. Total	5	0.02486972			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.26456	0.00290	1.2565	1.2726
quenched	3	1.39306	0.00290	1.3850	1.4011

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=EM-07



Oneway Anova
Summary of Fit

Rsquare	0.942772
Adj Rsquare	0.928465
Root Mean Square Error	0.017036
Mean of Response	2.121046
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.112917	t Ratio	8.117609
Std Err Dif	0.013910	DF	4
Upper CL Dif	0.151538	Prob > |t|	0.0013
Lower CL Dif	0.074297	Prob > t	0.0006
Confidence	0.95	Prob < t	0.9994

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.01912553	0.019126	65.8956	0.0013
Error	4	0.00116096	0.000290		
C. Total	5	0.02028649			

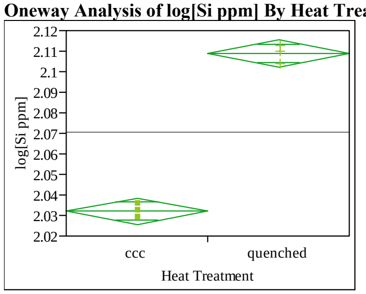
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.06459	0.00984	2.0373	2.0919
quenched	3	2.17750	0.00984	2.1502	2.2048

Std Error uses a pooled estimate of error variance

Exhibit E5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of the Matrix 2A Study Glasses

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=EM-07



Oneway Anova
Summary of Fit

Rsquare	0.992679
Adj Rsquare	0.990848
Root Mean Square Error	0.00404
Mean of Response	2.070488
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.076814	t Ratio	23.28851
Std Err Dif	0.003298	DF	4
Upper CL Dif	0.085972	Prob > |t|	<.0001
Lower CL Dif	0.067656	Prob > t	<.0001
Confidence	0.95	Prob < t	1.0000

Analysis of Variance

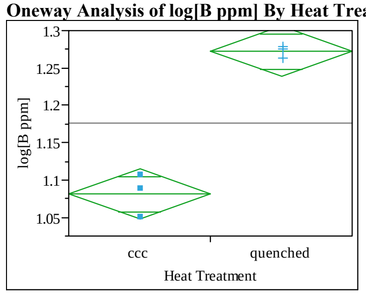
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00885063	0.008851	542.3545	<.0001
Error	4	0.00006528	0.000016		
C. Total	5	0.00891590			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.03208	0.00233	2.0256	2.0386
quenched	3	2.10890	0.00233	2.1024	2.1154

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=EM-08



Oneway Anova
Summary of Fit

Rsquare	0.968872
Adj Rsquare	0.961091
Root Mean Square Error	0.021002
Mean of Response	1.176645
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.191343	t Ratio	11.15812
Std Err Dif	0.017148	DF	4
Upper CL Dif	0.238954	Prob > |t|	0.0004
Lower CL Dif	0.143731	Prob > t	0.0002
Confidence	0.95	Prob < t	0.9998

Analysis of Variance

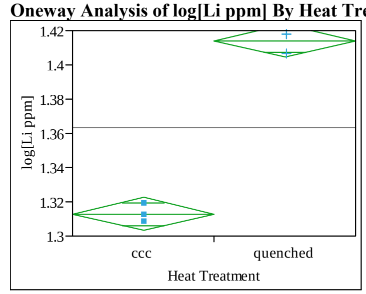
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.05491806	0.054918	124.5037	0.0004
Error	4	0.00176438	0.000441		
C. Total	5	0.05668244			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.08097	0.01213	1.0473	1.1146
quenched	3	1.27232	0.01213	1.2386	1.3060

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=EM-08



Oneway Anova
Summary of Fit

Rsquare	0.990863
Adj Rsquare	0.988578
Root Mean Square Error	0.005946
Mean of Response	1.363468
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.101105	t Ratio	20.82709
Std Err Dif	0.004855	DF	4
Upper CL Dif	0.114584	Prob > |t|	<.0001
Lower CL Dif	0.087627	Prob > t	<.0001
Confidence	0.95	Prob < t	1.0000

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.01533341	0.015333	433.7675	<.0001
Error	4	0.00014140	0.000035		
C. Total	5	0.01547481			

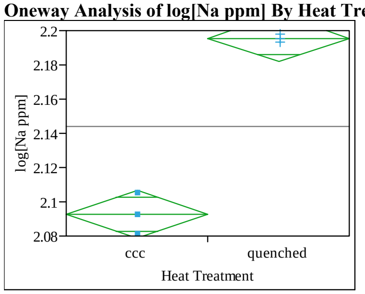
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.31292	0.00343	1.3034	1.3224
quenched	3	1.41402	0.00343	1.4045	1.4236

Std Error uses a pooled estimate of error variance

Exhibit E5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of the Matrix 2A Study Glasses

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=EM-08



Oneway Anova
Summary of Fit

Rsquare	0.981437
Adj Rsquare	0.976797
Root Mean Square Error	0.008663
Mean of Response	2.144166
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.102860	t Ratio	14.54255
Std Err Dif	0.007073	DF	4
Upper CL Dif	0.122498	Prob > |t|	0.0001
Lower CL Dif	0.083222	Prob > t	<.0001
Confidence	0.95	Prob < t	0.9999

Analysis of Variance

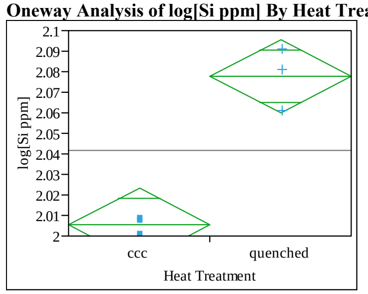
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.01587026	0.015870	211.4857	0.0001
Error	4	0.00030017	0.000075		
C. Total	5	0.01617043			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.09274	0.00500	2.0788	2.1066
quenched	3	2.19560	0.00500	2.1817	2.2095

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=EM-08



Oneway Anova
Summary of Fit

Rsquare	0.940824
Adj Rsquare	0.926031
Root Mean Square Error	0.011103
Mean of Response	2.041658
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.072297	t Ratio	7.974677
Std Err Dif	0.009066	DF	4
Upper CL Dif	0.097468	Prob > |t|	0.0013
Lower CL Dif	0.047127	Prob > t	0.0007
Confidence	0.95	Prob < t	0.9993

Analysis of Variance

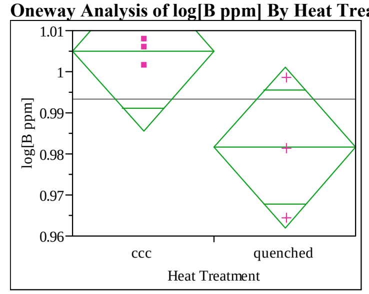
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00784038	0.007840	63.5955	0.0013
Error	4	0.00049314	0.000123		
C. Total	5	0.00833352			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.00551	0.00641	1.9877	2.0233
quenched	3	2.07781	0.00641	2.0600	2.0956

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=EM-09



Oneway Anova
Summary of Fit

Rsquare	0.580089
Adj Rsquare	0.475111
Root Mean Square Error	0.012235
Mean of Response	0.993297
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.02348	t Ratio	-2.35071
Std Err Dif	0.00999	DF	4
Upper CL Dif	0.00425	Prob > |t|	0.0785
Lower CL Dif	-0.05122	Prob > t	0.9608
Confidence	0.95	Prob < t	0.0392

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00082713	0.000827	5.5258	0.0785
Error	4	0.00059874	0.000150		
C. Total	5	0.00142587			

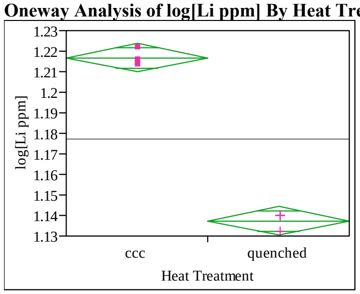
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.00504	0.00706	0.98543	1.0246
quenched	3	0.98156	0.00706	0.96194	1.0012

Std Error uses a pooled estimate of error variance

Exhibit E5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of the Matrix 2A Study Glasses

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=EM-09



Oneway Anova
Summary of Fit

Rsquare	0.991931
Adj Rsquare	0.989914
Root Mean Square Error	0.004389
Mean of Response	1.177155
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.07947	t Ratio	-22.175
Std Err Dif	0.00358	DF	4
Upper CL Dif	-0.06952	Prob > |t|	<.0001
Lower CL Dif	-0.08942	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

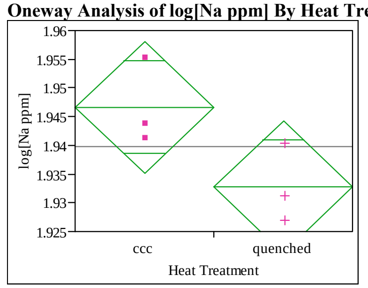
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00947385	0.009474	491.7297	<.0001
Error	4	0.00007707	0.000019		
C. Total	5	0.00955092			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.21689	0.00253	1.2099	1.2239
quenched	3	1.13742	0.00253	1.1304	1.1445

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=EM-09



Oneway Anova
Summary of Fit

Rsquare	0.584643
Adj Rsquare	0.480804
Root Mean Square Error	0.00715
Mean of Response	1.939711
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.01385	t Ratio	-2.37282
Std Err Dif	0.00584	DF	4
Upper CL Dif	0.00236	Prob > |t|	0.0766
Lower CL Dif	-0.03006	Prob > t	0.9617
Confidence	0.95	Prob < t	0.0383

Analysis of Variance

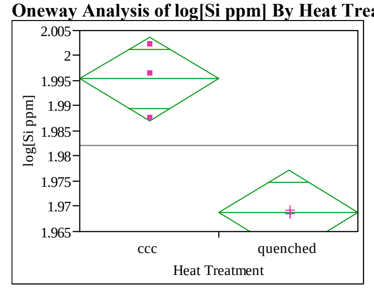
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00028787	0.000288	5.6303	0.0766
Error	4	0.00020451	0.000051		
C. Total	5	0.00049238			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.94664	0.00413	1.9352	1.9581
quenched	3	1.93278	0.00413	1.9213	1.9442

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=EM-09



Oneway Anova
Summary of Fit

Rsquare	0.906723
Adj Rsquare	0.883404
Root Mean Square Error	0.005226
Mean of Response	1.982055
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.02661	t Ratio	-6.23563
Std Err Dif	0.00427	DF	4
Upper CL Dif	-0.01476	Prob > |t|	0.0034
Lower CL Dif	-0.03845	Prob > t	0.9983
Confidence	0.95	Prob < t	0.0017

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00106194	0.001062	38.8831	0.0034
Error	4	0.00010924	0.000027		
C. Total	5	0.00117119			

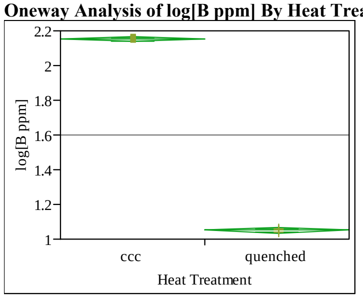
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.99536	0.00302	1.9870	2.0037
quenched	3	1.96875	0.00302	1.9604	1.9771

Std Error uses a pooled estimate of error variance

Exhibit E5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of the Matrix 2A Study Glasses

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=EM-10



Oneway Anova
Summary of Fit

Rsquare	0.999803
Adj Rsquare	0.999753
Root Mean Square Error	0.009475
Mean of Response	1.601383
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-1.1010	t Ratio	-142.319
Std Err Dif	0.0077	DF	4
Upper CL Dif	-1.0795	Prob > |t|	<.0001
Lower CL Dif	-1.1225	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

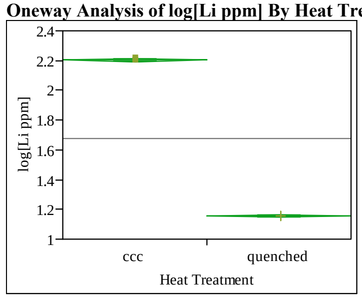
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	1.8183234	1.81832	20254.82	<.0001
Error	4	0.0003591	8.977e-5		
C. Total	5	1.8186825			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.15189	0.00547	2.1367	2.1671
quenched	3	1.05088	0.00547	1.0357	1.0661

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=EM-10



Oneway Anova
Summary of Fit

Rsquare	0.999879
Adj Rsquare	0.999849
Root Mean Square Error	0.007049
Mean of Response	1.679423
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-1.0472	t Ratio	-181.946
Std Err Dif	0.0058	DF	4
Upper CL Dif	-1.0312	Prob > |t|	<.0001
Lower CL Dif	-1.0631	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

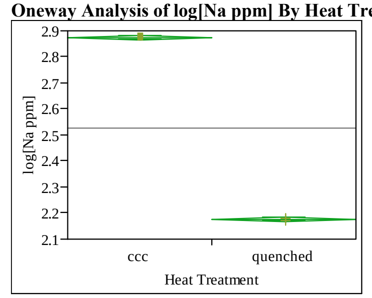
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	1.6447914	1.64479	33104.36	<.0001
Error	4	0.0001987	4.969e-5		
C. Total	5	1.6449901			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.20300	0.00407	2.1917	2.2143
quenched	3	1.15585	0.00407	1.1445	1.1671

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=EM-10



Oneway Anova
Summary of Fit

Rsquare	0.999808
Adj Rsquare	0.99976
Root Mean Square Error	0.005907
Mean of Response	2.525476
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.69658	t Ratio	-144.439
Std Err Dif	0.00482	DF	4
Upper CL Dif	-0.68319	Prob > |t|	<.0001
Lower CL Dif	-0.70996	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.72782524	0.727825	20862.49	<.0001
Error	4	0.00013955	0.000035		
C. Total	5	0.72796479			

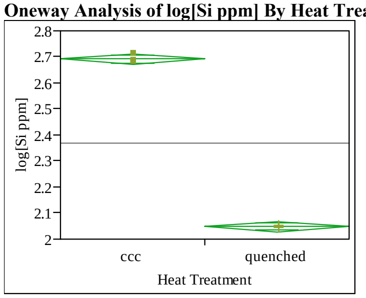
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.87376	0.00341	2.8643	2.8832
quenched	3	2.17719	0.00341	2.1677	2.1867

Std Error uses a pooled estimate of error variance

Exhibit E5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of the Matrix 2A Study Glasses

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=EM-10



Oneway Anova
Summary of Fit

Rsquare	0.998946
Adj Rsquare	0.998682
Root Mean Square Error	0.012804
Mean of Response	2.37014
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.64360	t Ratio	-61.5604
Std Err Dif	0.01045	DF	4
Upper CL Dif	-0.61457	Prob > |t|	<.0001
Lower CL Dif	-0.67263	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

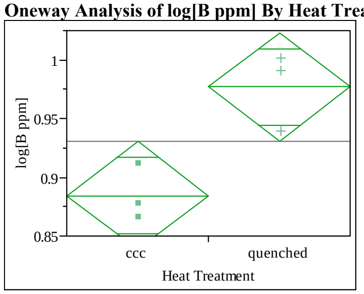
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.62133160	0.621332	3789.687	<.0001
Error	4	0.00065581	0.000164		
C. Total	5	0.62198741			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.69194	0.00739	2.6714	2.7125
quenched	3	2.04834	0.00739	2.0278	2.0689

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=EM-11



Oneway Anova
Summary of Fit

Rsquare	0.795083
Adj Rsquare	0.743854
Root Mean Square Error	0.028809
Mean of Response	0.930825
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.092668	t Ratio	3.939557
Std Err Dif	0.023523	DF	4
Upper CL Dif	0.157977	Prob > |t|	0.0170
Lower CL Dif	0.027359	Prob > t	0.0085
Confidence	0.95	Prob < t	0.9915

Analysis of Variance

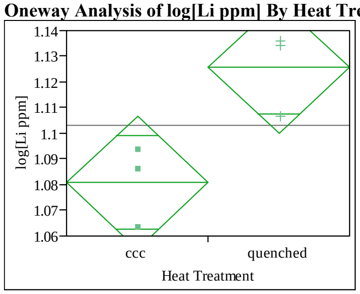
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.01288114	0.012881	15.5201	0.0170
Error	4	0.00331986	0.000830		
C. Total	5	0.01620100			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	0.884491	0.01663	0.83831	0.9307
quenched	3	0.977159	0.01663	0.93098	1.0233

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=EM-11



Oneway Anova
Summary of Fit

Rsquare	0.744164
Adj Rsquare	0.680205
Root Mean Square Error	0.016099
Mean of Response	1.103226
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.044837	t Ratio	3.411017
Std Err Dif	0.013145	DF	4
Upper CL Dif	0.081333	Prob > |t|	0.0270
Lower CL Dif	0.008341	Prob > t	0.0135
Confidence	0.95	Prob < t	0.9865

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00301553	0.003016	11.6350	0.0270
Error	4	0.00103670	0.000259		
C. Total	5	0.00405223			

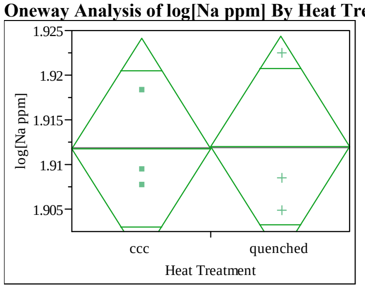
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.08081	0.00929	1.0550	1.1066
quenched	3	1.12564	0.00929	1.0998	1.1515

Std Error uses a pooled estimate of error variance

Exhibit E5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of the Matrix 2A Study Glasses

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=EM-11



Oneway Anova
Summary of Fit

Rsquare	0.000403
Adj Rsquare	-0.2495
Root Mean Square Error	0.007726
Mean of Response	1.91186
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.00025	t Ratio	0.040155
Std Err Dif	0.00631	DF	4
Upper CL Dif	0.01777	Prob > |t|	0.9699
Lower CL Dif	-0.01726	Prob > t	0.4849
Confidence	0.95	Prob < t	0.5151

Analysis of Variance

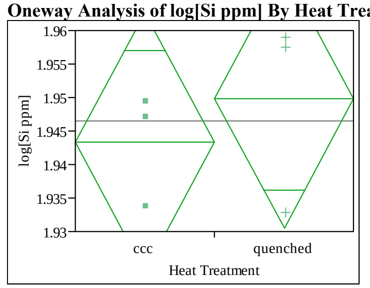
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	9.62505e-8	9.625e-8	0.0016	0.9699
Error	4	0.00023877	0.000060		
C. Total	5	0.00023887			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.91173	0.00446	1.8993	1.9241
quenched	3	1.91199	0.00446	1.8996	1.9244

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=EM-11



Oneway Anova
Summary of Fit

Rsquare	0.097423
Adj Rsquare	-0.12822
Root Mean Square Error	0.011998
Mean of Response	1.946557
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.00644	t Ratio	0.657082
Std Err Dif	0.00980	DF	4
Upper CL Dif	0.03364	Prob > |t|	0.5470
Lower CL Dif	-0.02076	Prob > t	0.2735
Confidence	0.95	Prob < t	0.7265

Analysis of Variance

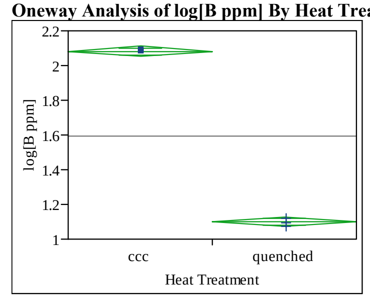
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00006216	0.000062	0.4318	0.5470
Error	4	0.00057585	0.000144		
C. Total	5	0.00063801			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.94334	0.00693	1.9241	1.9626
quenched	3	1.94978	0.00693	1.9305	1.9690

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=EM-12



Oneway Anova
Summary of Fit

Rsquare	0.999174
Adj Rsquare	0.998968
Root Mean Square Error	0.017339
Mean of Response	1.590495
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.9850	t Ratio	-69.5727
Std Err Dif	0.0142	DF	4
Upper CL Dif	-0.9457	Prob > |t|	<.0001
Lower CL Dif	-1.0243	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	1.4552125	1.45521	4840.362	<.0001
Error	4	0.0012026	0.00030		
C. Total	5	1.4564151			

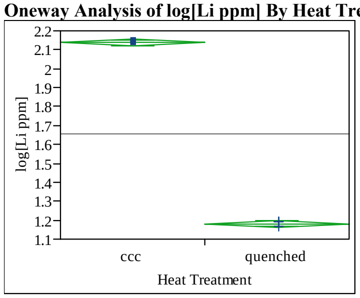
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.08297	0.01001	2.0552	2.1108
quenched	3	1.09802	0.01001	1.0702	1.1258

Std Error uses a pooled estimate of error variance

Exhibit E5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of the Matrix 2A Study Glasses

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=EM-12



Oneway Anova
Summary of Fit

Rsquare	0.99961
Adj Rsquare	0.999513
Root Mean Square Error	0.011543
Mean of Response	1.659092
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.95451	t Ratio	-101.275
Std Err Dif	0.00942	DF	4
Upper CL Dif	-0.92834	Prob > |t|	<.0001
Lower CL Dif	-0.98068	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

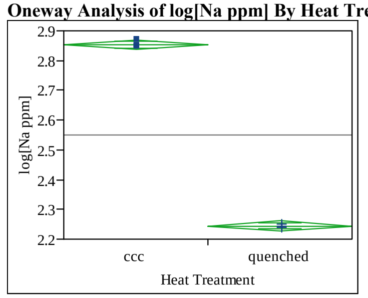
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	1.3666411	1.36664	10256.58	<.0001
Error	4	0.0005330	0.00013		
C. Total	5	1.3671741			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.13635	0.00666	2.1178	2.1549
quenched	3	1.18184	0.00666	1.1633	1.2003

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=EM-12



Oneway Anova
Summary of Fit

Rsquare	0.999291
Adj Rsquare	0.999114
Root Mean Square Error	0.009938
Mean of Response	2.549124
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.60946	t Ratio	-75.109
Std Err Dif	0.00811	DF	4
Upper CL Dif	-0.58693	Prob > |t|	<.0001
Lower CL Dif	-0.63199	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

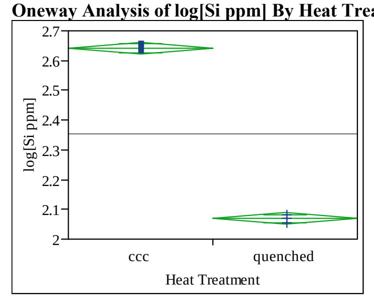
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.55716648	0.557166	5641.355	<.0001
Error	4	0.00039506	0.000099		
C. Total	5	0.55756154			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.85386	0.00574	2.8379	2.8698
quenched	3	2.24439	0.00574	2.2285	2.2603

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=EM-12



Oneway Anova
Summary of Fit

Rsquare	0.998812
Adj Rsquare	0.998515
Root Mean Square Error	0.01211
Mean of Response	2.354995
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.57346	t Ratio	-57.9963
Std Err Dif	0.00989	DF	4
Upper CL Dif	-0.54600	Prob > |t|	<.0001
Lower CL Dif	-0.60091	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.49328096	0.493281	3363.573	<.0001
Error	4	0.00058662	0.000147		
C. Total	5	0.49386757			

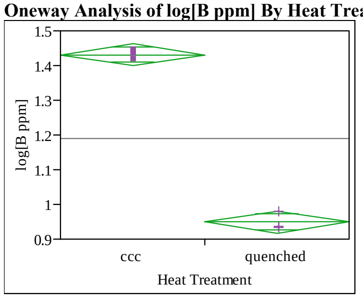
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.64172	0.00699	2.6223	2.6611
quenched	3	2.06827	0.00699	2.0489	2.0877

Std Error uses a pooled estimate of error variance

Exhibit E5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of the Matrix 2A Study Glasses

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=EM-13



Oneway Anova
Summary of Fit

Rsquare	0.995559
Adj Rsquare	0.994449
Root Mean Square Error	0.019695
Mean of Response	1.190492
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.48153	t Ratio	-29.9443
Std Err Dif	0.01608	DF	4
Upper CL Dif	-0.43688	Prob > |t|	<.0001
Lower CL Dif	-0.52618	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

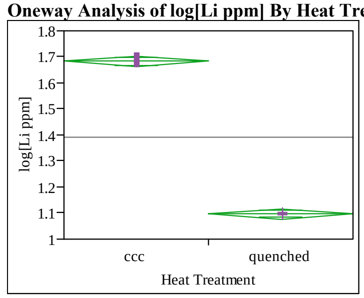
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.34780414	0.347804	896.6613	<.0001
Error	4	0.00155155	0.000388		
C. Total	5	0.34935569			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.43126	0.01137	1.3997	1.4628
quenched	3	0.94973	0.01137	0.9182	0.9813

