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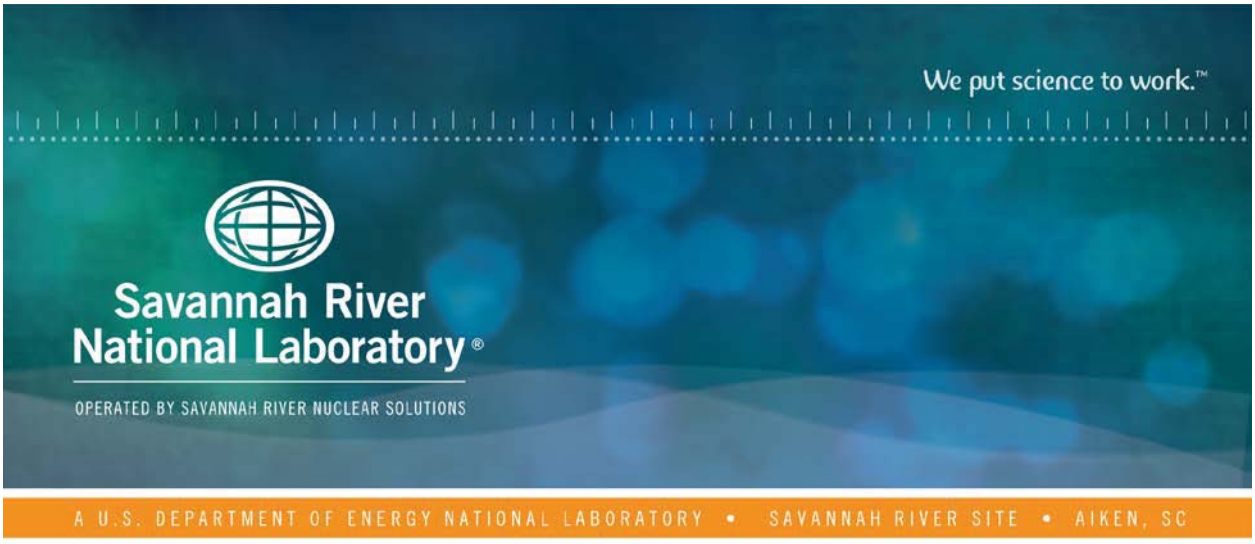

Composition Measurements of the LAW Phase 4 Glasses

M. C. Hsieh

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EXECUTIVE SUMMARY

In this report, the Savannah River National Laboratory provides results from the analyses of glass compositions for a series of simulated nuclear waste glasses fabricated at the Pacific Northwest National Laboratory. The series included quenched versions of the glasses. The resulting data will be used in the development of enhanced property/composition models for waste vitrification at Hanford.

Chemical analyses were performed on a representative sample of each of the quenched glasses to allow for comparisons with the targeted compositions. For the quenched glasses from Set 1, measured concentrations of B_2O_3 and SiO_2 were generally above the targeted values. Measured concentrations for MgO and P_2O_5 were generally low for glasses. Measured concentrations of ZrO_2 were both below and above the targeted values for glasses. For the quenched glasses from Set 2, measured concentrations of Al_2O_3, B_2O_3, P_2O_5, SiO_2, and ZrO_2 were generally below the targeted values. Measured concentrations of Na_2O were both below and above the targeted values for glasses. The measured concentrations of chlorine, fluorine, and SO_3 were below the targeted values for most of the study glasses, likely because of volatility during melting. Overall, there were no indications of errors in batching of the simulated waste glasses. These results can be used in further characterization of this series of glasses, including the normalization of Product Consistency Test results.

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LIST OF ABBREVIATIONS

AD	Acid Dissolution
ARG-1	Analytical Reference Glass-1
BDL	Below Detection Limit
DOE	Department of Energy
IC	Ion Chromatography
ICP-OES	Inductively Coupled Plasma – Optical Emission Spectroscopy
KH	Potassium Hydroxide fusion
LAW	Low Activity Waste
LRM	Low-level Reference Material
ORP	Office of River Protection
PF	Sodium Peroxide Fusion
PNNL	Pacific Northwest National Laboratory
SRNL	Savannah River National Laboratory
TTQAP	Task Technical and Quality Assurance Plan
wt %	Weight Percent
WTP	Hanford Waste Treatment and Immobilization Plant

1.0 Introduction

The U.S. Department of Energy (DOE) is building the Tank Waste Treatment and Immobilization Plant (WTP) at the Hanford Site in Washington state to remediate 55 million gallons of radioactive waste that is temporarily stored in 177 underground tanks. The Office of River Protection (ORP) has requested that the Savannah River National Laboratory (SRNL) contribute in areas of recognized capabilities and expertise for glass waste form development to support startup of the WTP.

Successful efforts have allowed for demonstration of greatly enhanced treatment efficiencies of those projected from the minimum requirements set forth in the WTP Contract. Additional flexibility and expansion of the qualified glass forming region are the current focus. SRNL support of this work is defined in the Task Technical and Quality Assurance Plan (TTQAP).[1]

In this report, SRNL provides results from the chemical analyses of a series of simulated nuclear waste glasses fabricated at the Pacific Northwest National Laboratory (PNNL). The glasses were selected as part of a broader study of the influence of glass composition on chemical durability, sulfur retention, and other properties.[2] The glasses were designated the Low-Activity Waste (LAW) Phase 4 study glasses. The resulting data will be used in the development of enhanced property/composition models for nuclear waste glasses.