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=EM-13



Oneway Anova
Summary of Fit

Rsquare	0.99876
Adj Rsquare	0.998451
Root Mean Square Error	0.012641
Mean of Response	1.390061
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.58593	t Ratio	-56.7703
Std Err Dif	0.01032	DF	4
Upper CL Dif	-0.55728	Prob > |t|	<.0001
Lower CL Dif	-0.61459	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

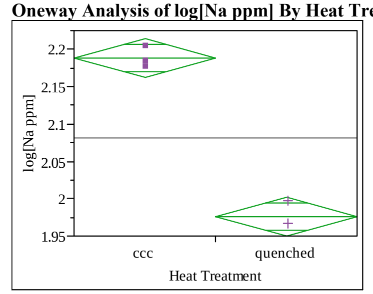
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.51497451	0.514975	3222.869	<.0001
Error	4	0.00063915	0.000160		
C. Total	5	0.51561366			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.68303	0.00730	1.6628	1.7033
quenched	3	1.09710	0.00730	1.0768	1.1174

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=EM-13



Oneway Anova
Summary of Fit

Rsquare	0.984281
Adj Rsquare	0.980352
Root Mean Square Error	0.016357
Mean of Response	2.082151
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.21136	t Ratio	-15.8265
Std Err Dif	0.01336	DF	4
Upper CL Dif	-0.17428	Prob > |t|	<.0001
Lower CL Dif	-0.24844	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.06701257	0.067013	250.4767	<.0001
Error	4	0.00107016	0.000268		
C. Total	5	0.06808273			

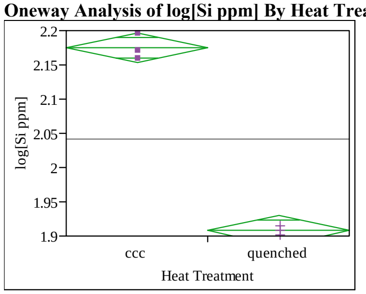
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.18783	0.00944	2.1616	2.2141
quenched	3	1.97647	0.00944	1.9502	2.0027

Std Error uses a pooled estimate of error variance

Exhibit E5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of the Matrix 2A Study Glasses

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=EM-13



Oneway Anova
Summary of Fit

Rsquare	0.993036
Adj Rsquare	0.991295
Root Mean Square Error	0.013685
Mean of Response	2.041291
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.26686	t Ratio	-23.8827
Std Err Dif	0.01117	DF	4
Upper CL Dif	-0.23583	Prob > |t|	<.0001
Lower CL Dif	-0.29788	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

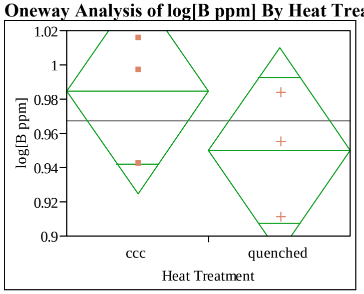
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.10681790	0.106818	570.3818	<.0001
Error	4	0.00074910	0.000187		
C. Total	5	0.10756699			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.17472	0.00790	2.1528	2.1967
quenched	3	1.90786	0.00790	1.8859	1.9298

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=EM-14



Oneway Anova
Summary of Fit

Rsquare	0.243929
Adj Rsquare	0.054911
Root Mean Square Error	0.037386
Mean of Response	0.967341
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.03468	t Ratio	-1.13601
Std Err Dif	0.03053	DF	4
Upper CL Dif	0.05008	Prob > |t|	0.3194
Lower CL Dif	-0.11943	Prob > t	0.8403
Confidence	0.95	Prob < t	0.1597

Analysis of Variance

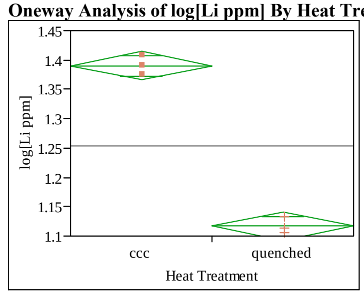
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00180380	0.001804	1.2905	0.3194
Error	4	0.00559097	0.001398		
C. Total	5	0.00739477			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	0.984680	0.02159	0.92475	1.0446
quenched	3	0.950002	0.02159	0.89007	1.0099

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=EM-14



Oneway Anova
Summary of Fit

Rsquare	0.99178
Adj Rsquare	0.989725
Root Mean Square Error	0.015231
Mean of Response	1.253357
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.27320	t Ratio	-21.9685
Std Err Dif	0.01244	DF	4
Upper CL Dif	-0.23867	Prob > |t|	<.0001
Lower CL Dif	-0.30773	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.11195729	0.111957	482.6162	<.0001
Error	4	0.00092792	0.000232		
C. Total	5	0.11288521			

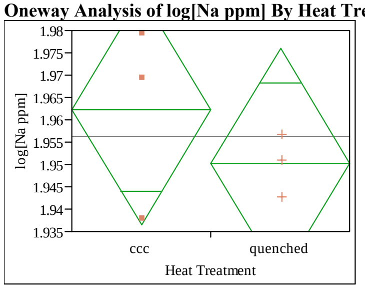
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.38996	0.00879	1.3655	1.4144
quenched	3	1.11676	0.00879	1.0923	1.1412

Std Error uses a pooled estimate of error variance

Exhibit E5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of the Matrix 2A Study Glasses

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=EM-14



Oneway Anova
Summary of Fit

Rsquare	0.172293
Adj Rsquare	-0.03463
Root Mean Square Error	0.016044
Mean of Response	1.956151
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.01195	t Ratio	-0.91248
Std Err Dif	0.01310	DF	4
Upper CL Dif	0.02442	Prob > |t|	0.4131
Lower CL Dif	-0.04833	Prob > t	0.7934
Confidence	0.95	Prob < t	0.2066

Analysis of Variance

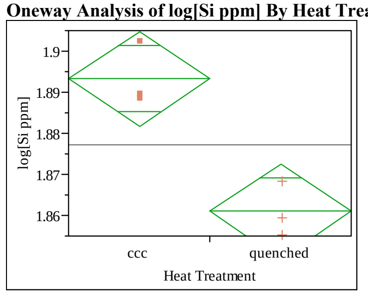
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00021433	0.000214	0.8326	0.4131
Error	4	0.00102967	0.000257		
C. Total	5	0.00124400			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.96213	0.00926	1.9364	1.9878
quenched	3	1.95017	0.00926	1.9245	1.9759

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=EM-14



Oneway Anova
Summary of Fit

Rsquare	0.883321
Adj Rsquare	0.854152
Root Mean Square Error	0.007192
Mean of Response	1.877135
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.03231	t Ratio	-5.50293
Std Err Dif	0.00587	DF	4
Upper CL Dif	-0.01601	Prob > |t|	0.0053
Lower CL Dif	-0.04862	Prob > t	0.9973
Confidence	0.95	Prob < t	0.0027

Analysis of Variance

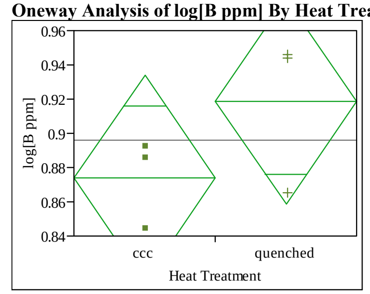
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00156637	0.001566	30.2822	0.0053
Error	4	0.00020690	0.000052		
C. Total	5	0.00177328			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.89329	0.00415	1.8818	1.9048
quenched	3	1.86098	0.00415	1.8494	1.8725

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=EM-15



Oneway Anova
Summary of Fit

Rsquare	0.346855
Adj Rsquare	0.183569
Root Mean Square Error	0.03736
Mean of Response	0.896141
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.04446	t Ratio	1.45747
Std Err Dif	0.03050	DF	4
Upper CL Dif	0.12915	Prob > |t|	0.2187
Lower CL Dif	-0.04023	Prob > t	0.1094
Confidence	0.95	Prob < t	0.8906

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00296496	0.002965	2.1242	0.2187
Error	4	0.00558316	0.001396		
C. Total	5	0.00854813			

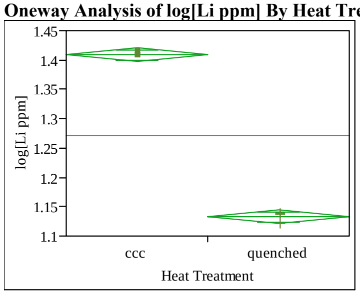
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	0.873911	0.02157	0.81402	0.93380
quenched	3	0.918370	0.02157	0.85848	0.97826

Std Error uses a pooled estimate of error variance

Exhibit E5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of the Matrix 2A Study Glasses

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=EM-15



Oneway Anova
Summary of Fit

Rsquare	0.998089
Adj Rsquare	0.997611
Root Mean Square Error	0.007392
Mean of Response	1.270507
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.27584	t Ratio	-45.7061
Std Err Dif	0.00604	DF	4
Upper CL Dif	-0.25909	Prob > |t|	<.0001
Lower CL Dif	-0.29260	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

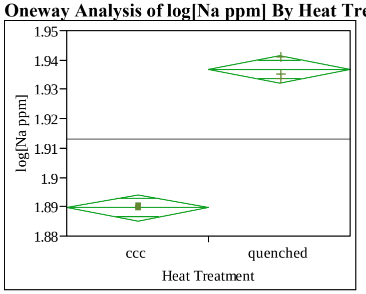
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.11413545	0.114135	2089.044	<.0001
Error	4	0.00021854	0.000055		
C. Total	5	0.11435399			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.40843	0.00427	1.3966	1.4203
quenched	3	1.13258	0.00427	1.1207	1.1444

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=EM-15



Oneway Anova
Summary of Fit

Rsquare	0.990549
Adj Rsquare	0.988186
Root Mean Square Error	0.002818
Mean of Response	1.913178
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.047112	t Ratio	20.47504
Std Err Dif	0.002301	DF	4
Upper CL Dif	0.053501	Prob > |t|	<.0001
Lower CL Dif	0.040724	Prob > t	<.0001
Confidence	0.95	Prob < t	1.0000

Analysis of Variance

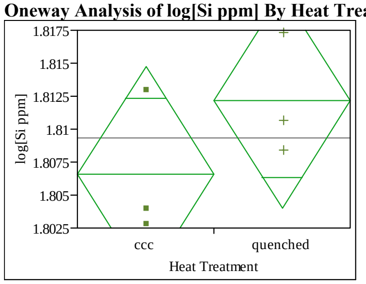
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00332937	0.003329	419.2275	<.0001
Error	4	0.00003177	7.942e-6		
C. Total	5	0.00336114			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.88962	0.00163	1.8851	1.8941
quenched	3	1.93673	0.00163	1.9322	1.9413

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=EM-15



Oneway Anova
Summary of Fit

Rsquare	0.311691
Adj Rsquare	0.139614
Root Mean Square Error	0.005115
Mean of Response	1.809352
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.00562	t Ratio	1.345861
Std Err Dif	0.00418	DF	4
Upper CL Dif	0.01722	Prob > |t|	0.2496
Lower CL Dif	-0.00597	Prob > t	0.1248
Confidence	0.95	Prob < t	0.8752

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00004739	0.000047	1.8113	0.2496
Error	4	0.00010465	0.000026		
C. Total	5	0.00015204			

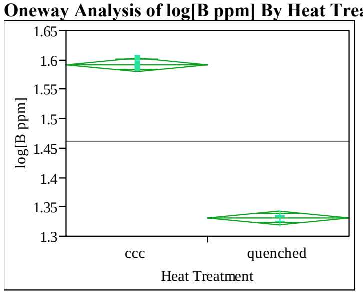
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.80654	0.00295	1.7983	1.8147
quenched	3	1.81216	0.00295	1.8040	1.8204

Std Error uses a pooled estimate of error variance

Exhibit E5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of the Matrix 2A Study Glasses

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=EM-16



Oneway Anova
Summary of Fit

Rsquare	0.99779
Adj Rsquare	0.997237
Root Mean Square Error	0.007521
Mean of Response	1.461773
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.26094	t Ratio	-42.4945
Std Err Dif	0.00614	DF	4
Upper CL Dif	-0.24389	Prob > |t|	<.0001
Lower CL Dif	-0.27799	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

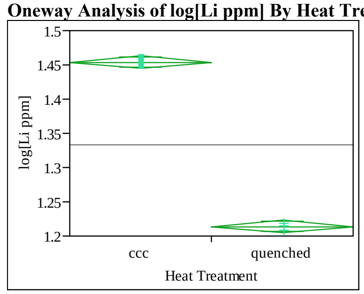
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.10213404	0.102134	1805.781	<.0001
Error	4	0.00022624	0.000057		
C. Total	5	0.10236028			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.59224	0.00434	1.5802	1.6043
quenched	3	1.33130	0.00434	1.3192	1.3434

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=EM-16



Oneway Anova
Summary of Fit

Rsquare	0.998292
Adj Rsquare	0.997866
Root Mean Square Error	0.006075
Mean of Response	1.334033
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.23988	t Ratio	-48.3591
Std Err Dif	0.00496	DF	4
Upper CL Dif	-0.22611	Prob > |t|	<.0001
Lower CL Dif	-0.25366	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

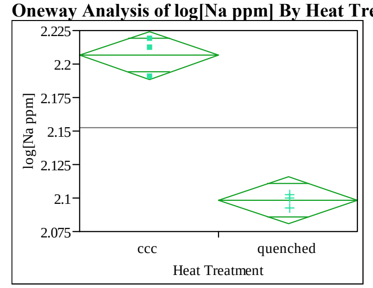
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.08631601	0.086316	2338.598	<.0001
Error	4	0.00014764	0.000037		
C. Total	5	0.08646365			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.45397	0.00351	1.4442	1.4637
quenched	3	1.21409	0.00351	1.2044	1.2238

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=EM-16



Oneway Anova
Summary of Fit

Rsquare	0.972723
Adj Rsquare	0.965903
Root Mean Square Error	0.011068
Mean of Response	2.152404
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.10793	t Ratio	-11.9433
Std Err Dif	0.00904	DF	4
Upper CL Dif	-0.08284	Prob > |t|	0.0003
Lower CL Dif	-0.13302	Prob > t	0.9999
Confidence	0.95	Prob < t	0.0001

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.01747440	0.017474	142.6425	0.0003
Error	4	0.00049002	0.000123		
C. Total	5	0.01796441			

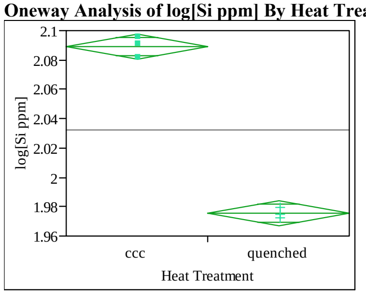
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.20637	0.00639	2.1886	2.2241
quenched	3	2.09844	0.00639	2.0807	2.1162

Std Error uses a pooled estimate of error variance

Exhibit E5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of the Matrix 2A Study Glasses

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=EM-16



Oneway Anova
Summary of Fit

Rsquare	0.993856
Adj Rsquare	0.99232
Root Mean Square Error	0.005473
Mean of Response	2.032262
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.11366	t Ratio	-25.4368
Std Err Dif	0.00447	DF	4
Upper CL Dif	-0.10125	Prob > |t|	<.0001
Lower CL Dif	-0.12607	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

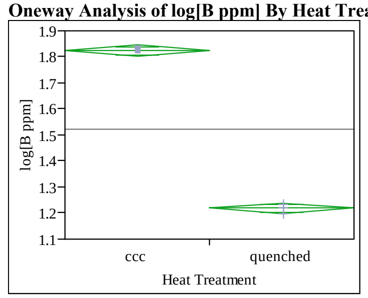
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.01937821	0.019378	647.0330	<.0001
Error	4	0.00011980	0.000030		
C. Total	5	0.01949800			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.08909	0.00316	2.0803	2.0979
quenched	3	1.97543	0.00316	1.9667	1.9842

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=EM-17



Oneway Anova
Summary of Fit

Rsquare	0.998635
Adj Rsquare	0.998293
Root Mean Square Error	0.013721
Mean of Response	1.520926
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.60596	t Ratio	-54.0882
Std Err Dif	0.01120	DF	4
Upper CL Dif	-0.57485	Prob > |t|	<.0001
Lower CL Dif	-0.63706	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

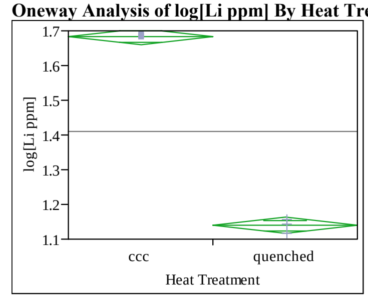
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.55077870	0.550779	2925.536	<.0001
Error	4	0.00075306	0.000188		
C. Total	5	0.55153176			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.82391	0.00792	1.8019	1.8459
quenched	3	1.21795	0.00792	1.1960	1.2399

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=EM-17



Oneway Anova
Summary of Fit

Rsquare	0.998122
Adj Rsquare	0.997653
Root Mean Square Error	0.014469
Mean of Response	1.410887
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.54472	t Ratio	-46.1083
Std Err Dif	0.01181	DF	4
Upper CL Dif	-0.51192	Prob > |t|	<.0001
Lower CL Dif	-0.57752	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.44507409	0.445074	2125.978	<.0001
Error	4	0.00083740	0.000209		
C. Total	5	0.44591149			

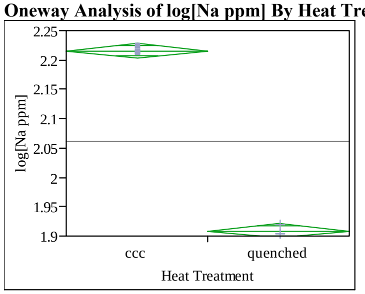
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.68324	0.00835	1.6601	1.7064
quenched	3	1.13853	0.00835	1.1153	1.1617

Std Error uses a pooled estimate of error variance

Exhibit E5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of the Matrix 2A Study Glasses

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=EM-17



Oneway Anova
Summary of Fit

Rsquare	0.998463
Adj Rsquare	0.998079
Root Mean Square Error	0.007378
Mean of Response	2.062294
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.30713	t Ratio	-50.9828
Std Err Dif	0.00602	DF	4
Upper CL Dif	-0.29040	Prob > |t|	<.0001
Lower CL Dif	-0.32386	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

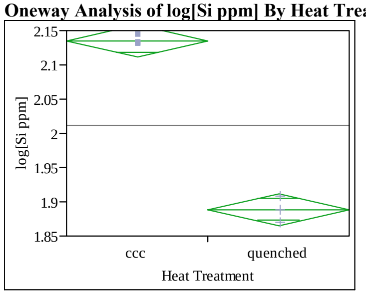
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.14149338	0.141493	2599.250	<.0001
Error	4	0.00021774	0.000054		
C. Total	5	0.14171112			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.21586	0.00426	2.2040	2.2277
quenched	3	1.90873	0.00426	1.8969	1.9206

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=EM-17



Oneway Anova
Summary of Fit

Rsquare	0.990829
Adj Rsquare	0.988536
Root Mean Square Error	0.014497
Mean of Response	2.012064
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.24607	t Ratio	-20.7881
Std Err Dif	0.01184	DF	4
Upper CL Dif	-0.21321	Prob > |t|	<.0001
Lower CL Dif	-0.27894	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

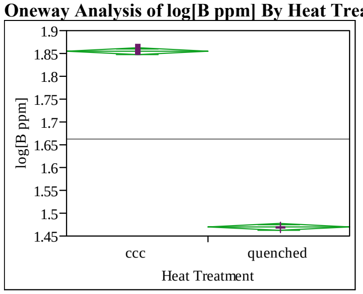
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.09082647	0.090826	432.1464	<.0001
Error	4	0.00084070	0.000210		
C. Total	5	0.09166717			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.13510	0.00837	2.1119	2.1583
quenched	3	1.88903	0.00837	1.8658	1.9123

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=EM-18



Oneway Anova
Summary of Fit

Rsquare	0.999603
Adj Rsquare	0.999504
Root Mean Square Error	0.004697
Mean of Response	1.661478
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.38493	t Ratio	-100.372
Std Err Dif	0.00384	DF	4
Upper CL Dif	-0.37429	Prob > |t|	<.0001
Lower CL Dif	-0.39558	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.22226156	0.222262	10074.58	<.0001
Error	4	0.00008825	0.000022		
C. Total	5	0.22234981			

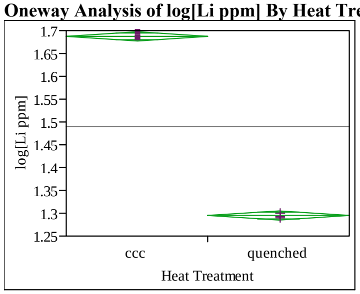
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.85394	0.00271	1.8464	1.8615
quenched	3	1.46901	0.00271	1.4615	1.4765

Std Error uses a pooled estimate of error variance

Exhibit E5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of the Matrix 2A Study Glasses

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=EM-18



Oneway Anova
Summary of Fit

Rsquare	0.999217
Adj Rsquare	0.999021
Root Mean Square Error	0.006724
Mean of Response	1.491068
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.39225	t Ratio	-71.4437
Std Err Dif	0.00549	DF	4
Upper CL Dif	-0.37701	Prob > |t|	<.0001
Lower CL Dif	-0.40750	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

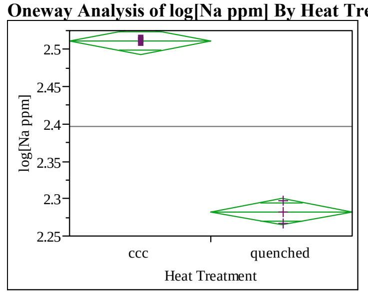
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.23079513	0.230795	5104.209	<.0001
Error	4	0.00018087	0.000045		
C. Total	5	0.23097599			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.68719	0.00388	1.6764	1.6980
quenched	3	1.29494	0.00388	1.2842	1.3057

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=EM-18



Oneway Anova
Summary of Fit

Rsquare	0.993921
Adj Rsquare	0.992402
Root Mean Square Error	0.010955
Mean of Response	2.39676
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.22876	t Ratio	-25.5741
Std Err Dif	0.00894	DF	4
Upper CL Dif	-0.20392	Prob > |t|	<.0001
Lower CL Dif	-0.25360	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

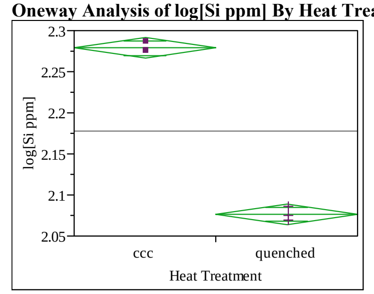
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.07849675	0.078497	654.0368	<.0001
Error	4	0.00048008	0.000120		
C. Total	5	0.07897683			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.51114	0.00633	2.4936	2.5287
quenched	3	2.28238	0.00633	2.2648	2.2999

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=EM-18



Oneway Anova
Summary of Fit

Rsquare	0.996175
Adj Rsquare	0.995218
Root Mean Square Error	0.007681
Mean of Response	2.177519
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.20242	t Ratio	-32.2748
Std Err Dif	0.00627	DF	4
Upper CL Dif	-0.18501	Prob > |t|	<.0001
Lower CL Dif	-0.21983	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.06146123	0.061461	1041.664	<.0001
Error	4	0.00023601	0.000059		
C. Total	5	0.06169724			

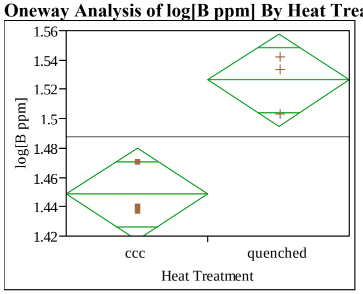
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.27873	0.00443	2.2664	2.2910
quenched	3	2.07631	0.00443	2.0640	2.0886

Std Error uses a pooled estimate of error variance

Exhibit E5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of the Matrix 2A Study Glasses

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=EM-19



Oneway Anova
Summary of Fit

Rsquare	0.855292
Adj Rsquare	0.819115
Root Mean Square Error	0.019532
Mean of Response	1.487397
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.077544	t Ratio	4.862295
Std Err Dif	0.015948	DF	4
Upper CL Dif	0.121823	Prob > |t|	0.0083
Lower CL Dif	0.033265	Prob > t	0.0041
Confidence	0.95	Prob < t	0.9959

Analysis of Variance

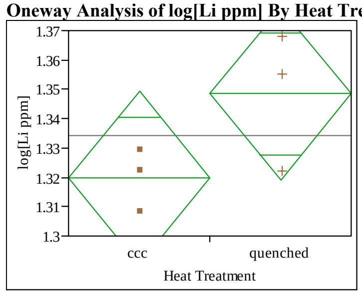
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00901964	0.009020	23.6419	0.0083
Error	4	0.00152604	0.000382		
C. Total	5	0.01054569			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.44862	0.01128	1.4173	1.4799
quenched	3	1.52617	0.01128	1.4949	1.5575

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=EM-19



Oneway Anova
Summary of Fit

Rsquare	0.479072
Adj Rsquare	0.34884
Root Mean Square Error	0.018326
Mean of Response	1.334187
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.02870	t Ratio	1.917969
Std Err Dif	0.01496	DF	4
Upper CL Dif	0.07024	Prob > |t|	0.1276
Lower CL Dif	-0.01285	Prob > t	0.0638
Confidence	0.95	Prob < t	0.9362

Analysis of Variance

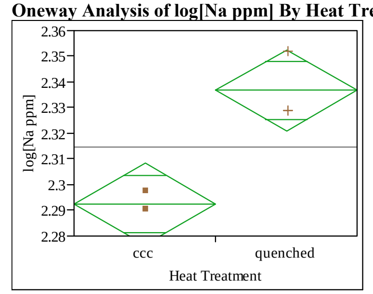
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00123545	0.001235	3.6786	0.1276
Error	4	0.00134339	0.000336		
C. Total	5	0.00257885			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.31984	0.01058	1.2905	1.3492
quenched	3	1.34854	0.01058	1.3192	1.3779

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=EM-19



Oneway Anova
Summary of Fit

Rsquare	0.882225
Adj Rsquare	0.852781
Root Mean Square Error	0.009907
Mean of Response	2.314636
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.044278	t Ratio	5.473856
Std Err Dif	0.008089	DF	4
Upper CL Dif	0.066737	Prob > |t|	0.0054
Lower CL Dif	0.021820	Prob > t	0.0027
Confidence	0.95	Prob < t	0.9973

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00294086	0.002941	29.9631	0.0054
Error	4	0.00039260	0.000098		
C. Total	5	0.00333345			

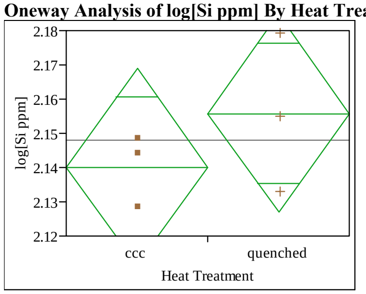
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.29250	0.00572	2.2766	2.3084
quenched	3	2.33678	0.00572	2.3209	2.3527

Std Error uses a pooled estimate of error variance

Exhibit E5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of the Matrix 2A Study Glasses

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=EM-19



Oneway Anova
Summary of Fit

Rsquare	0.219271
Adj Rsquare	0.024088
Root Mean Square Error	0.01805
Mean of Response	2.147962
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.01562	t Ratio	1.059912
Std Err Dif	0.01474	DF	4
Upper CL Dif	0.05654	Prob > |t|	0.3489
Lower CL Dif	-0.02530	Prob > t	0.1745
Confidence	0.95	Prob < t	0.8255

Analysis of Variance

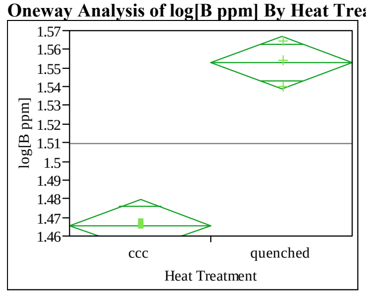
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00036601	0.000366	1.1234	0.3489
Error	4	0.00130320	0.000326		
C. Total	5	0.00166920			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.14015	0.01042	2.1112	2.1691
quenched	3	2.15577	0.01042	2.1268	2.1847

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=EM-20



Oneway Anova
Summary of Fit

Rsquare	0.973989
Adj Rsquare	0.967486
Root Mean Square Error	0.008718
Mean of Response	1.509276
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.087112	t Ratio	12.23847
Std Err Dif	0.007118	DF	4
Upper CL Dif	0.106874	Prob > |t|	0.0003
Lower CL Dif	0.067350	Prob > t	0.0001
Confidence	0.95	Prob < t	0.9999

Analysis of Variance

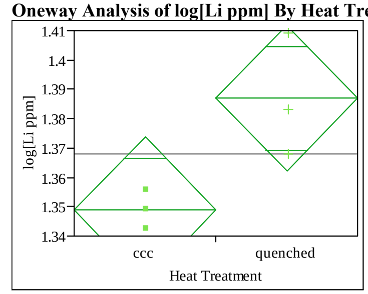
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.01138273	0.011383	149.7802	0.0003
Error	4	0.00030398	0.000076		
C. Total	5	0.01168671			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.46572	0.00503	1.4517	1.4797
quenched	3	1.55283	0.00503	1.5389	1.5668

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=EM-20



Oneway Anova
Summary of Fit

Rsquare	0.69202
Adj Rsquare	0.615025
Root Mean Square Error	0.015497
Mean of Response	1.367897
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.037933	t Ratio	2.997977
Std Err Dif	0.012653	DF	4
Upper CL Dif	0.073063	Prob > |t|	0.0400
Lower CL Dif	0.002803	Prob > t	0.0200
Confidence	0.95	Prob < t	0.9800

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00215837	0.002158	8.9879	0.0400
Error	4	0.00096057	0.000240		
C. Total	5	0.00311895			

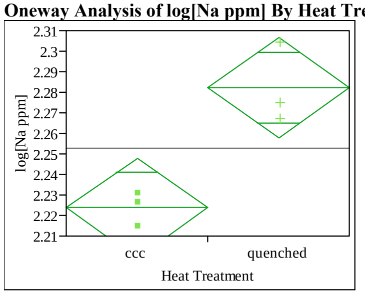
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.34893	0.00895	1.3241	1.3738
quenched	3	1.38686	0.00895	1.3620	1.4117

Std Error uses a pooled estimate of error variance

Exhibit E5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of the Matrix 2A Study Glasses

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=EM-20



Oneway Anova
Summary of Fit

Rsquare	0.848312
Adj Rsquare	0.81039
Root Mean Square Error	0.015167
Mean of Response	2.252968
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.058571	t Ratio	4.729688
Std Err Dif	0.012384	DF	4
Upper CL Dif	0.092953	Prob > |t|	0.0091
Lower CL Dif	0.024188	Prob > t	0.0046
Confidence	0.95	Prob < t	0.9954

Analysis of Variance

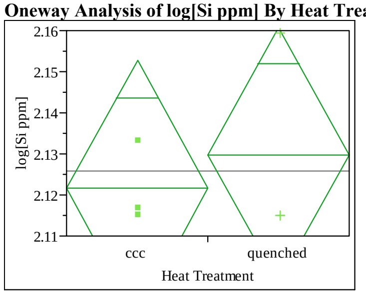
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00514577	0.005146	22.3699	0.0091
Error	4	0.00092012	0.000230		
C. Total	5	0.00606589			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.22368	0.00876	2.1994	2.2480
quenched	3	2.28225	0.00876	2.2579	2.3066

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=EM-20



Oneway Anova
Summary of Fit

Rsquare	0.063245
Adj Rsquare	-0.17094
Root Mean Square Error	0.019402
Mean of Response	2.125718
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.00823	t Ratio	0.519671
Std Err Dif	0.01584	DF	4
Upper CL Dif	0.05222	Prob > |t|	0.6307
Lower CL Dif	-0.03575	Prob > t	0.3154
Confidence	0.95	Prob < t	0.6846

Analysis of Variance

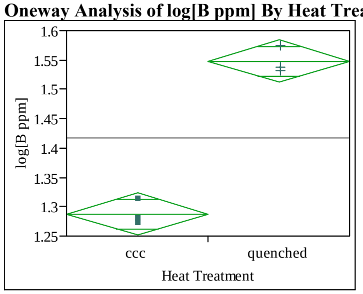
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00010166	0.000102	0.2701	0.6307
Error	4	0.00150575	0.000376		
C. Total	5	0.00160741			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.12160	0.01120	2.0905	2.1527
quenched	3	2.12983	0.01120	2.0987	2.1609

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=EM-21



Oneway Anova
Summary of Fit

Rsquare	0.98085
Adj Rsquare	0.976063
Root Mean Square Error	0.022297
Mean of Response	1.417493
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.260585	t Ratio	14.31372
Std Err Dif	0.018205	DF	4
Upper CL Dif	0.311131	Prob > |t|	0.0001
Lower CL Dif	0.210039	Prob > t	<.0001
Confidence	0.95	Prob < t	0.9999

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.10185683	0.101857	204.8827	0.0001
Error	4	0.00198859	0.000497		
C. Total	5	0.10384541			

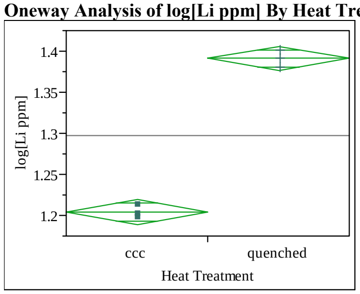
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.28720	0.01287	1.2515	1.3229
quenched	3	1.54779	0.01287	1.5120	1.5835

Std Error uses a pooled estimate of error variance

Exhibit E5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of the Matrix 2A Study Glasses

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=EM-21



Oneway Anova
Summary of Fit

Rsquare	0.99344
Adj Rsquare	0.991801
Root Mean Square Error	0.009304
Mean of Response	1.297568
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.186980	t Ratio	24.61293
Std Err Dif	0.007597	DF	4
Upper CL Dif	0.208072	Prob > |t|	<.0001
Lower CL Dif	0.165888	Prob > t	<.0001
Confidence	0.95	Prob < t	1.0000

Analysis of Variance

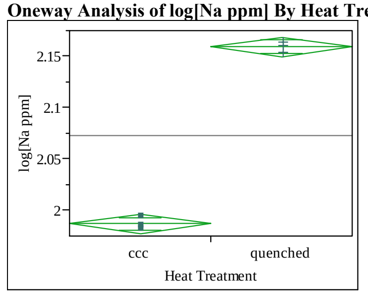
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.05244226	0.052442	605.7964	<.0001
Error	4	0.00034627	0.000087		
C. Total	5	0.05278853			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.20408	0.00537	1.1892	1.2190
quenched	3	1.39106	0.00537	1.3761	1.4060

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=EM-21



Oneway Anova
Summary of Fit

Rsquare	0.996981
Adj Rsquare	0.996226
Root Mean Square Error	0.005811
Mean of Response	2.072968
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.172443	t Ratio	36.34575
Std Err Dif	0.004745	DF	4
Upper CL Dif	0.185616	Prob > |t|	<.0001
Lower CL Dif	0.159270	Prob > t	<.0001
Confidence	0.95	Prob < t	1.0000

Analysis of Variance

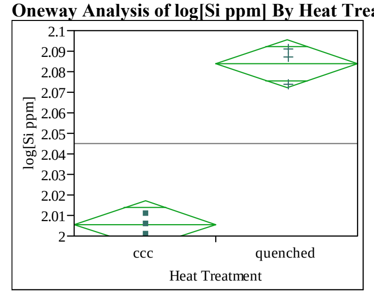
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.04460491	0.044605	1321.013	<.0001
Error	4	0.00013506	0.000034		
C. Total	5	0.04473997			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.98675	0.00335	1.9774	1.9961
quenched	3	2.15919	0.00335	2.1499	2.1685

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=EM-21



Oneway Anova
Summary of Fit

Rsquare	0.977136
Adj Rsquare	0.97142
Root Mean Square Error	0.007324
Mean of Response	2.044834
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.078184	t Ratio	13.07462
Std Err Dif	0.005980	DF	4
Upper CL Dif	0.094787	Prob > |t|	0.0002
Lower CL Dif	0.061581	Prob > t	<.0001
Confidence	0.95	Prob < t	0.9999

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00916912	0.009169	170.9457	0.0002
Error	4	0.00021455	0.000054		
C. Total	5	0.00938367			

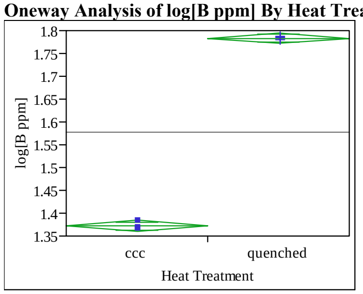
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.00574	0.00423	1.9940	2.0175
quenched	3	2.08393	0.00423	2.0722	2.0957

Std Error uses a pooled estimate of error variance

Exhibit E5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of the Matrix 2A Study Glasses

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=EM-22



Oneway Anova
Summary of Fit

Rsquare	0.999136
Adj Rsquare	0.99892
Root Mean Square Error	0.007408
Mean of Response	1.577687
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.411318	t Ratio	68.00057
Std Err Dif	0.006049	DF	4
Upper CL Dif	0.428112	Prob > |t|	<.0001
Lower CL Dif	0.394524	Prob > t	<.0001
Confidence	0.95	Prob < t	1.0000

Analysis of Variance

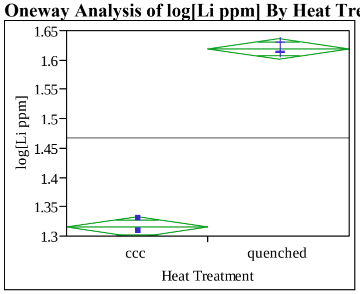
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.25377428	0.253774	4624.077	<.0001
Error	4	0.00021952	0.000055		
C. Total	5	0.25399380			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.37203	0.00428	1.3602	1.3839
quenched	3	1.78335	0.00428	1.7715	1.7952

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=EM-22



Oneway Anova
Summary of Fit

Rsquare	0.996612
Adj Rsquare	0.995765
Root Mean Square Error	0.010854
Mean of Response	1.467158
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.303981	t Ratio	34.30193
Std Err Dif	0.008862	DF	4
Upper CL Dif	0.328585	Prob > |t|	<.0001
Lower CL Dif	0.279376	Prob > t	<.0001
Confidence	0.95	Prob < t	1.0000

Analysis of Variance

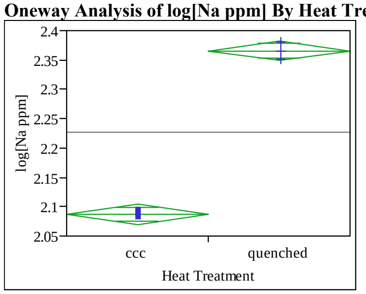
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.13860649	0.138606	1176.622	<.0001
Error	4	0.00047120	0.000118		
C. Total	5	0.13907769			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.31517	0.00627	1.2978	1.3326
quenched	3	1.61915	0.00627	1.6018	1.6365

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=EM-22



Oneway Anova
Summary of Fit

Rsquare	0.996103
Adj Rsquare	0.995129
Root Mean Square Error	0.010695
Mean of Response	2.226151
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.279219	t Ratio	31.97638
Std Err Dif	0.008732	DF	4
Upper CL Dif	0.303463	Prob > |t|	<.0001
Lower CL Dif	0.254975	Prob > t	<.0001
Confidence	0.95	Prob < t	1.0000

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.11694509	0.116945	1022.489	<.0001
Error	4	0.00045749	0.000114		
C. Total	5	0.11740258			

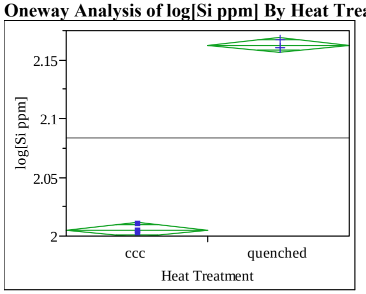
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.08654	0.00617	2.0694	2.1037
quenched	3	2.36576	0.00617	2.3486	2.3829

Std Error uses a pooled estimate of error variance

Exhibit E5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of the Matrix 2A Study Glasses

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=EM-22



Oneway Anova
Summary of Fit

Rsquare	0.998369
Adj Rsquare	0.997961
Root Mean Square Error	0.003897
Mean of Response	2.083984
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.157425	t Ratio	49.47499
Std Err Dif	0.003182	DF	4
Upper CL Dif	0.166259	Prob > |t|	<.0001
Lower CL Dif	0.148590	Prob > t	<.0001
Confidence	0.95	Prob < t	1.0000

Analysis of Variance

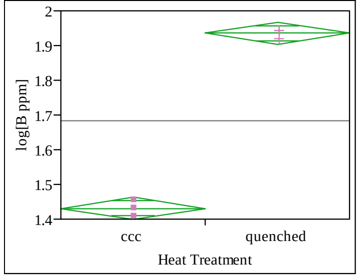
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.03717384	0.037174	2447.774	<.0001
Error	4	0.00006075	0.000015		
C. Total	5	0.03723459			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.00527	0.00225	1.9990	2.0115
quenched	3	2.16270	0.00225	2.1564	2.1689

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=EM-23



Oneway Anova
Summary of Fit

Rsquare	0.995935
Adj Rsquare	0.994919
Root Mean Square Error	0.019728
Mean of Response	1.683062
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.504274	t Ratio	31.30656
Std Err Dif	0.016108	DF	4
Upper CL Dif	0.548996	Prob > |t|	<.0001
Lower CL Dif	0.459552	Prob > t	<.0001
Confidence	0.95	Prob < t	1.0000

Analysis of Variance

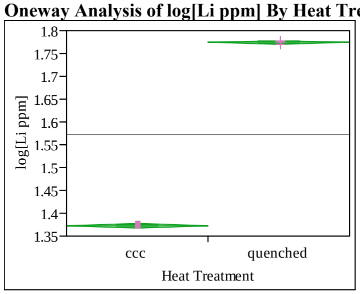
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.38143898	0.381439	980.1010	<.0001
Error	4	0.00155673	0.000389		
C. Total	5	0.38299571			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.43092	0.01139	1.3993	1.4625
quenched	3	1.93520	0.01139	1.9036	1.9668

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=EM-23



Oneway Anova
Summary of Fit

Rsquare	0.999889
Adj Rsquare	0.999861
Root Mean Square Error	0.002602
Mean of Response	1.573309
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.402418	t Ratio	189.4416
Std Err Dif	0.002124	DF	4
Upper CL Dif	0.408316	Prob > |t|	<.0001
Lower CL Dif	0.396520	Prob > t	<.0001
Confidence	0.95	Prob < t	1.0000

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.24291044	0.242910	35888.12	<.0001
Error	4	0.00002707	6.769e-6		
C. Total	5	0.24293751			

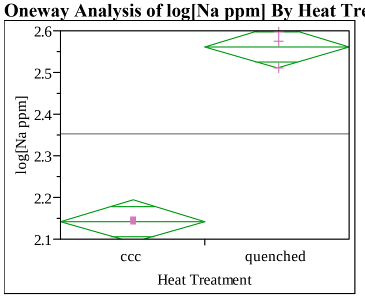
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.37210	0.00150	1.3679	1.3763
quenched	3	1.77452	0.00150	1.7703	1.7787

Std Error uses a pooled estimate of error variance

Exhibit E5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of the Matrix 2A Study Glasses

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=EM-23



Oneway Anova
Summary of Fit

Rsquare	0.98488
Adj Rsquare	0.981101
Root Mean Square Error	0.03181
Mean of Response	2.352471
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.419253	t Ratio	16.14181
Std Err Dif	0.025973	DF	4
Upper CL Dif	0.491366	Prob > |t|	<.0001
Lower CL Dif	0.347140	Prob > t	<.0001
Confidence	0.95	Prob < t	1.0000

Analysis of Variance

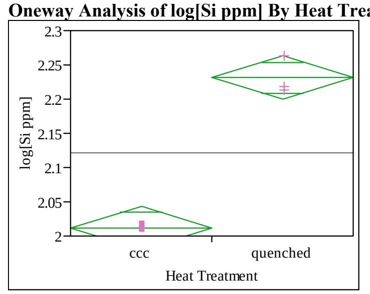
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.26365969	0.263660	260.5581	<.0001
Error	4	0.00404761	0.001012		
C. Total	5	0.26770731			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.14284	0.01837	2.0919	2.1938
quenched	3	2.56210	0.01837	2.5111	2.6131

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=EM-23



Oneway Anova
Summary of Fit

Rsquare	0.978651
Adj Rsquare	0.973314
Root Mean Square Error	0.019855
Mean of Response	2.121656
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.219528	t Ratio	13.54115
Std Err Dif	0.016212	DF	4
Upper CL Dif	0.264539	Prob > |t|	0.0002
Lower CL Dif	0.174516	Prob > t	<.0001
Confidence	0.95	Prob < t	0.9999

Analysis of Variance

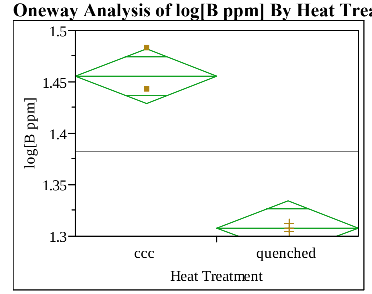
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.07228852	0.072289	183.3628	0.0002
Error	4	0.00157695	0.000394		
C. Total	5	0.07386547			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.01189	0.01146	1.9801	2.0437
quenched	3	2.23142	0.01146	2.1996	2.2632

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=EM-24



Oneway Anova
Summary of Fit

Rsquare	0.967498
Adj Rsquare	0.959373
Root Mean Square Error	0.016508
Mean of Response	1.381747
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.14708	t Ratio	-10.9119
Std Err Dif	0.01348	DF	4
Upper CL Dif	-0.10966	Prob > |t|	0.0004
Lower CL Dif	-0.18450	Prob > t	0.9998
Confidence	0.95	Prob < t	0.0002

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.03244839	0.032448	119.0706	0.0004
Error	4	0.00109006	0.000273		
C. Total	5	0.03353844			

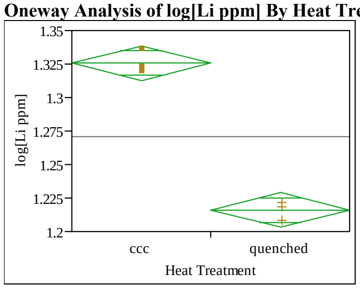
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.45529	0.00953	1.4288	1.4817
quenched	3	1.30821	0.00953	1.2817	1.3347

Std Error uses a pooled estimate of error variance

Exhibit E5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of the Matrix 2A Study Glasses

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=EM-24



Oneway Anova
Summary of Fit

Rsquare	0.985572
Adj Rsquare	0.981965
Root Mean Square Error	0.00811
Mean of Response	1.270867
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.10946	t Ratio	-16.53
Std Err Dif	0.00662	DF	4
Upper CL Dif	-0.09108	Prob > |t|	<.0001
Lower CL Dif	-0.12785	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

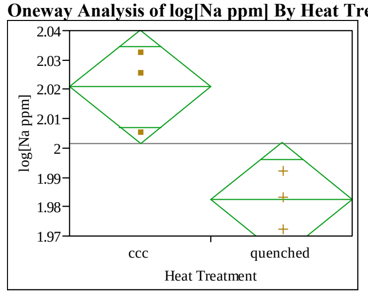
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.01797316	0.017973	273.2412	<.0001
Error	4	0.00026311	0.000066		
C. Total	5	0.01823627			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.32560	0.00468	1.3126	1.3386
quenched	3	1.21614	0.00468	1.2031	1.2291

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=EM-24



Oneway Anova
Summary of Fit

Rsquare	0.789429
Adj Rsquare	0.736787
Root Mean Square Error	0.012132
Mean of Response	2.001637
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.03836	t Ratio	-3.87247
Std Err Dif	0.00991	DF	4
Upper CL Dif	-0.01086	Prob > |t|	0.0180
Lower CL Dif	-0.06586	Prob > t	0.9910
Confidence	0.95	Prob < t	0.0090

Analysis of Variance

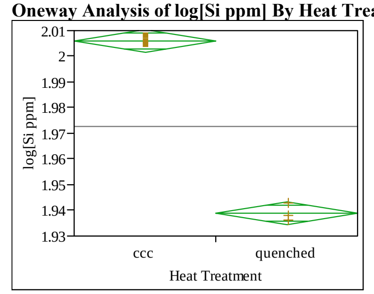
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00220719	0.002207	14.9960	0.0180
Error	4	0.00058874	0.000147		
C. Total	5	0.00279593			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.02082	0.00700	2.0014	2.0403
quenched	3	1.98246	0.00700	1.9630	2.0019

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=EM-24



Oneway Anova
Summary of Fit

Rsquare	0.995506
Adj Rsquare	0.994383
Root Mean Square Error	0.002758
Mean of Response	1.97248
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.06703	t Ratio	-29.7672
Std Err Dif	0.00225	DF	4
Upper CL Dif	-0.06078	Prob > |t|	<.0001
Lower CL Dif	-0.07329	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00674011	0.006740	886.0862	<.0001
Error	4	0.00003043	7.607e-6		
C. Total	5	0.00677053			

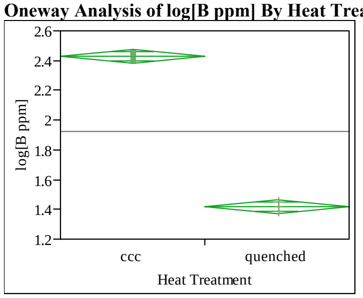
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.00600	0.00159	2.0016	2.0104
quenched	3	1.93896	0.00159	1.9345	1.9434

Std Error uses a pooled estimate of error variance

Exhibit E5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of the Matrix 2A Study Glasses

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=EM-25



Oneway Anova
Summary of Fit

Rsquare	0.997788
Adj Rsquare	0.997235
Root Mean Square Error	0.029157
Mean of Response	1.923479
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-1.0113	t Ratio	-42.48
Std Err Dif	0.0238	DF	4
Upper CL Dif	-0.9452	Prob > |t|	<.0001
Lower CL Dif	-1.0774	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

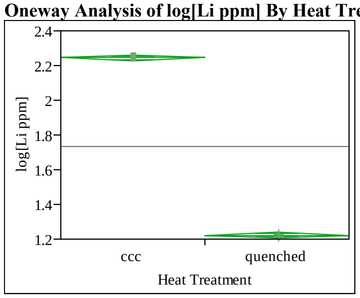
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	1.5340664	1.53407	1804.549	<.0001
Error	4	0.0034004	0.00085		
C. Total	5	1.5374668			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.42912	0.01683	2.3824	2.4759
quenched	3	1.41783	0.01683	1.3711	1.4646

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=EM-25



Oneway Anova
Summary of Fit

Rsquare	0.999732
Adj Rsquare	0.999665
Root Mean Square Error	0.010244
Mean of Response	1.733205
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-1.0222	t Ratio	-122.207
Std Err Dif	0.0084	DF	4
Upper CL Dif	-0.9990	Prob > |t|	<.0001
Lower CL Dif	-1.0454	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

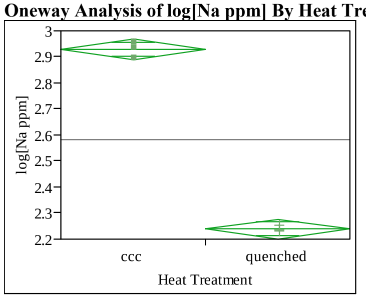
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	1.5673143	1.56731	14934.47	<.0001
Error	4	0.0004198	0.00010		
C. Total	5	1.5677341			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.24430	0.00591	2.2279	2.2607
quenched	3	1.22211	0.00591	1.2057	1.2385

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=EM-25



Oneway Anova
Summary of Fit

Rsquare	0.996731
Adj Rsquare	0.995914
Root Mean Square Error	0.024182
Mean of Response	2.583572
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.68955	t Ratio	-34.9241
Std Err Dif	0.01974	DF	4
Upper CL Dif	-0.63473	Prob > |t|	<.0001
Lower CL Dif	-0.74437	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.71321332	0.713213	1219.695	<.0001
Error	4	0.00233899	0.000585		
C. Total	5	0.71555230			

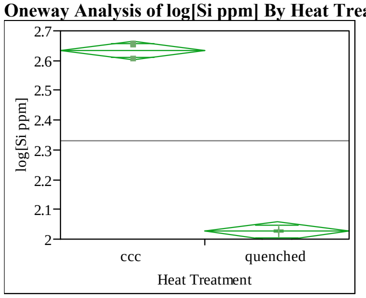
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.92835	0.01396	2.8896	2.9671
quenched	3	2.23880	0.01396	2.2000	2.2776

Std Error uses a pooled estimate of error variance

Exhibit E5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of the Matrix 2A Study Glasses

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=EM-25



Oneway Anova
Summary of Fit

Rsquare	0.997104
Adj Rsquare	0.99638
Root Mean Square Error	0.020091
Mean of Response	2.330157
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.60880	t Ratio	-37.1132
Std Err Dif	0.01640	DF	4
Upper CL Dif	-0.56325	Prob > |t|	<.0001
Lower CL Dif	-0.65434	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

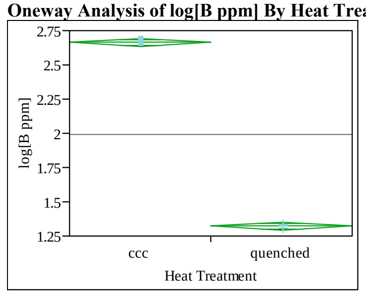
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.55595405	0.555954	1377.388	<.0001
Error	4	0.00161452	0.000404		
C. Total	5	0.55756857			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.63456	0.01160	2.6024	2.6668
quenched	3	2.02576	0.01160	1.9936	2.0580

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=EM-26



Oneway Anova
Summary of Fit

Rsquare	0.999505
Adj Rsquare	0.999381
Root Mean Square Error	0.018297
Mean of Response	1.991926
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-1.3420	t Ratio	-89.8313
Std Err Dif	0.0149	DF	4
Upper CL Dif	-1.3005	Prob > |t|	<.0001
Lower CL Dif	-1.3835	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

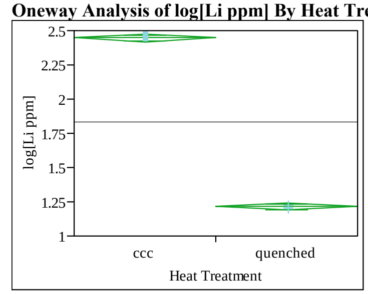
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	2.7015198	2.70152	8069.659	<.0001
Error	4	0.0013391	0.00033		
C. Total	5	2.7028589			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.66294	0.01056	2.6336	2.6923
quenched	3	1.32092	0.01056	1.2916	1.3502

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=EM-26



Oneway Anova
Summary of Fit

Rsquare	0.999559
Adj Rsquare	0.999449
Root Mean Square Error	0.015863
Mean of Response	1.8295
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-1.2331	t Ratio	-95.2053
Std Err Dif	0.0130	DF	4
Upper CL Dif	-1.1971	Prob > |t|	<.0001
Lower CL Dif	-1.2690	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	2.2807236	2.28072	9064.049	<.0001
Error	4	0.0010065	0.00025		
C. Total	5	2.2817301			

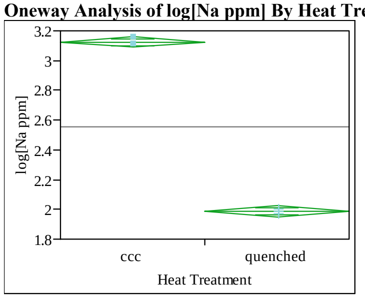
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.44604	0.00916	2.4206	2.4715
quenched	3	1.21296	0.00916	1.1875	1.2384

Std Error uses a pooled estimate of error variance

Exhibit E5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of the Matrix 2A Study Glasses

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=EM-26



Oneway Anova
Summary of Fit

Rsquare	0.999009
Adj Rsquare	0.998762
Root Mean Square Error	0.02192
Mean of Response	2.555039
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-1.1368	t Ratio	-63.5164
Std Err Dif	0.0179	DF	4
Upper CL Dif	-1.0871	Prob > |t|	<.0001
Lower CL Dif	-1.1865	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

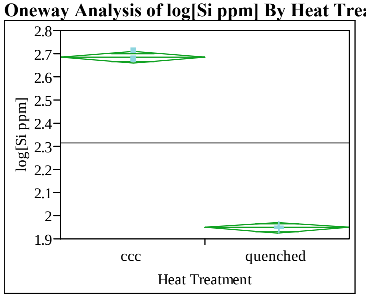
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	1.9385298	1.93853	4034.333	<.0001
Error	4	0.0019220	0.00048		
C. Total	5	1.9404519			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	3.12345	0.01266	3.0883	3.1586
quenched	3	1.98663	0.01266	1.9515	2.0218

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=EM-26



Oneway Anova
Summary of Fit

Rsquare	0.99892
Adj Rsquare	0.99865
Root Mean Square Error	0.014806
Mean of Response	2.31625
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.73536	t Ratio	-60.8264
Std Err Dif	0.01209	DF	4
Upper CL Dif	-0.70179	Prob > |t|	<.0001
Lower CL Dif	-0.76892	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

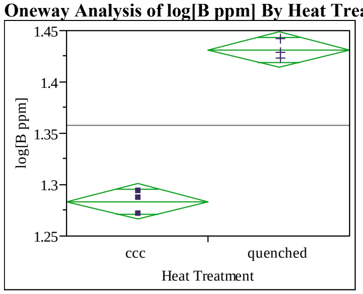
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.81112471	0.811125	3699.848	<.0001
Error	4	0.00087693	0.000219		
C. Total	5	0.81200164			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.68393	0.00855	2.6602	2.7077
quenched	3	1.94857	0.00855	1.9248	1.9723

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=EM-27



Oneway Anova
Summary of Fit

Rsquare	0.986345
Adj Rsquare	0.982932
Root Mean Square Error	0.010634
Mean of Response	1.357506
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.147591	t Ratio	16.99822
Std Err Dif	0.008683	DF	4
Upper CL Dif	0.171698	Prob > |t|	<.0001
Lower CL Dif	0.123484	Prob > t	<.0001
Confidence	0.95	Prob < t	1.0000

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.03267467	0.032675	288.9395	<.0001
Error	4	0.00045234	0.000113		
C. Total	5	0.03312700			

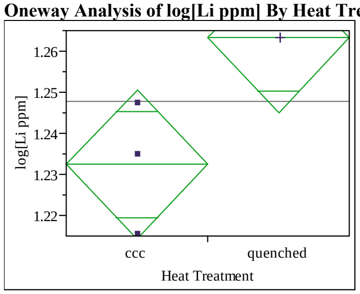
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.28371	0.00614	1.2667	1.3008
quenched	3	1.43130	0.00614	1.4143	1.4483

Std Error uses a pooled estimate of error variance

Exhibit E5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of the Matrix 2A Study Glasses

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=EM-27



Oneway Anova
Summary of Fit

Rsquare	0.734774
Adj Rsquare	0.668468
Root Mean Square Error	0.011356
Mean of Response	1.247817
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.030866	t Ratio	3.328888
Std Err Dif	0.009272	DF	4
Upper CL Dif	0.056610	Prob > |t|	0.0291
Lower CL Dif	0.005122	Prob > t	0.0146
Confidence	0.95	Prob < t	0.9854

Analysis of Variance

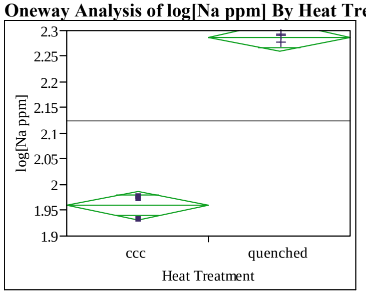
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00142909	0.001429	11.0815	0.0291
Error	4	0.00051585	0.000129		
C. Total	5	0.00194493			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.23238	0.00656	1.2142	1.2506
quenched	3	1.26325	0.00656	1.2450	1.2815

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=EM-27



Oneway Anova
Summary of Fit

Rsquare	0.992384
Adj Rsquare	0.99048
Root Mean Square Error	0.017622
Mean of Response	2.123397
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.328481	t Ratio	22.83017
Std Err Dif	0.014388	DF	4
Upper CL Dif	0.368429	Prob > |t|	<.0001
Lower CL Dif	0.288534	Prob > t	<.0001
Confidence	0.95	Prob < t	1.0000

Analysis of Variance

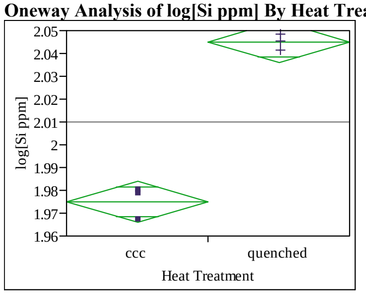
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.16184996	0.161850	521.2166	<.0001
Error	4	0.00124209	0.000311		
C. Total	5	0.16309206			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.95916	0.01017	1.9309	1.9874
quenched	3	2.28764	0.01017	2.2594	2.3159

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=EM-27



Oneway Anova
Summary of Fit

Rsquare	0.982838
Adj Rsquare	0.978547
Root Mean Square Error	0.005661
Mean of Response	2.010125
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	0.069958	t Ratio	15.13496
Std Err Dif	0.004622	DF	4
Upper CL Dif	0.082792	Prob > |t|	0.0001
Lower CL Dif	0.057125	Prob > t	<.0001
Confidence	0.95	Prob < t	0.9999

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00734126	0.007341	229.0670	0.0001
Error	4	0.00012819	0.000032		
C. Total	5	0.00746946			

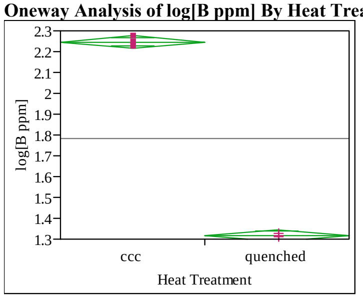
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.97515	0.00327	1.9661	1.9842
quenched	3	2.04510	0.00327	2.0360	2.0542

Std Error uses a pooled estimate of error variance

Exhibit E5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of the Matrix 2A Study Glasses

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=EM-28



Oneway Anova
Summary of Fit

Rsquare	0.998968
Adj Rsquare	0.99871
Root Mean Square Error	0.018287
Mean of Response	1.782061
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.92899	t Ratio	-62.2168
Std Err Dif	0.01493	DF	4
Upper CL Dif	-0.88753	Prob > |t|	<.0001
Lower CL Dif	-0.97044	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

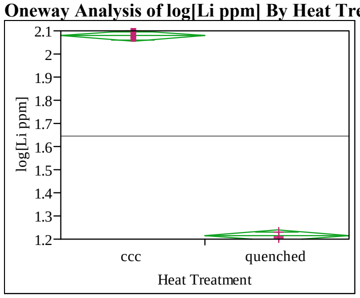
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	1.2945233	1.29452	3870.934	<.0001
Error	4	0.0013377	0.00033		
C. Total	5	1.2958610			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.24655	0.01056	2.2172	2.2759
quenched	3	1.31757	0.01056	1.2883	1.3469

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=EM-28



Oneway Anova
Summary of Fit

Rsquare	0.999224
Adj Rsquare	0.999031
Root Mean Square Error	0.014711
Mean of Response	1.646444
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.86229	t Ratio	-71.7895
Std Err Dif	0.01201	DF	4
Upper CL Dif	-0.82894	Prob > |t|	<.0001
Lower CL Dif	-0.89564	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

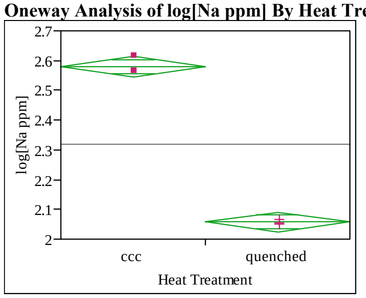
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	1.1153221	1.11532	5153.727	<.0001
Error	4	0.0008656	0.00022		
C. Total	5	1.1161877			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.07759	0.00849	2.0540	2.1012
quenched	3	1.21530	0.00849	1.1917	1.2389

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=EM-28



Oneway Anova
Summary of Fit

Rsquare	0.995733
Adj Rsquare	0.994666
Root Mean Square Error	0.020929
Mean of Response	2.318753
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.52208	t Ratio	-30.5509
Std Err Dif	0.01709	DF	4
Upper CL Dif	-0.47463	Prob > |t|	<.0001
Lower CL Dif	-0.56952	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.40884655	0.408847	933.3582	<.0001
Error	4	0.00175215	0.000438		
C. Total	5	0.41059870			

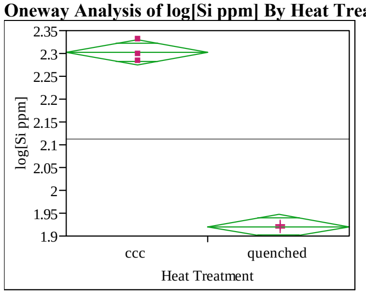
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.57979	0.01208	2.5462	2.6133
quenched	3	2.05771	0.01208	2.0242	2.0913

Std Error uses a pooled estimate of error variance

Exhibit E5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of the Matrix 2A Study Glasses

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=EM-28



Oneway Anova
Summary of Fit

Rsquare	0.994694
Adj Rsquare	0.993367
Root Mean Square Error	0.017081
Mean of Response	2.112056
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.38191	t Ratio	-27.3834
Std Err Dif	0.01395	DF	4
Upper CL Dif	-0.34318	Prob > |t|	<.0001
Lower CL Dif	-0.42063	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

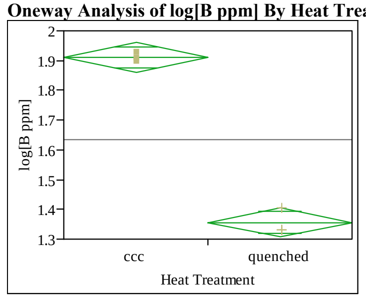
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.21877923	0.218779	749.8480	<.0001
Error	4	0.00116706	0.000292		
C. Total	5	0.21994629			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.30301	0.00986	2.2756	2.3304
quenched	3	1.92110	0.00986	1.8937	1.9485

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=EM-29



Oneway Anova
Summary of Fit

Rsquare	0.991525
Adj Rsquare	0.989406
Root Mean Square Error	0.031358
Mean of Response	1.633132
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.55387	t Ratio	-21.6326
Std Err Dif	0.02560	DF	4
Upper CL Dif	-0.48278	Prob > |t|	<.0001
Lower CL Dif	-0.62495	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

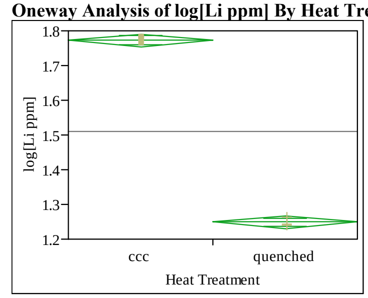
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.46015428	0.460154	467.9696	<.0001
Error	4	0.00393320	0.000983		
C. Total	5	0.46408748			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.91007	0.01810	1.8598	1.9603
quenched	3	1.35620	0.01810	1.3059	1.4065

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=EM-29



Oneway Anova
Summary of Fit

Rsquare	0.998738
Adj Rsquare	0.998423
Root Mean Square Error	0.011415
Mean of Response	1.510614
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.52444	t Ratio	-56.2685
Std Err Dif	0.00932	DF	4
Upper CL Dif	-0.49856	Prob > |t|	<.0001
Lower CL Dif	-0.55031	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.41254850	0.412548	3166.139	<.0001
Error	4	0.00052120	0.000130		
C. Total	5	0.41306970			

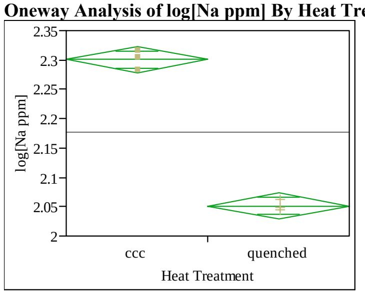
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.77283	0.00659	1.7545	1.7911
quenched	3	1.24840	0.00659	1.2301	1.2667

Std Error uses a pooled estimate of error variance

Exhibit E5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of the Matrix 2A Study Glasses

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=EM-29



Oneway Anova
Summary of Fit

Rsquare	0.992088
Adj Rsquare	0.99011
Root Mean Square Error	0.013615
Mean of Response	2.175991
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.24895	t Ratio	-22.3952
Std Err Dif	0.01112	DF	4
Upper CL Dif	-0.21809	Prob > |t|	<.0001
Lower CL Dif	-0.27981	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

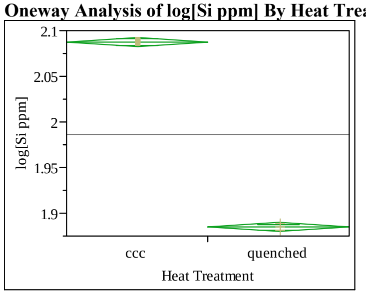
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.09296432	0.092964	501.5450	<.0001
Error	4	0.00074142	0.000185		
C. Total	5	0.09370575			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.30047	0.00786	2.2786	2.3223
quenched	3	2.05152	0.00786	2.0297	2.0733

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=EM-29



Oneway Anova
Summary of Fit

Rsquare	0.999397
Adj Rsquare	0.999247
Root Mean Square Error	0.003049
Mean of Response	1.985979
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.20275	t Ratio	-81.4538
Std Err Dif	0.00249	DF	4
Upper CL Dif	-0.19584	Prob > |t|	<.0001
Lower CL Dif	-0.20966	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

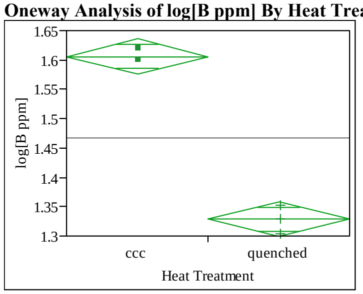
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.06166048	0.061660	6634.716	<.0001
Error	4	0.00003717	9.294e-6		
C. Total	5	0.06169766			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.08735	0.00176	2.0825	2.0922
quenched	3	1.88460	0.00176	1.8797	1.8895

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[B ppm] By Heat Treatment Glass ID=EM-30



Oneway Anova
Summary of Fit

Rsquare	0.98852
Adj Rsquare	0.98565
Root Mean Square Error	0.018316
Mean of Response	1.467411
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.27756	t Ratio	-18.559
Std Err Dif	0.01496	DF	4
Upper CL Dif	-0.23603	Prob > |t|	<.0001
Lower CL Dif	-0.31908	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.11555546	0.115555	344.4358	<.0001
Error	4	0.00134197	0.000335		
C. Total	5	0.11689742			

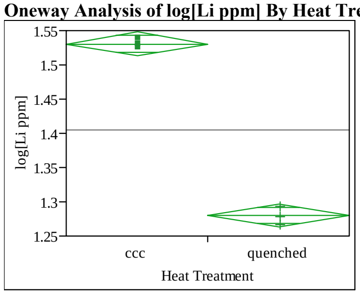
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.60619	0.01058	1.5768	1.6356
quenched	3	1.32863	0.01058	1.2993	1.3580

Std Error uses a pooled estimate of error variance

Exhibit E5. Effects of Heat Treatment (HT) on PCT log(ppm) Response of the Matrix 2A Study Glasses

Oneway Analysis of log[Li ppm] By Heat Treatment Glass ID=EM-30



Oneway Anova
Summary of Fit

Rsquare	0.995369
Adj Rsquare	0.994212
Root Mean Square Error	0.010477
Mean of Response	1.405319
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.25085	t Ratio	-29.3228
Std Err Dif	0.00855	DF	4
Upper CL Dif	-0.22710	Prob > |t|	<.0001
Lower CL Dif	-0.27460	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Analysis of Variance

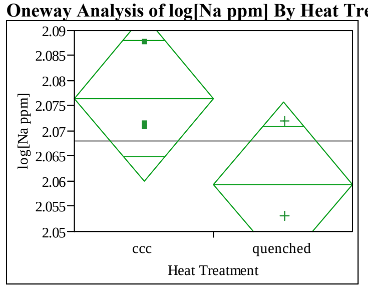
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.09438924	0.094389	859.8276	<.0001
Error	4	0.00043911	0.000110		
C. Total	5	0.09482834			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.53074	0.00605	1.5139	1.5475
quenched	3	1.27989	0.00605	1.2631	1.2967

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Na ppm] By Heat Treatment Glass ID=EM-30



Oneway Anova
Summary of Fit

Rsquare	0.512523
Adj Rsquare	0.390654
Root Mean Square Error	0.010238
Mean of Response	2.067926
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.01714	t Ratio	-2.05073
Std Err Dif	0.00836	DF	4
Upper CL Dif	0.00607	Prob > |t|	0.1096
Lower CL Dif	-0.04035	Prob > t	0.9452
Confidence	0.95	Prob < t	0.0548

Analysis of Variance

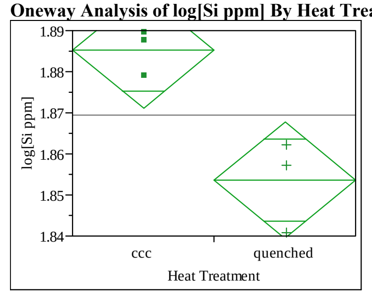
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00044080	0.000441	4.2055	0.1096
Error	4	0.00041926	0.000105		
C. Total	5	0.00086006			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	2.07650	0.00591	2.0601	2.0929
quenched	3	2.05935	0.00591	2.0429	2.0758

Std Error uses a pooled estimate of error variance

Oneway Analysis of log[Si ppm] By Heat Treatment Glass ID=EM-30



Oneway Anova
Summary of Fit

Rsquare	0.828401
Adj Rsquare	0.785501
Root Mean Square Error	0.008829
Mean of Response	1.869382
Observations (or Sum Wgts)	6

t Test
quenched-ccc

Assuming equal variances

Difference	-0.03168	t Ratio	-4.39434
Std Err Dif	0.00721	DF	4
Upper CL Dif	-0.01166	Prob > |t|	0.0117
Lower CL Dif	-0.05169	Prob > t	0.9941
Confidence	0.95	Prob < t	0.0059

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Heat Treatment	1	0.00150516	0.001505	19.3102	0.0117
Error	4	0.00031179	0.000078		
C. Total	5	0.00181694			

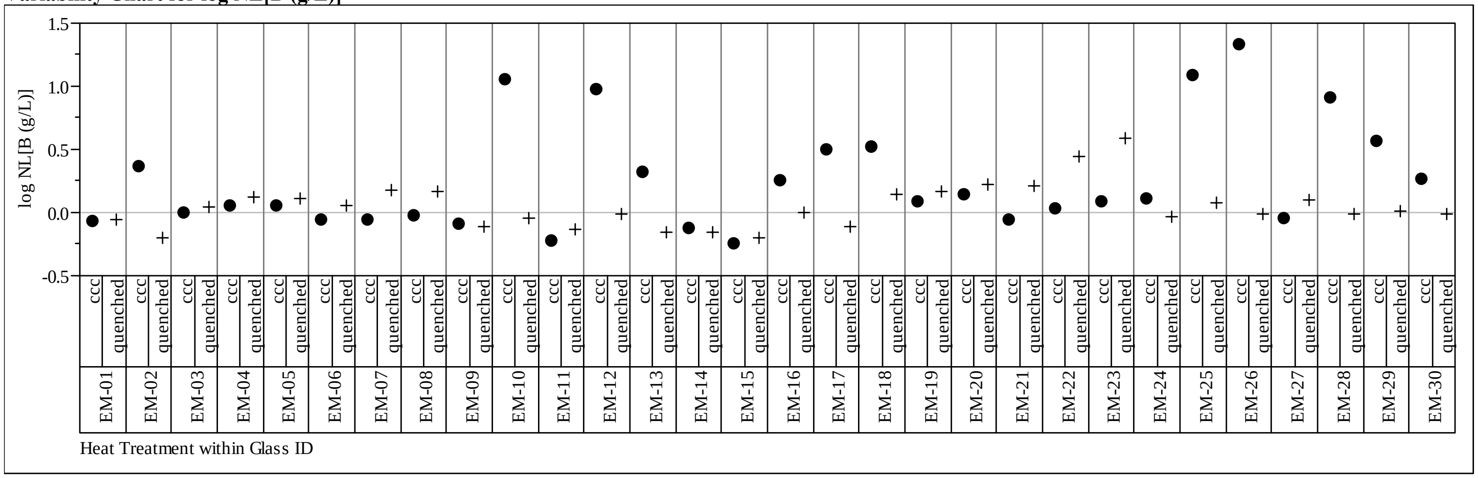
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
ccc	3	1.88522	0.00510	1.8711	1.8994
quenched	3	1.85354	0.00510	1.8394	1.8677

Std Error uses a pooled estimate of error variance

Exhibit E6. Effects of Heat Treatment for the Matrix 2A Study Glasses by Compositional View

Comp View=Measured
Variability Chart for log NL[B (g/L)]



Comp View=Measured
Variability Chart for log NL[Li(g/L)]

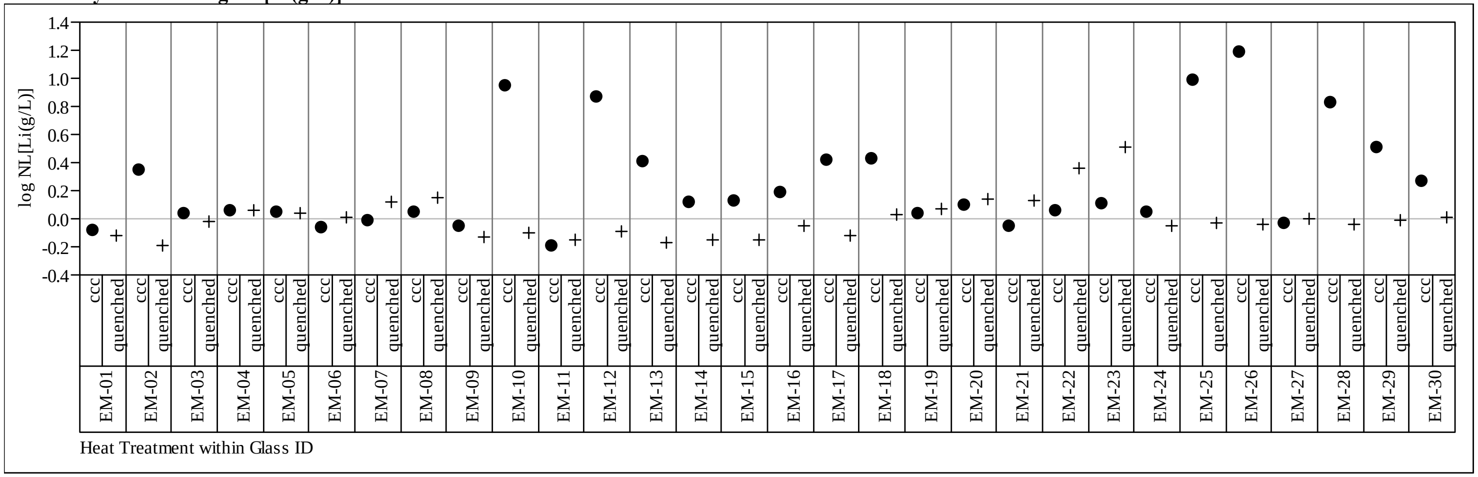
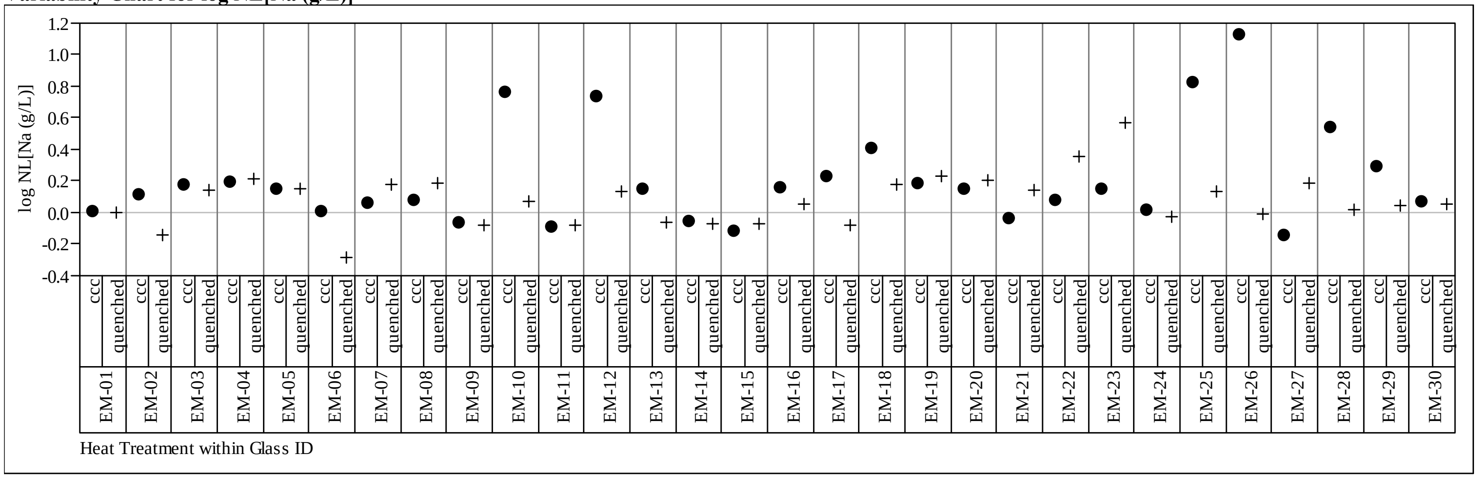


Exhibit E6. Effects of Heat Treatment for the Matrix 2A Study Glasses by Compositional View

Comp View=Measured
Variability Chart for log NL[Na (g/L)]



Comp View=Measured
Variability Chart for log NL[Si (g/L)]

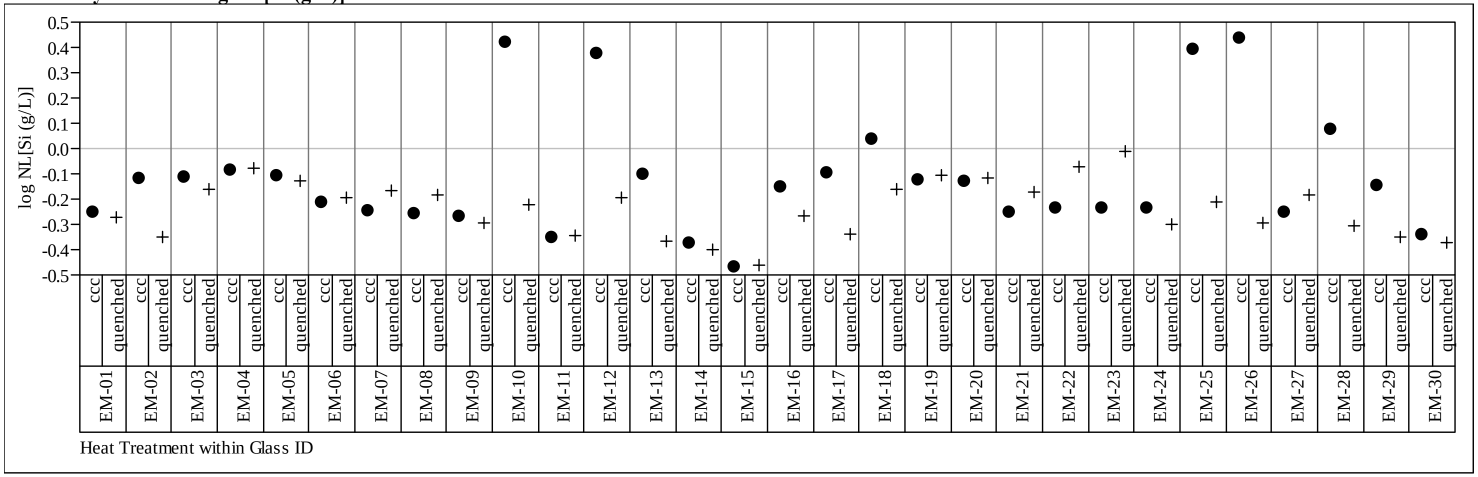
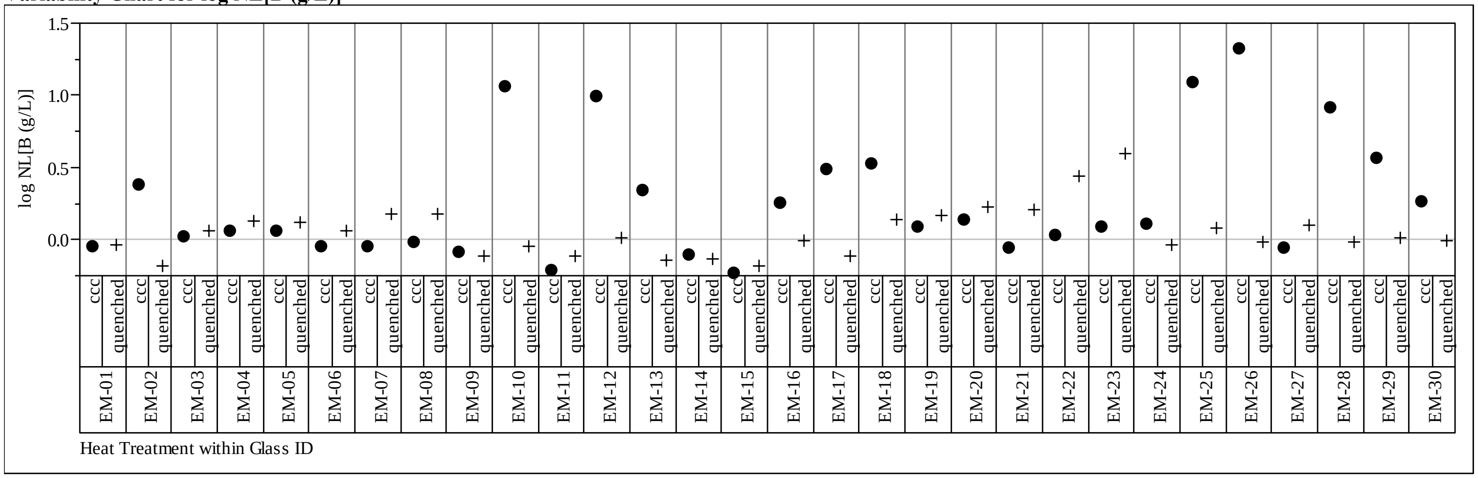


Exhibit E6. Effects of Heat Treatment for the Matrix 2A Study Glasses by Compositional View

Comp View=Measured bc
Variability Chart for log NL[B (g/L)]



Comp View=Measured bc
Variability Chart for log NL[Li(g/L)]

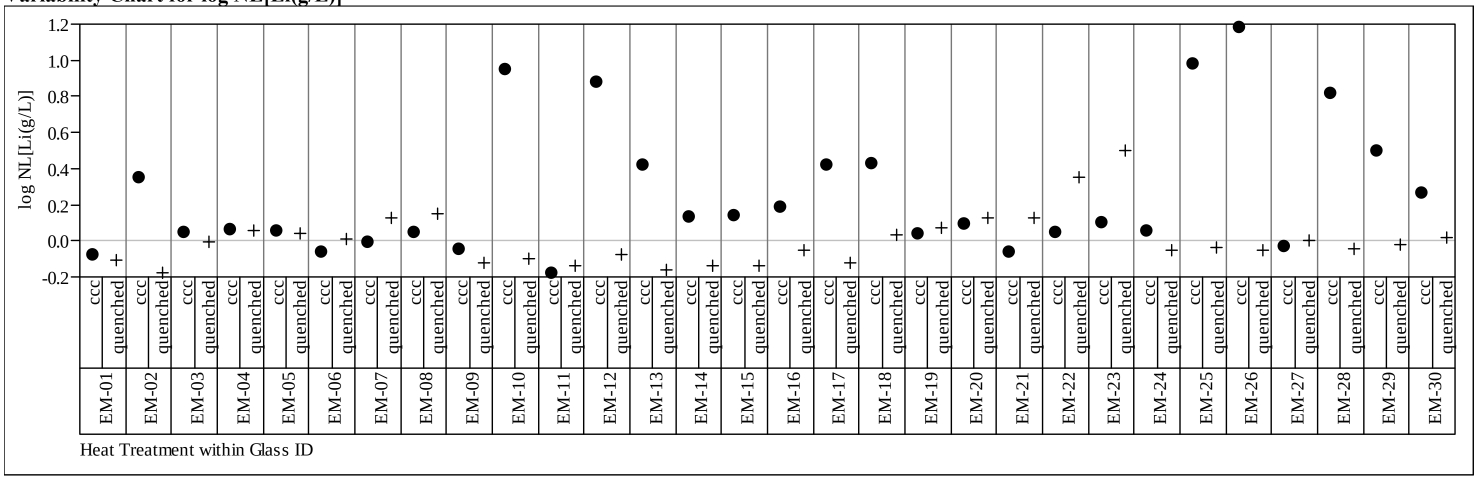
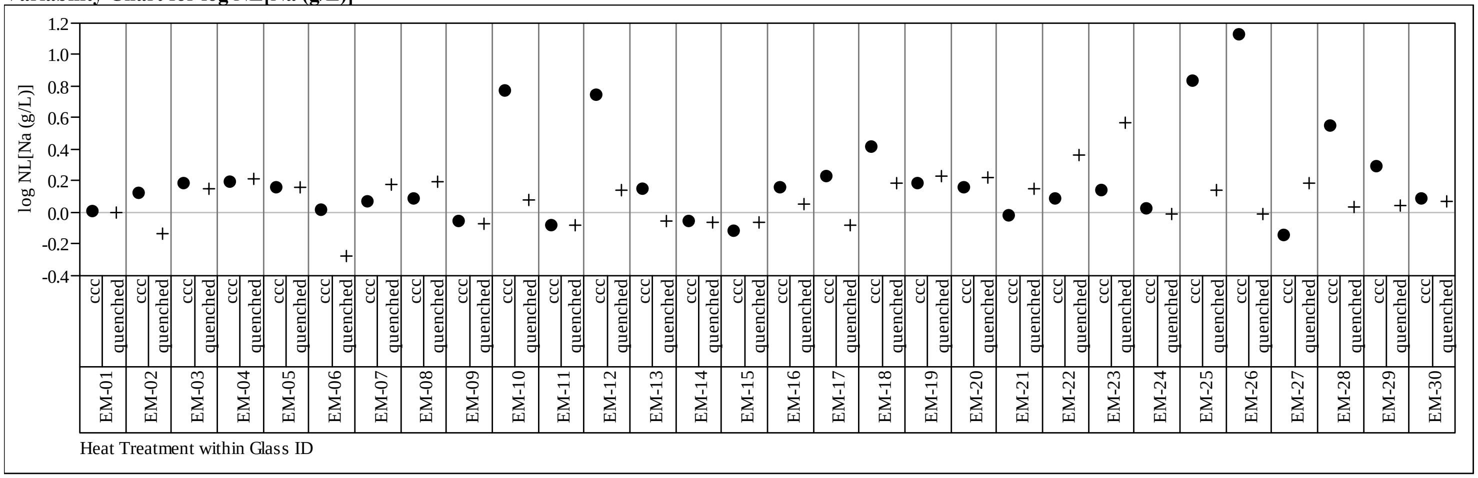


Exhibit E6. Effects of Heat Treatment for the Matrix 2A Study Glasses by Compositional View

Comp View=Measured bc
Variability Chart for log NL[Na (g/L)]



Comp View=Measured bc
Variability Chart for log NL[Si (g/L)]

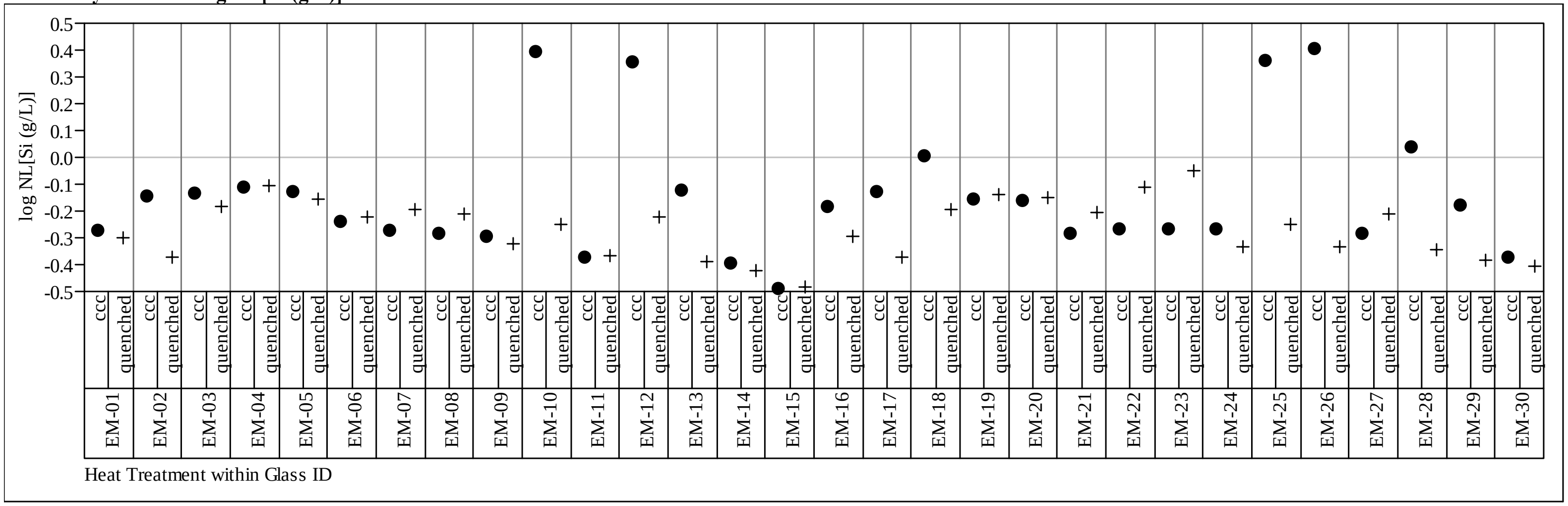
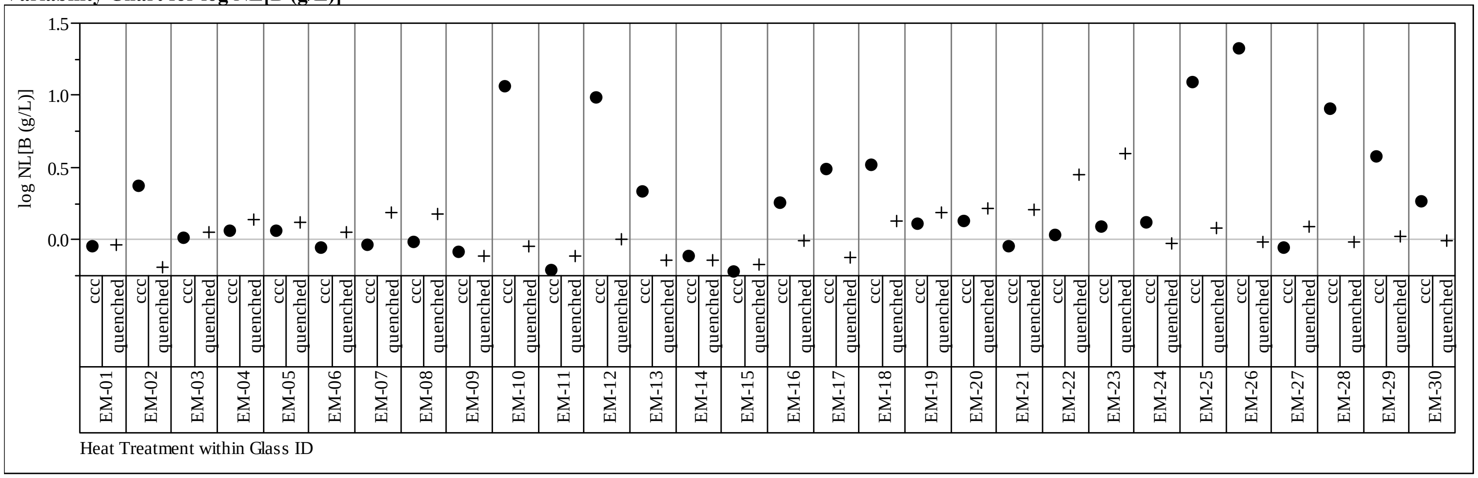


Exhibit E6. Effects of Heat Treatment for the Matrix 2A Study Glasses by Compositional View

Comp View=Targeted
Variability Chart for log NL[B (g/L)]



Comp View=Targeted
Variability Chart for log NL[Li(g/L)]

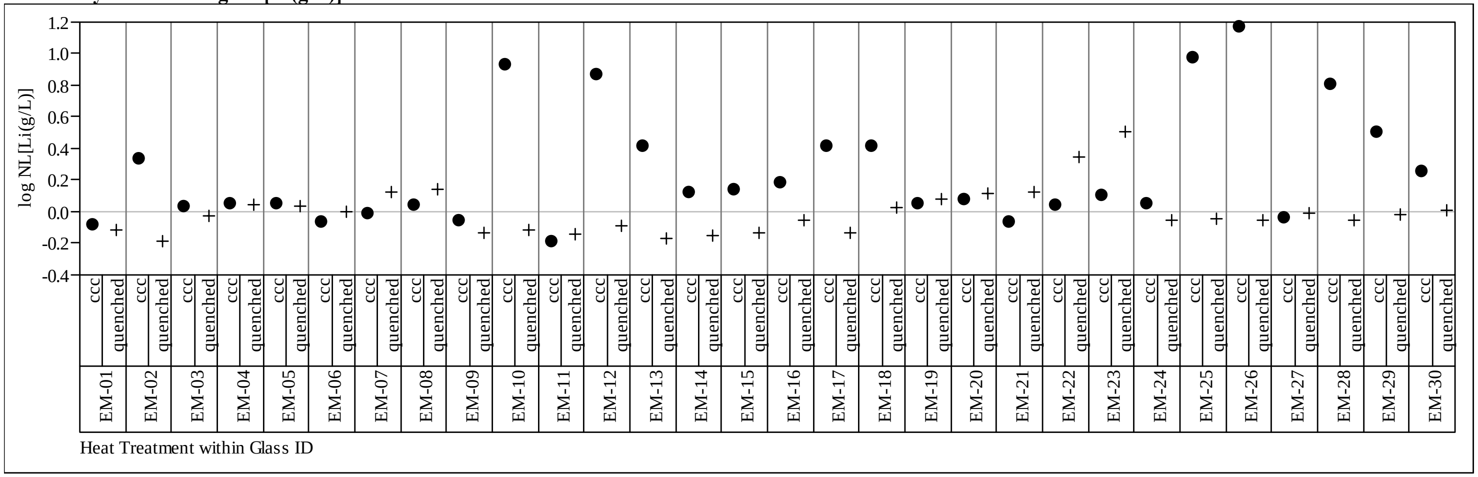
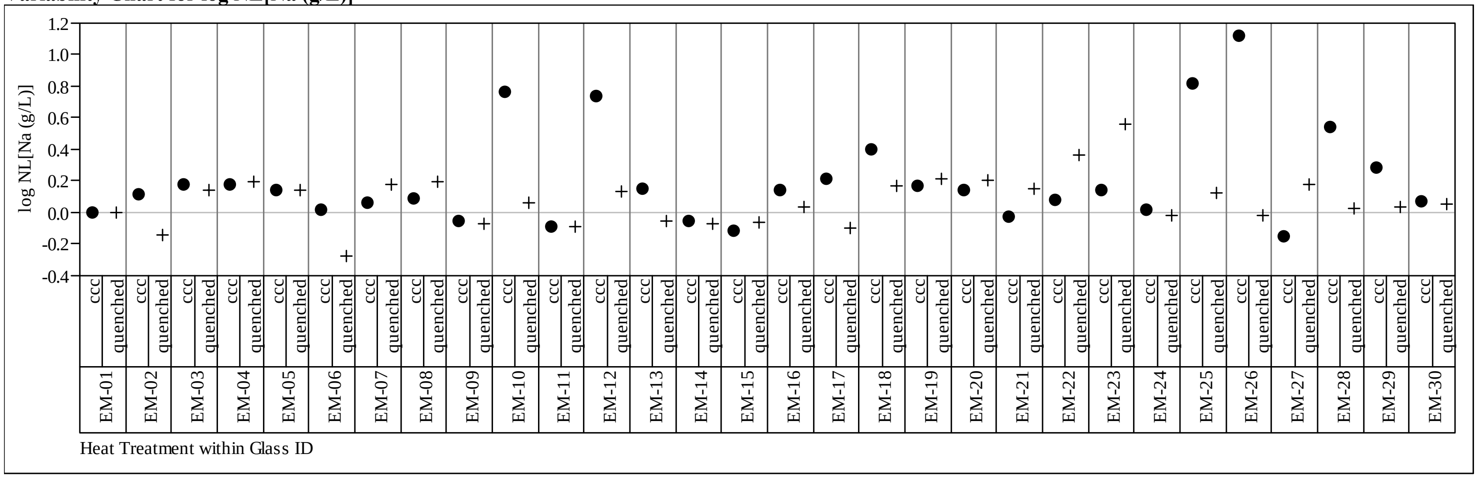


Exhibit E6. Effects of Heat Treatment for the Matrix 2A Study Glasses by Compositional View

Comp View=Targeted
Variability Chart for log NL[Na (g/L)]



Comp View=Targeted
Variability Chart for log NL[Si (g/L)]

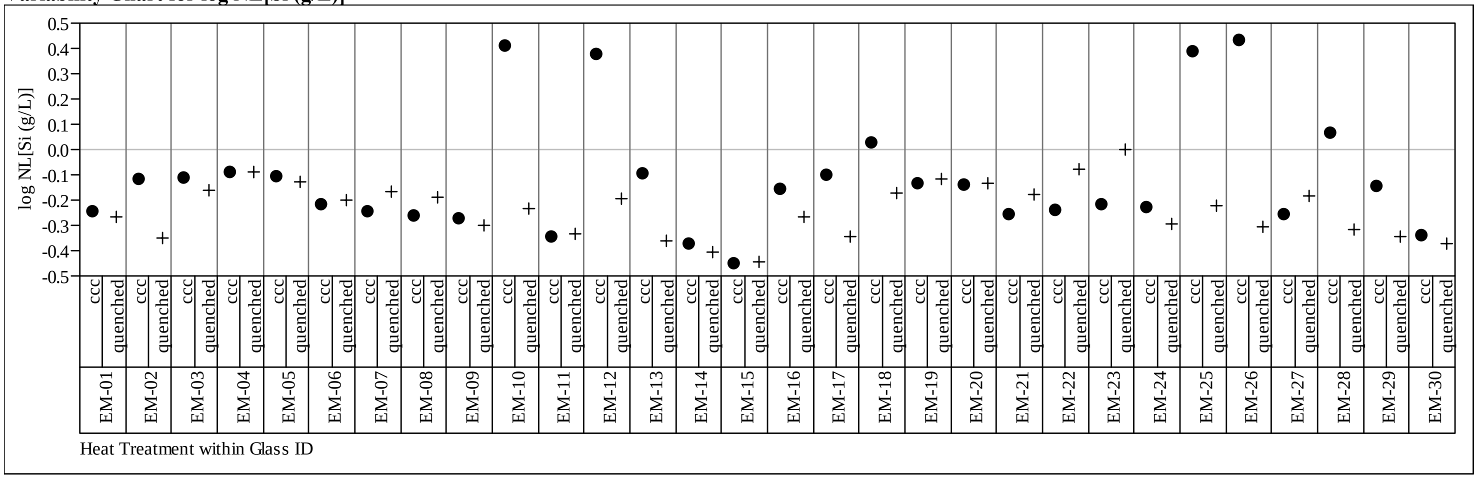


Exhibit E7. del Gp (ΔG_p) Predictions versus Common Logarithm Normalized Leachate (log NL[.]) for B over All Compositional Views and Heat Treatments for the Matrix 2A Study Glasses

Legend

Symbol	Standard/ Comp View-Heat Treatment
z	EA
◊	ARM
□	Measured-ccc
□	Measured bc -ccc
□	Targeted-ccc
•	Measured-quenched
•	Measured bc - quenched
•	Targeted- quenched

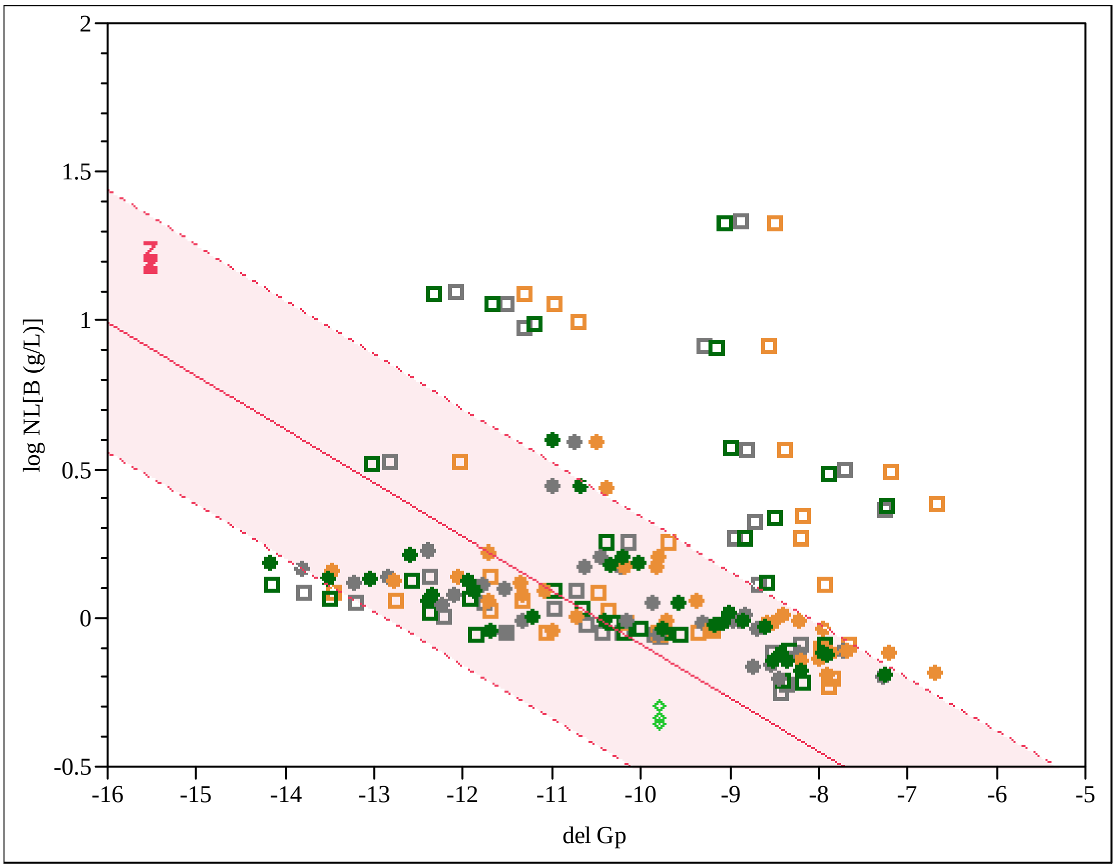


Exhibit E6. Effects of Heat Treatment for the Matrix 2A Study Glasses by Compositional View

Exhibit E8. del Gp (ΔG_p) Predictions versus Common Logarithm Normalized Leachate (log NL[.]) for Li over All Compositional Views and Heat Treatments for the Matrix 2A Study Glasses

Legend

Symbol	Standard/ Comp View-Heat Treatment
z	EA
◊	ARM
□	Measured-ccc
□	Measured bc -ccc
□	Targeted-ccc
•	Measured-quenched
•	Measured bc - quenched
•	Targeted- quenched

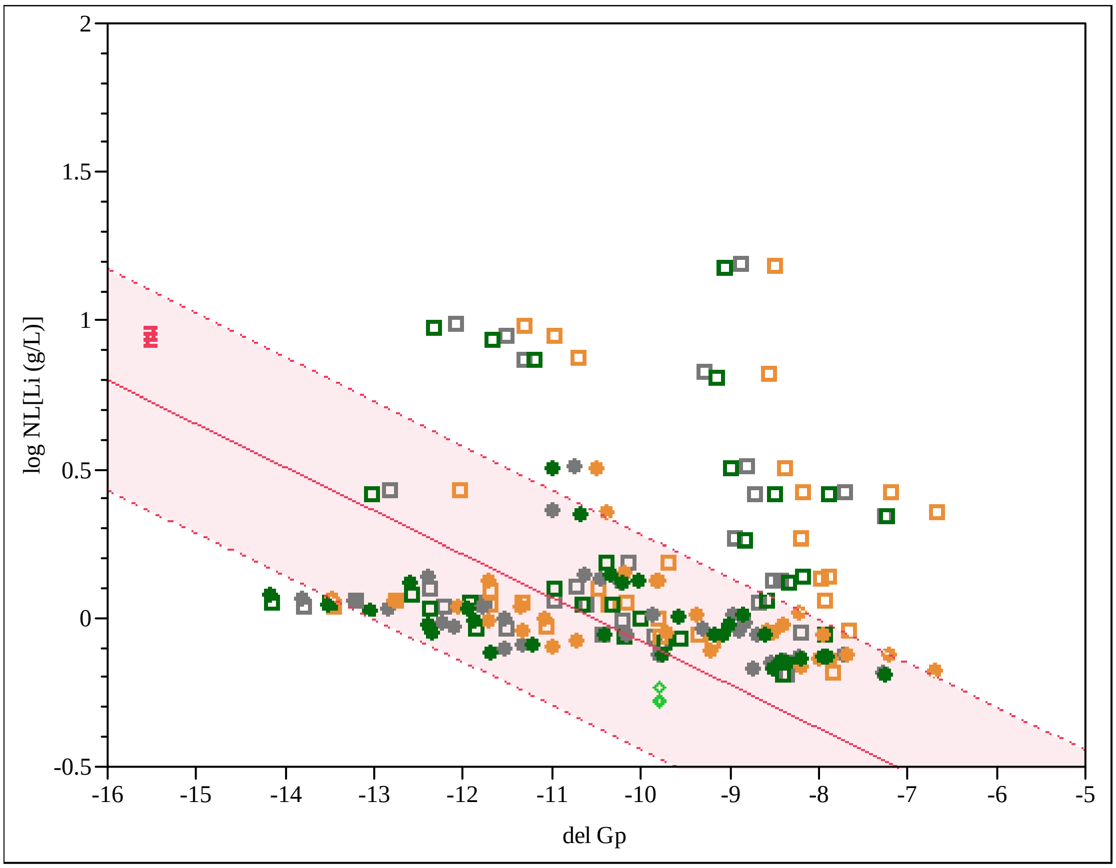


Exhibit E6. Effects of Heat Treatment for the Matrix 2A Study Glasses by Compositional View

Exhibit E9. del Gp (ΔG_p) Predictions versus Common Logarithm Normalized Leachate (log NL[.]) for Na over All Compositional Views and Heat Treatments for the Matrix 2A Study Glasses

Legend

Symbol	Standard/ Comp View-Heat Treatment
z	EA
◊	ARM
□	Measured-ccc
□	Measured bc -ccc
□	Targeted-ccc
•	Measured-quenched
•	Measured bc - quenched
•	Targeted- quenched

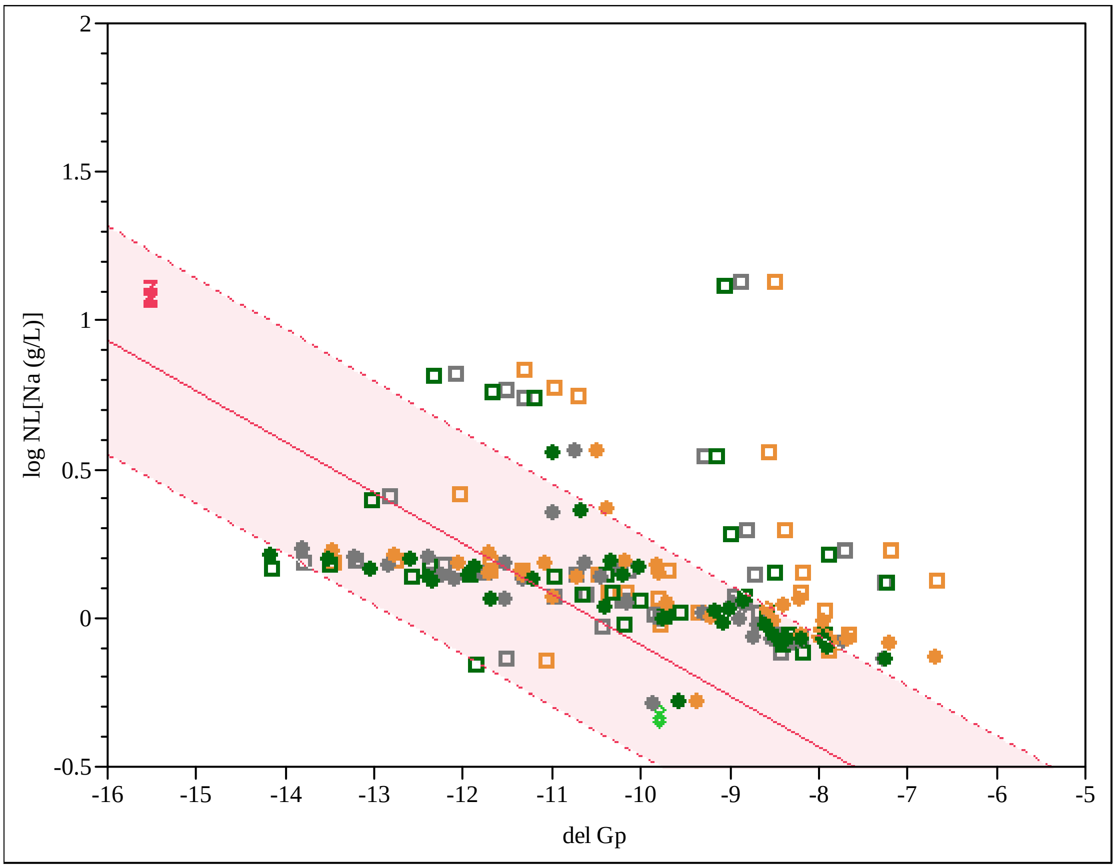
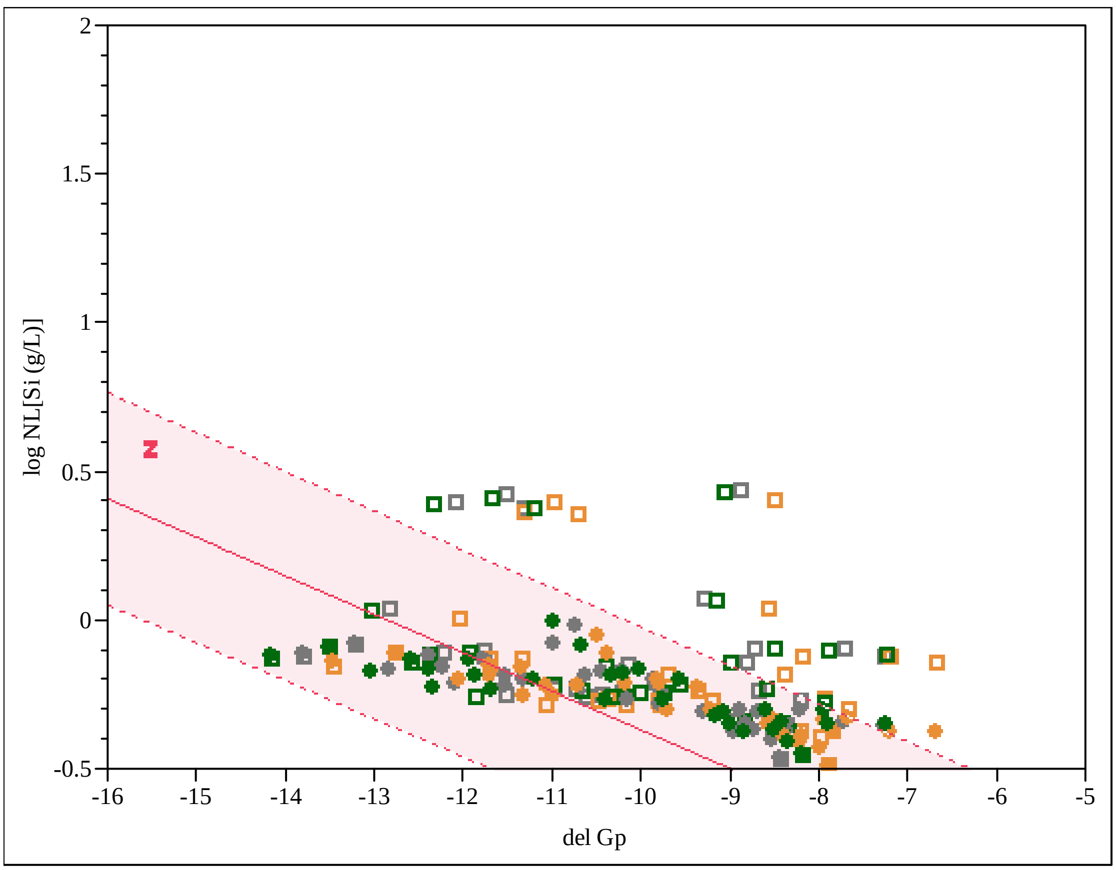


Exhibit E6. Effects of Heat Treatment for the Matrix 2A Study Glasses by Compositional View

Exhibit E10. del Gp (ΔG_p) Predictions versus Common Logarithm Normalized Leachate (log NL[.]) for Si over All Compositional Views and Heat Treatments for the Matrix 2A Study Glasses

Legend

Symbol	Standard/ Comp View-Heat Treatment
z	EA
◊	ARM
□	Measured-ccc
□	Measured bc -ccc
□	Targeted-ccc
•	Measured-quenched
•	Measured bc - quenched
•	Targeted- quenched



Appendix F:

Exhibits Supporting the Analysis of the Viscosity Measurements of the FY07 Study Glasses

Exhibit F1. VFT fit of HWL-01.

Nonlinear Fit Glass ID=HWL-01

Prediction Model

Response: ln(n; poise), Predictor: ln(n; VTF)

Control Panel

Converged in Gradient

Criterion	Current	Stop Limit
Iteration	4	60
Obj Change	5.263988e-11	1e-15
Relative Gradient	2.378013e-10	0.000001
Gradient	1.528211e-10	0.000001

Parameter	Current Value
C	32.898708219
B	10360.224951
A	-5.367705196

SSE

0.0023201717

N

7

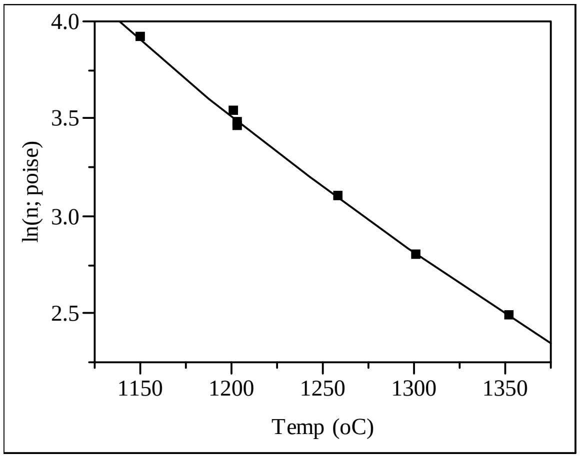
Edit Alpha

0.050Convergence Criterion

0.00001Goal SSE for CL

.

Plot



Parameter	Estimate	Low	High
C	32.898708219	64.1049	192.315
B	10360.224951	3212.47	9637.41
A	-5.367705196	-5.8424	-1.9475

Solution

SSE	DFE	MSE	RMSE
0.0023201717	4	0.00058	0.0240841

Parameter	Estimate	ApproxStdErr
C	32.898708219	487.792693
B	10360.224951	8337.50906
A	-5.367705196	3.43123739

Solved By:

Analytic NR

Exhibit F2. VFT fit of HWL-02.

Nonlinear Fit Glass ID=HWL-02

Prediction Model

Response: ln(n; poise), Predictor: ln(n; VTF)

Control Panel

Converged in Gradient

Criterion	Current	Stop Limit
Iteration	5	60
Obj Change	3.04695e-11	1e-15
Relative Gradient	3.1564125e-9	0.000001
Gradient	4.840781e-10	0.000001

Parameter	Current Value
C	298.71010353
B	6378.9992588
A	-3.880868723

SSE

0.0031715456

N

7

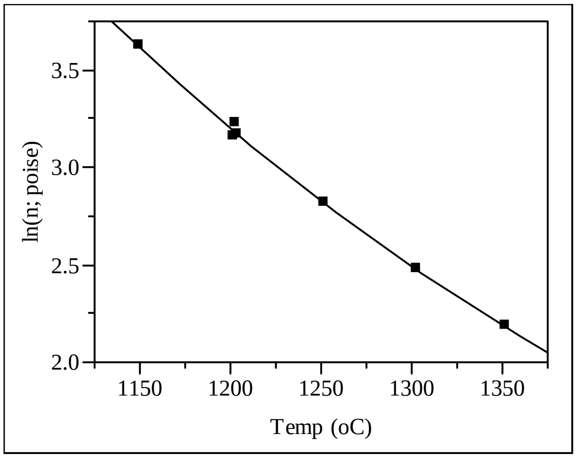
Edit Alpha

0.050Convergence Criterion

0.00001Goal SSE for CL

.

Plot



Parameter	Estimate	Low	High
C	298.71010353	64.1049	192.315
B	6378.9992588	3212.47	9637.41
A	-3.880868723	-5.8424	-1.9475

Solution

SSE	DFE	MSE	RMSE
0.0031715456	4	0.0007929	0.0281582

Parameter	Estimate	ApproxStdErr
C	298.71010353	339.583628
B	6378.9992588	4589.77043
A	-3.880868723	2.42268864

Solved By:

Analytic NR

Exhibit F3. VFT fit of HWL-03.

Nonlinear Fit Glass ID=HWL-03

Prediction Model

Response: ln(n; poise), Predictor: ln(n; VTF)

Control Panel

Converged in Gradient

Criterion	Current	Stop Limit
Iteration	5	60
Obj Change	1.4390075e-8	1e-15
Relative Gradient	8.3549164e-8	0.000001
Gradient	2.8331483e-8	0.000001

Parameter	Current Value
C	361.61764711
B	5436.4239197
A	-3.115226982

SSE

0.0023709961

N

7

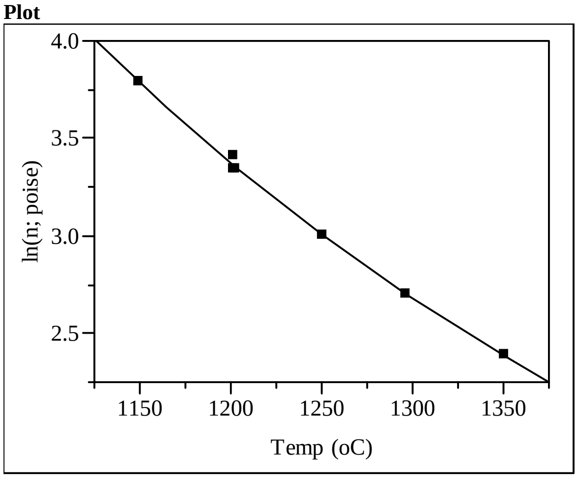
Edit Alpha

0.050Convergence Criterion

0.00001Goal SSE for CL

.

Plot



Parameter	Estimate	Low	High
C	361.61764711	64.1049	192.315
B	5436.4239197	3212.47	9637.41
A	-3.115226982	-5.8424	-1.9475

Solution

SSE	DFE	MSE	RMSE
0.0023709961	4	0.0005927	0.0243464

Parameter	Estimate	ApproxStdErr
C	361.61764711	262.65512
B	5436.4239197	3247.00643
A	-3.115226982	1.83884711

Solved By:

Analytic NR

Exhibit F4. VFT fit of HWL-04.

Nonlinear Fit Glass ID=HWL-04

Prediction Model

Response: ln(n; poise), Predictor: ln(n; VTF)

Control Panel

Converged in Gradient

Criterion	Current	Stop Limit
Iteration	6	60
Obj Change	3.302132e-10	1e-15
Relative Gradient	1.399796e-7	0.000001
Gradient	1.5907225e-8	0.000001

Parameter	Current Value
C	577.19439015
B	3207.0082042
A	-1.846488611

SSE

0.0073591031

N

7

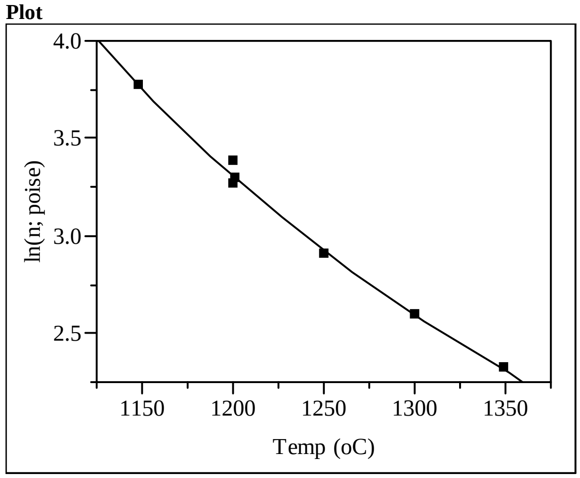
Edit Alpha

0.050Convergence Criterion

0.00001Goal SSE for CL

.

Plot



Parameter	Estimate	Low	High
C	577.19439015	64.1049	192.315
B	3207.0082042	3212.47	9637.41
A	-1.846488611	-5.8424	-1.9475

Solution

SSE	DFE	MSE	RMSE
0.0073591031	4	0.0018398	0.0428926

Parameter	Estimate	ApproxStdErr
C	577.19439015	250.058095
B	3207.0082042	2432.73651
A	-1.846488611	1.83262655

Solved By:

Analytic NR

Exhibit F5. VFT fit of HWL-05.

Nonlinear Fit Glass ID=HWL-05
Prediction Model
Response: ln(n; poise), Predictor: ln(n; VTF)

Control Panel

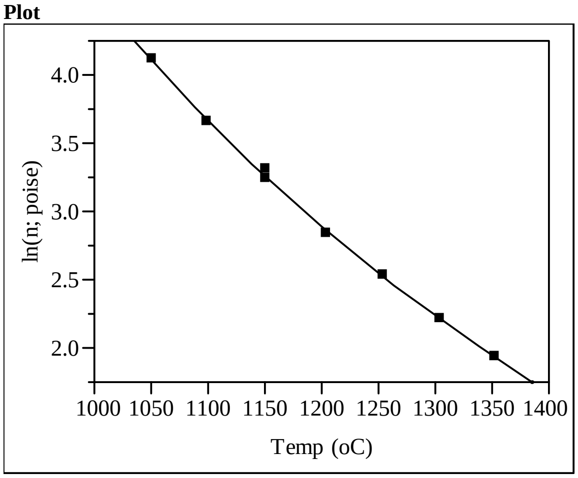
Converged in Gradient

Criterion	Current	Stop Limit
Iteration	4	60
Obj Change	5.091096e-12	1e-15
Relative Gradient	1.5171486e-8	0.000001
Gradient	2.3547302e-9	0.000001

Parameter	Current Value
C	28.896681672
B	9749.3368622
A	-5.442200958

SSE
0.0040635089
N
8

Edit Alpha
0.050Convergence Criterion
0.00001Goal SSE for CL
.
Plot



Parameter	Estimate	Low	High
C	28.896681672	64.1049	192.315
B	9749.3368622	3212.47	9637.41
A	-5.442200958	-5.8424	-1.9475

Solution

SSE	DFE	MSE	RMSE
0.0040635089	5	0.0008127	0.0285079

Parameter	Estimate	ApproxStdErr
C	28.896681672	214.750547
B	9749.3368622	3626.32098
A	-5.442200958	1.56209545

Solved By:
Analytic NR

Exhibit F6. VFT fit of HWL-06.

Nonlinear Fit Glass ID=HWL-06
Prediction Model
Response: ln(n; poise), Predictor: ln(n; VTF)

Control Panel

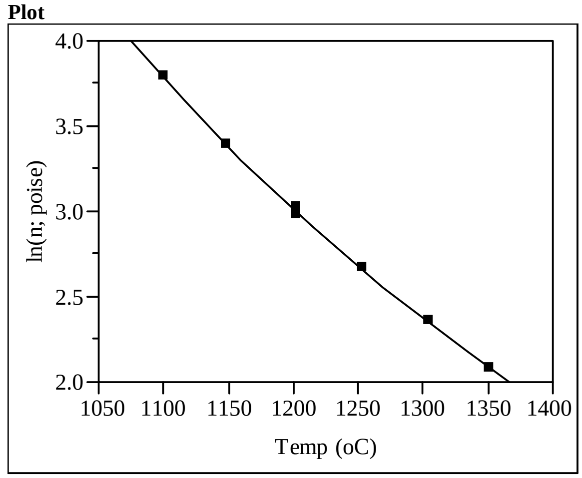
Converged in Gradient

Criterion	Current	Stop Limit
Iteration	3	60
Obj Change	1.4634513e-7	1e-15
Relative Gradient	6.3164387e-7	0.000001
Gradient	5.0814296e-7	0.000001

Parameter	Current Value
C	157.04822371
B	7621.7137359
A	-4.300167133

SSE
0.0015027846
N
8

Edit Alpha
0.050Convergence Criterion
0.00001Goal SSE for CL
.
Plot



Parameter	Estimate	Low	High
C	157.04822371	64.1049	192.315
B	7621.7137359	3212.47	9637.41
A	-4.300167133	-5.8424	-1.9475

Solution

SSE	DFE	MSE	RMSE
0.0015027846	5	0.0003006	0.0173366

Parameter	Estimate	ApproxStdErr
C	157.04822371	160.914395
B	7621.7137359	2324.9741
A	-4.300167133	1.09806997

Solved By:
Analytic NR

Exhibit F7. VFT fit of HWL-07.

Nonlinear Fit Glass ID=HWL-07
Prediction Model
Response: ln(n; poise), Predictor: ln(n; VTF)

Control Panel

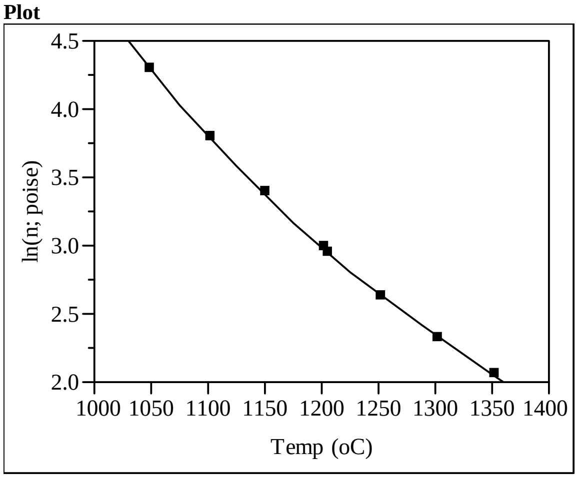
Converged in Gradient

Criterion	Current	Stop Limit
Iteration	4	60
Obj Change	6.6635756e-7	1e-15
Relative Gradient	1.8556182e-7	0.000001
Gradient	4.6298334e-8	0.000001

Parameter	Current Value
C	280.37088172
B	6108.2407399
A	-3.654364924

SSE
0.0008406691
N
8

Edit Alpha
0.050Convergence Criterion
0.00001Goal SSE for CL
.
Plot



Parameter	Estimate	Low	High
C	280.37088172	64.1049	192.315
B	6108.2407399	3212.47	9637.41
A	-3.654364924	-5.8424	-1.9475

Solution

SSE	DFE	MSE	RMSE
0.0008406691	5	0.0001681	0.0129666

Parameter	Estimate	ApproxStdErr
C	280.37088172	57.5089567
B	6108.2407399	785.286682
A	-3.654364924	0.435286

Solved By:
Analytic NR

Exhibit F8. VFT fit of HWL-08.

Nonlinear Fit Glass ID=HWL-08
Prediction Model
Response: ln(n; poise), Predictor: ln(n; VTF)

Control Panel

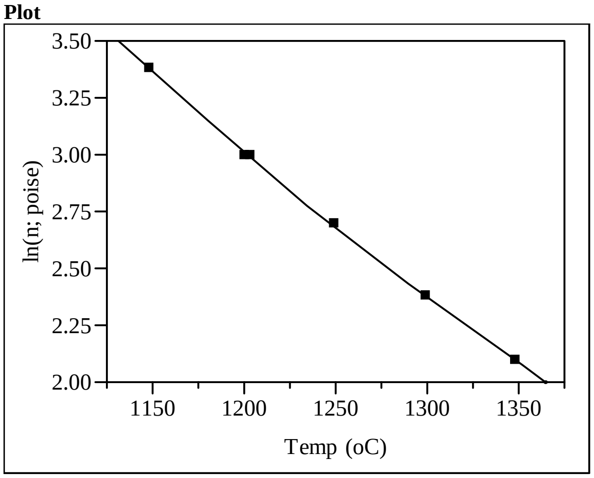
Converged in Gradient

Criterion	Current	Stop Limit
Iteration	4	60
Obj Change	1.148136e-12	1e-15
Relative Gradient	5.76534e-10	0.000001
Gradient	8.175355e-11	0.000001

Parameter	Current Value
C	-150.5612882
B	12498.671267
A	-6.248955755

SSE
0.0004458241
N
6

Edit Alpha
0.050Convergence Criterion
0.00001Goal SSE for CL
.
Plot



Parameter	Estimate	Low	High
C	-150.5612882	64.1049	192.315
B	12498.671267	3212.47	9637.41
A	-6.248955755	-5.8424	-1.9475

Solution

SSE	DFE	MSE	RMSE
0.0004458241	3	0.0001486	0.0121905

Parameter	Estimate	ApproxStdErr
C	-150.5612882	375.374201
B	12498.671267	6733.95321
A	-6.248955755	2.4119941

Solved By:
Analytic NR

Exhibit F9. VFT fit of HWL-09.

Nonlinear Fit Glass ID=HWL-09
Prediction Model
Response: ln(n; poise), Predictor: ln(n; VTF)

Control Panel

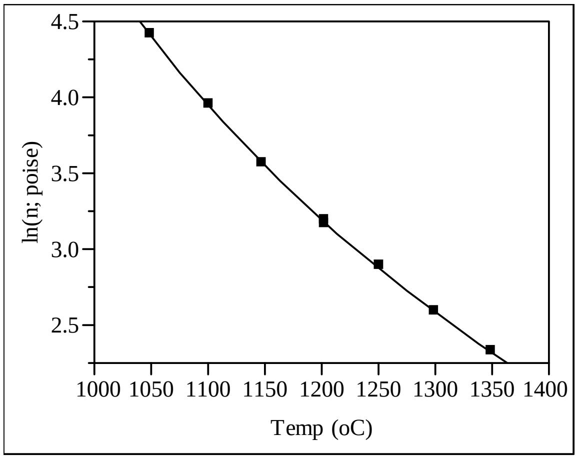
Converged in Gradient

Criterion	Current	Stop Limit
Iteration	4	60
Obj Change	1.8736545e-7	1e-15
Relative Gradient	4.9482126e-7	0.000001
Gradient	4.6867428e-7	0.000001

Parameter	Current Value
C	282.37939783
B	5700.4083374
A	-3.023589341

SSE
0.0004949219
N
8

Edit Alpha
0.050Convergence Criterion
0.00001Goal SSE for CL
.
Plot



Parameter	Estimate	Low	High
C	282.37939783	64.1049	192.315
B	5700.4083374	3212.47	9637.41
A	-3.023589341	-5.8424	-1.9475

Solution

SSE	DFE	MSE	RMSE
0.0004949219	5	9.8984e-5	0.0099491

Parameter	Estimate	ApproxStdErr
C	282.37939783	47.9416228
B	5700.4083374	613.31046
A	-3.023589341	0.3412921

Solved By:
Analytic NR

Exhibit F10. VFT fit of HWL-10.

Nonlinear Fit Glass ID=HWL-10
Prediction Model
Response: ln(n; poise), Predictor: ln(n; VTF)

Control Panel

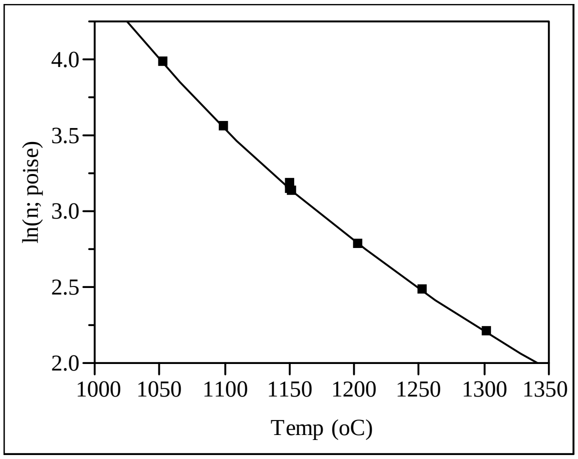
Converged in Gradient

Criterion	Current	Stop Limit
Iteration	4	60
Obj Change	0.0000584291	1e-15
Relative Gradient	8.4824529e-7	0.000001
Gradient	8.3435047e-7	0.000001

Parameter	Current Value
C	359.59832205
B	4646.1326469
A	-2.729726354

SSE
0.0009418132
N
8

Edit Alpha
0.050Convergence Criterion
0.00001Goal SSE for CL
.
Plot



Parameter	Estimate	Low	High
C	359.59832205	64.1049	192.315
B	4646.1326469	3212.47	9637.41
A	-2.729726354	-5.8424	-1.9475

Solution

SSE	DFE	MSE	RMSE
0.0009418132	5	0.0001884	0.0137245

Parameter	Estimate	ApproxStdErr
C	359.59832205	71.290716
B	4646.1326469	828.519457
A	-2.729726354	0.51512938

Solved By:
Analytic NR

Exhibit F11. VFT fit of HWL-11.

Nonlinear Fit Glass ID=HWL-11
Prediction Model
Response: ln(n; poise), Predictor: ln(n; VTF)

Control Panel

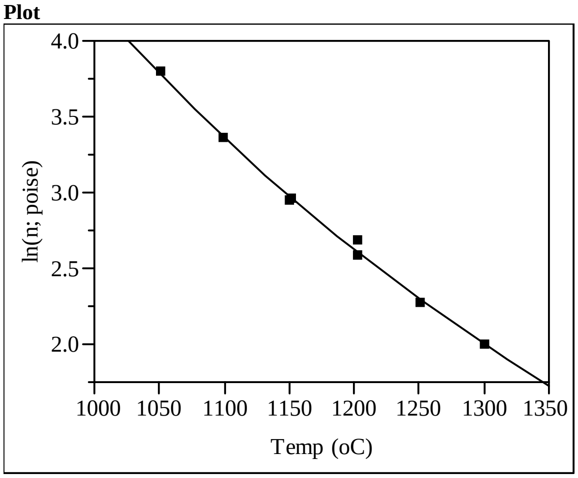
Converged in Gradient

Criterion	Current	Stop Limit
Iteration	3	60
Obj Change	3.4865106e-7	1e-15
Relative Gradient	4.1635725e-7	0.000001
Gradient	3.076968e-7	0.000001

Parameter	Current Value
C	77.810378009
B	8458.6788468
A	-4.923236692

SSE
0.0084790265
N
8

Edit Alpha
0.050Convergence Criterion
0.00001Goal SSE for CL
.
Plot



Parameter	Estimate	Low	High
C	77.810378009	64.1049	192.315
B	8458.6788468	3212.47	9637.41
A	-4.923236692	-5.8424	-1.9475

Solution

SSE	DFE	MSE	RMSE
0.0084790265	5	0.0016958	0.0411802

Parameter	Estimate	ApproxStdErr
C	77.810378009	400.319967
B	8458.6788468	6255.59332
A	-4.923236692	2.87906525

Solved By:
Analytic NR

Exhibit F12. VFT fit of HWL-12.

Nonlinear Fit Glass ID=HWL-12
Prediction Model
Response: ln(n; poise), Predictor: ln(n; VTF)

Control Panel

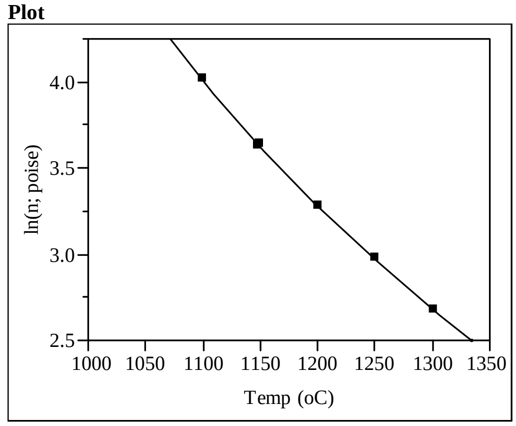
Converged in Gradient

Criterion	Current	Stop Limit
Iteration	4	60
Obj Change	1.204915e-11	1e-15
Relative Gradient	4.088051e-8	0.000001
Gradient	9.7855589e-9	0.000001

Parameter	Current Value
C	194.73864068
B	6659.9801306
A	-3.348813405

SSE
0.0003630188
N
7

Edit Alpha
0.050Convergence Criterion
0.00001Goal SSE for CL
.
Plot



Parameter	Estimate	Low	High
C	194.73864068	64.1049	192.315
B	6659.9801306	3212.47	9637.41
A	-3.348813405	-5.8424	-1.9475

Solution

SSE	DFE	MSE	RMSE
0.0003630188	4	9.0755e-5	0.0095265

Parameter	Estimate	ApproxStdErr
C	194.73864068	141.698342
B	6659.9801306	1891.55115
A	-3.348813405	0.94471215

Solved By: Analytic NR
Excluded Data

Count	SSE	MSE	RMSE
1	0.4428612701	0.4428613	0.6654782

Exhibit F13. VFT fit of HWL-13.

Nonlinear Fit Glass ID=HWL-13
Prediction Model
Response: ln(n; poise), Predictor: ln(n; VTF)

Control Panel

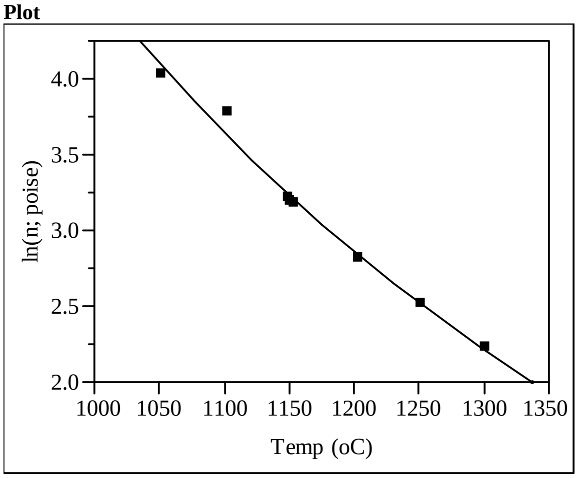
Converged in Gradient

Criterion	Current	Stop Limit
Iteration	4	60
Obj Change	8.885701e-11	1e-15
Relative Gradient	1.0226446e-6	0.000001
Gradient	1.455821e-7	0.000001

Parameter	Current Value
C	155.98607456
B	7716.4880594
A	-4.535145831

SSE
0.03179374
N
8

Edit Alpha
0.050Convergence Criterion
0.00001Goal SSE for CL
.
Plot



Parameter	Estimate	Low	High
C	155.98607456	64.1049	192.315
B	7716.4880594	3212.47	9637.41
A	-4.535145831	-5.8424	-1.9475

Solution

SSE	DFE	MSE	RMSE
0.03179374	5	0.0063587	0.0797418

Parameter	Estimate	ApproxStdErr
C	155.98607456	619.788051
B	7716.4880594	9500.57129
A	-4.535145831	4.70114323

Solved By:
Analytic NR

Exhibit F14. VFT fit of HWL-14.

Nonlinear Fit Glass ID=HWL-14
Prediction Model
Response: ln(n; poise), Predictor: ln(n; VTF)

Control Panel

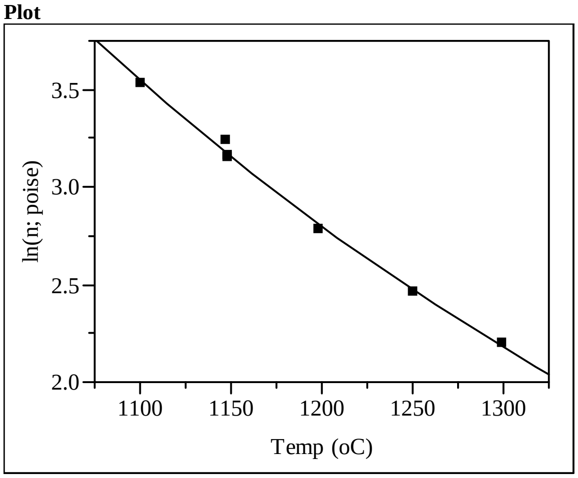
Converged in Gradient

Criterion	Current	Stop Limit
Iteration	3	60
Obj Change	1.712448e-7	1e-15
Relative Gradient	9.9296204e-7	0.000001
Gradient	9.55992e-7	0.000001

Parameter	Current Value
C	201.45083903
B	6745.8791647
A	-3.963817385

SSE
0.0052338242
N
7

Edit Alpha
0.050Convergence Criterion
0.00001Goal SSE for CL
.
Plot



Parameter	Estimate	Low	High
C	201.45083903	64.1049	192.315
B	6745.8791647	3212.47	9637.41
A	-3.963817385	-5.8424	-1.9475

Solution

SSE	DFE	MSE	RMSE
0.0052338242	4	0.0013085	0.0361726

Parameter	Estimate	ApproxStdErr
C	201.45083903	530.936689
B	6745.8791647	7225.78259
A	-3.963817385	3.63218639

Solved By:
Analytic NR

Exhibit F15. VFT fit of HWL-15.

Nonlinear Fit Glass ID=HWL-15
Prediction Model
Response: ln(n; poise), Predictor: ln(n; VTF)

Control Panel

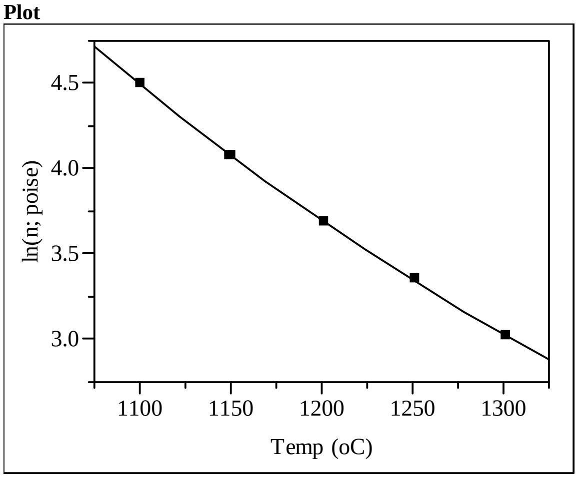
Converged in Gradient

Criterion	Current	Stop Limit
Iteration	3	60
Obj Change	6.4943278e-9	1e-15
Relative Gradient	4.6373494e-8	0.000001
Gradient	2.8947743e-8	0.000001

Parameter	Current Value
C	117.22263461
B	8510.7299306
A	-4.166169957

SSE
0.0002494863
N
6

Edit Alpha
0.050Convergence Criterion
0.00001Goal SSE for CL
.
Plot



Parameter	Estimate	Low	High
C	117.22263461	64.1049	192.315
B	8510.7299306	3212.47	9637.41
A	-4.166169957	-5.8424	-1.9475

Solution

SSE	DFE	MSE	RMSE
0.0002494863	3	8.3162e-5	0.0091193

Parameter	Estimate	ApproxStdErr
C	117.22263461	148.04222
B	8510.7299306	2342.61817
A	-4.166169957	1.08549067

Solved By:
Analytic NR

Exhibit F16. VFT fit of HWL-16.

Nonlinear Fit Glass ID=HWL-16
Prediction Model
Response: ln(n; poise), Predictor: ln(n; VTF)

Control Panel

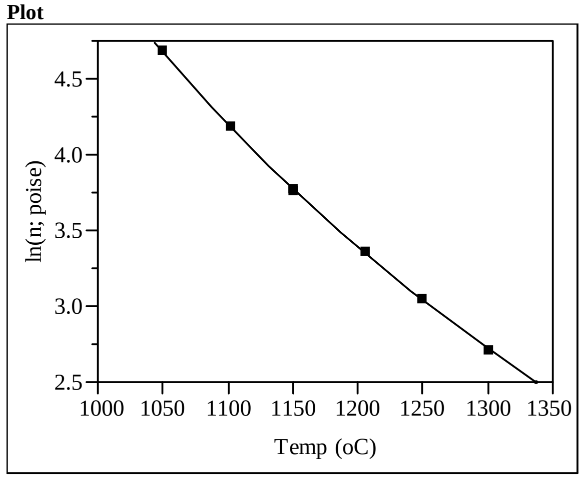
Converged in Gradient

Criterion	Current	Stop Limit
Iteration	4	60
Obj Change	5.824086e-9	1e-15
Relative Gradient	2.2503423e-7	0.000001
Gradient	1.7032405e-7	0.000001

Parameter	Current Value
C	225.97877039
B	6932.4117331
A	-3.736986231

SSE
0.0002245075
N
7

Edit Alpha
0.050Convergence Criterion
0.00001Goal SSE for CL
.
Plot



Parameter	Estimate	Low	High
C	225.97877039	64.1049	192.315
B	6932.4117331	3212.47	9637.41
A	-3.736986231	-5.8424	-1.9475

Solution

SSE	DFE	MSE	RMSE
0.0002245075	4	5.6127e-5	0.0074918

Parameter	Estimate	ApproxStdErr
C	225.97877039	50.5417006
B	6932.4117331	750.561136
A	-3.736986231	0.39983774

Solved By:
Analytic NR

Exhibit F17. VFT fit of HWL-17.

Nonlinear Fit Glass ID=HWL-17
Prediction Model
Response: ln(n; poise), Predictor: ln(n; VTF)

Control Panel

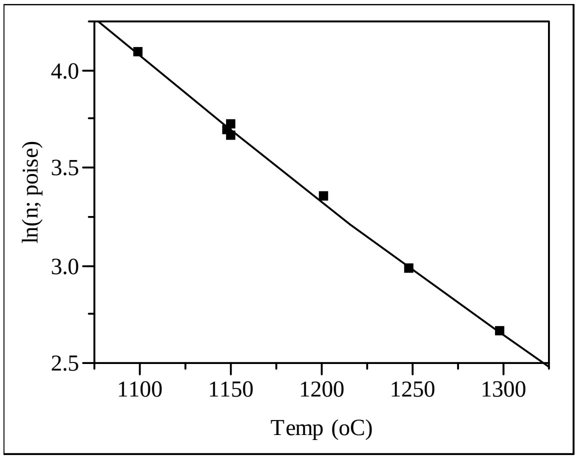
Converged in Gradient

Criterion	Current	Stop Limit
Iteration	7	60
Obj Change	3.1076226e-6	1e-15
Relative Gradient	1.9137027e-7	0.000001
Gradient	1.9028577e-7	0.000001

Parameter	Current Value
C	-906.650614
B	31621.140371
A	-11.68735998

SSE
0.0030315395
N
7

Edit Alpha
0.050Convergence Criterion
0.00001Goal SSE for CL
.
Plot



Parameter	Estimate	Low	High
C	-906.650614	64.1049	192.315
B	31621.140371	3212.47	9637.41
A	-11.68735998	-5.8424	-1.9475

Solution

SSE	DFE	MSE	RMSE
0.0030315395	4	0.0007579	0.0275297

Parameter	Estimate	ApproxStdErr
C	-906.650614	1743.36888
B	31621.140371	52421.5782
A	-11.68735998	12.452797

Solved By:
Analytic NR

Exhibit F18. VFT fit of HWL-18.

Nonlinear Fit Glass ID=HWL-18
Prediction Model
Response: ln(n; poise), Predictor: ln(n; VTF)

Control Panel

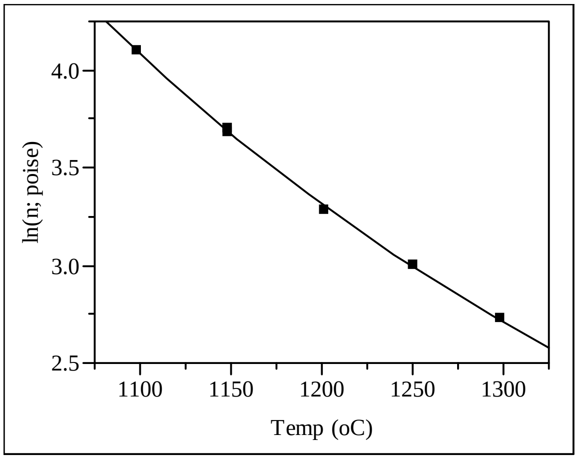
Converged in Gradient

Criterion	Current	Stop Limit
Iteration	5	60
Obj Change	1.1670942e-9	1e-15
Relative Gradient	7.8548913e-8	0.000001
Gradient	1.7494548e-8	0.000001

Parameter	Current Value
C	390.50800484
B	4427.4221439
A	-2.161102944

SSE
0.0006775769
N
7

Edit Alpha
0.050Convergence Criterion
0.00001Goal SSE for CL
.
Plot



Parameter	Estimate	Low	High
C	390.50800484	64.1049	192.315
B	4427.4221439	3212.47	9637.41
A	-2.161102944	-5.8424	-1.9475

Solution

SSE	DFE	MSE	RMSE
0.0006775769	4	0.0001694	0.0130152

Parameter	Estimate	ApproxStdErr
C	390.50800484	120.602251
B	4427.4221439	1338.15349
A	-2.161102944	0.83425647

Solved By:
Analytic NR

Exhibit F19. VFT fit of HWL-17.

Nonlinear Fit Glass ID=HWL-17
Prediction Model
Response: ln(n; poise), Predictor: ln(n; VTF)

Control Panel

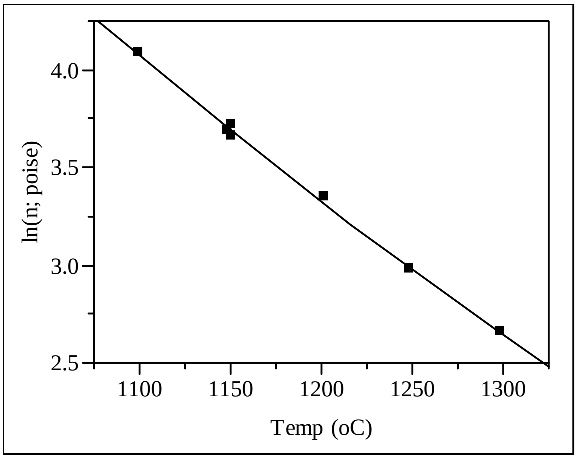
Converged in Gradient

Criterion	Current	Stop Limit
Iteration	7	60
Obj Change	3.1076226e-6	1e-15
Relative Gradient	1.9137027e-7	0.000001
Gradient	1.9028577e-7	0.000001

Parameter	Current Value
C	-906.650614
B	31621.140371
A	-11.68735998

SSE
0.0030315395
N
7

Edit Alpha
0.050Convergence Criterion
0.00001Goal SSE for CL
.
Plot



Parameter	Estimate	Low	High
C	-906.650614	64.1049	192.315
B	31621.140371	3212.47	9637.41
A	-11.68735998	-5.8424	-1.9475

Solution

SSE	DFE	MSE	RMSE
0.0030315395	4	0.0007579	0.0275297

Parameter	Estimate	ApproxStdErr
C	-906.650614	1743.36888
B	31621.140371	52421.5782
A	-11.68735998	12.452797

Solved By:
Analytic NR

Exhibit F20. VFT fit of HWL-18.

Nonlinear Fit Glass ID=HWL-18
Prediction Model
Response: ln(n; poise), Predictor: ln(n; VTF)

Control Panel

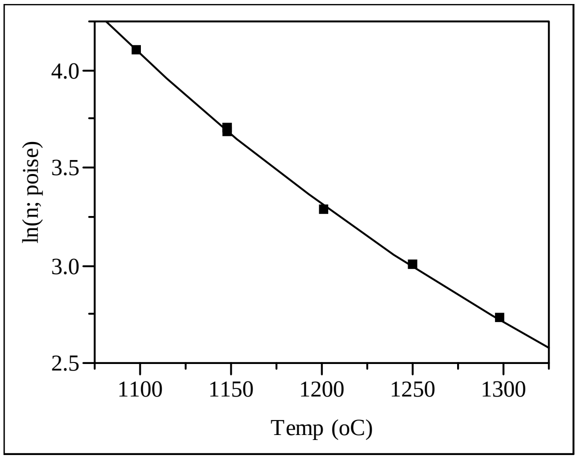
Converged in Gradient

Criterion	Current	Stop Limit
Iteration	5	60
Obj Change	1.1670942e-9	1e-15
Relative Gradient	7.8548913e-8	0.000001
Gradient	1.7494548e-8	0.000001

Parameter	Current Value
C	390.50800484
B	4427.4221439
A	-2.161102944

SSE
0.0006775769
N
7

Edit Alpha
0.050Convergence Criterion
0.00001Goal SSE for CL
.
Plot



Parameter	Estimate	Low	High
C	390.50800484	64.1049	192.315
B	4427.4221439	3212.47	9637.41
A	-2.161102944	-5.8424	-1.9475

Solution

SSE	DFE	MSE	RMSE
0.0006775769	4	0.0001694	0.0130152

Parameter	Estimate	ApproxStdErr
C	390.50800484	120.602251
B	4427.4221439	1338.15349
A	-2.161102944	0.83425647

Solved By:
Analytic NR

Exhibit F21. VFT fit of HWL-19.

Nonlinear Fit Glass ID=HWL-19
Prediction Model
Response: ln(n; poise), Predictor: ln(n; VTF)

Control Panel

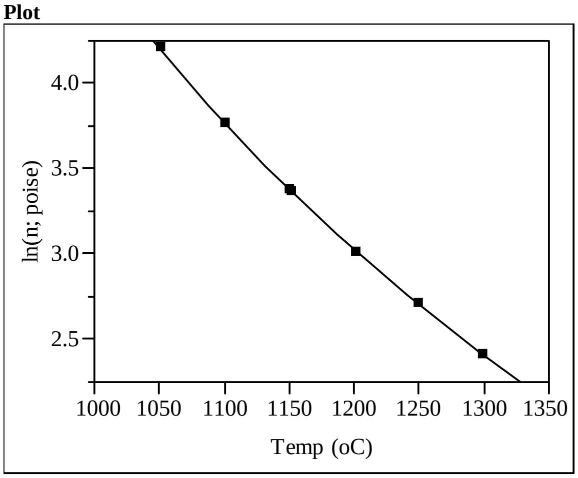
Converged in Gradient

Criterion	Current	Stop Limit
Iteration	3	60
Obj Change	3.4541383e-7	1e-15
Relative Gradient	8.4224986e-7	0.000001
Gradient	7.9847331e-7	0.000001

Parameter	Current Value
C	170.94138922
B	7148.1071299
A	-3.926858216

SSE
0.0001070493
N
8

Edit Alpha
0.050Convergence Criterion
0.00001Goal SSE for CL
.
Plot



Parameter	Estimate	Low	High
C	170.94138922	64.1049	192.315
B	7148.1071299	3212.47	9637.41
A	-3.926858216	-5.8424	-1.9475

Solution

SSE	DFE	MSE	RMSE
0.0001070493	5	0.0000214	0.0046271

Parameter	Estimate	ApproxStdErr
C	170.94138922	36.5453279
B	7148.1071299	527.734993
A	-3.926858216	0.26554508

Solved By:
Analytic NR

Exhibit F22. VFT fit of HWL-20.

Nonlinear Fit Glass ID=HWL-20
Prediction Model
Response: ln(n; poise), Predictor: ln(n; VTF)

Control Panel

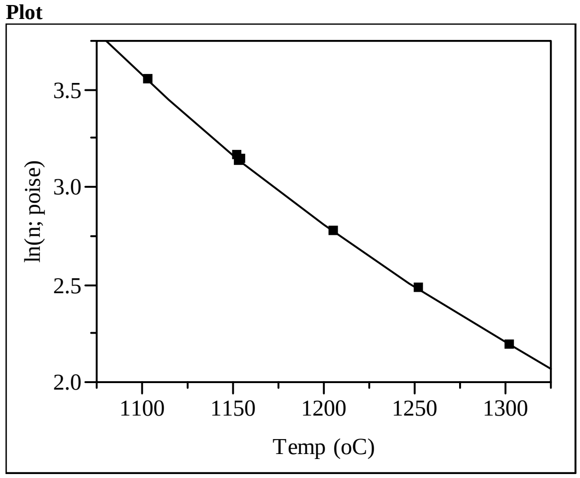
Converged in Gradient

Criterion	Current	Stop Limit
Iteration	5	60
Obj Change	9.851786e-13	1e-15
Relative Gradient	6.062204e-10	0.000001
Gradient	1.008724e-11	0.000001

Parameter	Current Value
C	354.92694722
B	4827.9870864
A	-2.908436702

SSE
0.0001908104
N
7

Edit Alpha
0.050Convergence Criterion
0.00001Goal SSE for CL
.
Plot



Parameter	Estimate	Low	High
C	354.92694722	64.1049	192.315
B	4827.9870864	3212.47	9637.41
A	-2.908436702	-5.8424	-1.9475

Solution

SSE	DFE	MSE	RMSE
0.0001908104	4	0.0000477	0.0069067

Parameter	Estimate	ApproxStdErr
C	354.92694722	71.0737706
B	4827.9870864	818.185372
A	-2.908436702	0.4855827

Solved By:
Analytic NR

Exhibit F23. VFT fit of HWL-19.

Nonlinear Fit Glass ID=HWL-19
Prediction Model
Response: ln(n; poise), Predictor: ln(n; VTF)

Control Panel

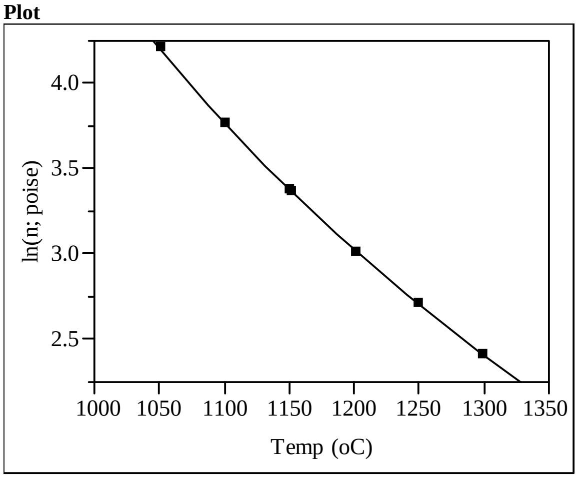
Converged in Gradient

Criterion	Current	Stop Limit
Iteration	3	60
Obj Change	3.4541383e-7	1e-15
Relative Gradient	8.4224986e-7	0.000001
Gradient	7.9847331e-7	0.000001

Parameter	Current Value
C	170.94138922
B	7148.1071299
A	-3.926858216

SSE
0.0001070493
N
8

Edit Alpha
0.050Convergence Criterion
0.00001Goal SSE for CL
.
Plot



Parameter	Estimate	Low	High
C	170.94138922	64.1049	192.315
B	7148.1071299	3212.47	9637.41
A	-3.926858216	-5.8424	-1.9475

Solution

SSE	DFE	MSE	RMSE
0.0001070493	5	0.0000214	0.0046271

Parameter	Estimate	ApproxStdErr
C	170.94138922	36.5453279
B	7148.1071299	527.734993
A	-3.926858216	0.26554508

Solved By:
Analytic NR

Exhibit F24. VFT fit of HWL-20.

Nonlinear Fit Glass ID=HWL-20
Prediction Model
Response: ln(n; poise), Predictor: ln(n; VTF)

Control Panel

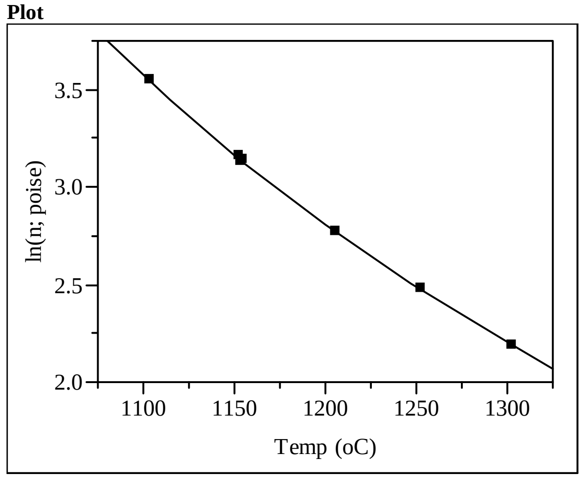
Converged in Gradient

Criterion	Current	Stop Limit
Iteration	5	60
Obj Change	9.851786e-13	1e-15
Relative Gradient	6.062204e-10	0.000001
Gradient	1.008724e-11	0.000001

Parameter	Current Value
C	354.92694722
B	4827.9870864
A	-2.908436702

SSE
0.0001908104
N
7

Edit Alpha
0.050Convergence Criterion
0.00001Goal SSE for CL
.
Plot



Parameter	Estimate	Low	High
C	354.92694722	64.1049	192.315
B	4827.9870864	3212.47	9637.41
A	-2.908436702	-5.8424	-1.9475

Solution

SSE	DFE	MSE	RMSE
0.0001908104	4	0.0000477	0.0069067

Parameter	Estimate	ApproxStdErr
C	354.92694722	71.0737706
B	4827.9870864	818.185372
A	-2.908436702	0.4855827

Solved By:
Analytic NR

Exhibit F25. VFT fit of HWL-21.

Nonlinear Fit Glass ID=HWL-21
Prediction Model
Response: ln(n; poise), Predictor: ln(n; VTF)

Control Panel

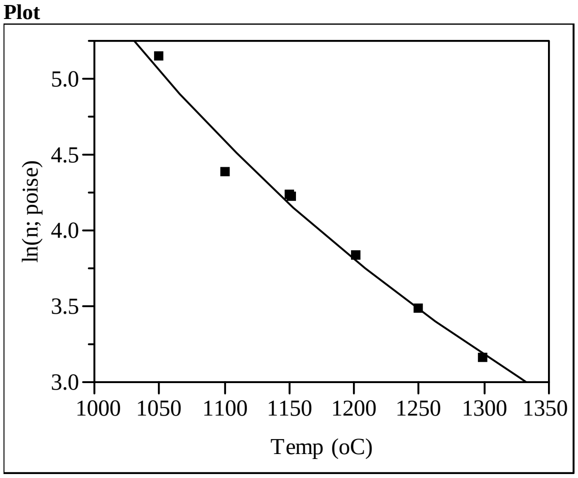
Converged in Gradient

Criterion	Current	Stop Limit
Iteration	5	60
Obj Change	3.229029e-10	1e-15
Relative Gradient	3.286672e-6	0.000001
Gradient	5.585698e-7	0.000001

Parameter	Current Value
C	275.48636794
B	5971.417642
A	-2.652642969

SSE
0.057611855
N
8

Edit Alpha
0.050Convergence Criterion
0.00001Goal SSE for CL
.
Plot



Parameter	Estimate	Low	High
C	275.48636794	64.1049	192.315
B	5971.417642	3212.47	9637.41
A	-2.652642969	-5.8424	-1.9475

Solution

SSE	DFE	MSE	RMSE
0.057611855	5	0.0115224	0.1073423

Parameter	Estimate	ApproxStdErr
C	275.48636794	645.406853
B	5971.417642	8725.95367
A	-2.652642969	4.91646005

Solved By:
Analytic NR

Exhibit F26. VFT fit of HWL-22.

Nonlinear Fit Glass ID=HWL-22
Prediction Model
Response: ln(n; poise), Predictor: ln(n; VTF)

Control Panel

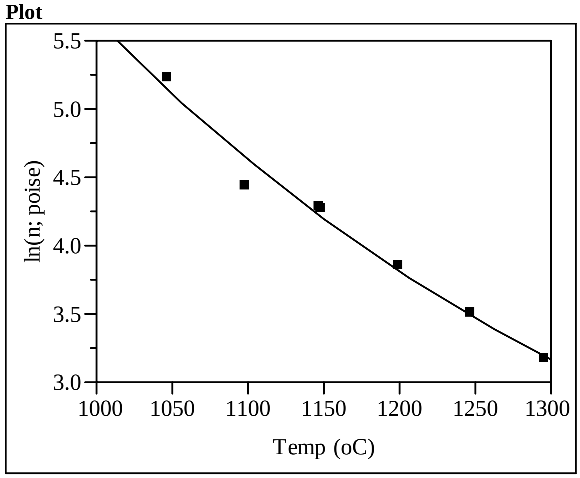
Converged in Gradient

Criterion	Current	Stop Limit
Iteration	6	60
Obj Change	1.486582e-11	1e-15
Relative Gradient	1.0255877e-6	0.000001
Gradient	4.8677143e-8	0.000001

Parameter	Current Value
C	308.95431582
B	5721.1030471
A	-2.608530938

SSE
0.0579034785
N
8

Edit Alpha
0.050Convergence Criterion
0.00001Goal SSE for CL
.
Plot



Parameter	Estimate	Low	High
C	308.95431582	64.1049	192.315
B	5721.1030471	3212.47	9637.41
A	-2.608530938	-5.8424	-1.9475

Solution

SSE	DFE	MSE	RMSE
0.0579034785	5	0.0115807	0.1076136

Parameter	Estimate	ApproxStdErr
C	308.95431582	568.04075
B	5721.1030471	7689.54442
A	-2.608530938	4.52582311

Solved By:
Analytic NR

Table F1. Viscosity at 1150°C Determined from the Fitted Data

Glass ID	Viscosity from Fit (P)
HWL-01	49.72
HWL-02	37.06
HWL-03	43.84
HWL-04	42.61
HWL-05	25.89
HWL-06	29.24
HWL-07	29.07
HWL-08	28.83
HWL-09	34.69
HWL-10	23.30
HWL-11	19.41
HWL-12	37.45
HWL-13	25.22
HWL-14	23.29
HWL-15	58.82
HWL-16	43.18
HWL-17	39.95
HWL-18	39.19
HWL-19	29.20
HWL-20	23.66
HWL-21	65.08
HWL-22	66.28