2.0 Experimental Procedure

2.1 Quality Assurance

Requirements for performing reviews of technical reports and the extent of review are established in Savannah River Site Manual E7, Procedure 2.60. SRNL documents the extent and type of review using the SRNL Technical Report Design Checklist contained in WSRC-IM-2002-00011, Rev. 2. Laboratory data for this study were recorded in the SRNL Electronic Laboratory Notebook system, experiments C3489-00079-34 and L6390-00413-07. The glasses provided by PNNL were fabricated following a Task Plan.[3]

2.2 Glasses Selected for Study

The baseline (quenched) glass compositions in this study were selected and fabricated by PNNL. The glasses were received and subsequently analyzed in two groups. Identifiers for the glasses are listed in Table 2-1.

In the sections that follow, the methods used for measuring the chemical compositions of the study glasses are described, and reviews of the resulting data are provided. Detailed data from these analyses are included in the appendices.

Table 2-1. Identifiers for the LAW Phase 4 Glasses

Set 1	Set 2
LP4-01-Q	LP4-04-1-Q
LP4-02-Q	LP4-06-2-Q
LP4-03-Q	LP4-07-1-Q
LP4-05-Q	LP4-08-1-Q
LP4-09-Q	LP4-13-Q
LP4-10-Q	LP4-19-Q
LP4-11-Q	LP4-22-Q
LP4-12-Q	LP4-23-1-Q
LP4-14-Q	LP4-24-Q
LP4-15-Q	LP4-25-1-Q
LP4-16-Q	
LP4-17-Q	
LP4-18-Q	
LP4-20-Q	
LP4-21-Q	

2.3 Glass Composition Analysis

Chemical analyses were performed under the auspices of two analytical plans[4,5] on a representative sample of each of the quenched glasses listed in Table 2-1 to allow for comparisons with the targeted compositions. Three dissolution techniques, sodium peroxide fusion (PF),[6] acid dissolution (AD),[7] and potassium hydroxide fusion (KH),[8] were used for preparing each of the glass samples, in duplicate, for analysis. Note that for some analytes, the analytical plans specified more than one preparation method for analyses. The results were reviewed, and in general, the method that provided better recovery of the analyte was selected for reporting.

Each of the duplicate samples was analyzed twice for each element of interest by Inductively Coupled Plasma – Optical Emission Spectroscopy (ICP-OES)[9] or ion chromatography (IC),[10] for a total of four measurements per element per glass. Glass standards were also intermittently measured to assess the performance of the ICP-OES and IC instruments over the course of these analyses. Specifically, several samples of the Low-level Reference Material (LRM)[11] were included as part of the analytical plans. The LRM composition reported as the "Consensus Average" is used as the reference composition of this glass.[11] The preparation and measurement methods used for each of the reported glass components are listed in Table 2-2.

Table 2-2. Preparation and Measurement Methods Used in Reporting the Analyte Concentrations of the Study Glasses

Analyte	Measurement Method	Preparation Method Set 1	Preparation Method Set 2
Al	ICP-OES	PF	PF
B	ICP-OES	PF	PF
Ca	ICP-OES	AD	AD
Cl	IC	KH	KH
Cr	ICP-OES	AD	AD
F	IC	KH	KH
Fe	ICP-OES	AD	AD
K	ICP-OES	AD	AD
Li	ICP-OES	AD	PF
Mg	ICP-OES	AD	PF
Na	ICP-OES	AD	AD
Ni	ICP-OES	AD	AD
P	ICP-OES	AD	AD
Pb	ICP-OES	AD	AD
S	ICP-OES	AD	AD
Si	ICP-OES	PF	PF
Sn	ICP-OES	PF	PF
Ti	ICP-OES	AD	AD
V	ICP-OES	AD	AD
Zn	ICP-OES	AD	AD
Zr	ICP-OES	AD	AD

3.0 Results and Discussion

3.1 Review and Evaluation of the Set 1 Quenched Glass Composition Measurements

Table A-1 in Appendix A provides the elemental concentration measurements in weight percent (wt %) for the glasses as prepared by the PF method. Table A-2 in Appendix A provides the elemental concentration measurements in wt % for the glasses as prepared by the AD method. Table A-3 in Appendix A provides the elemental concentration measurements in wt % for the glasses as prepared by the KH method. Elemental measurements for samples of the LRM reference glasses are also included in the tables of Appendix A. These unprocessed data are provided so that the values are readily available should they be of interest for future reviews.

In the sections that follow, the analytical sequences of the measurements are explored, the measurements of the LRM standard glass are reviewed, the measurements for each glass are reviewed, the average chemical composition for each glass is determined, and comparisons are made between the measurements and the targeted compositions of the glasses. JMP© Version 14.3.0 (SAS Institute, Inc.)[12] was used to support these analyses.

3.1.1 Treatment of Detection Limits

The elemental concentrations in Table A-1 through Table A-3 of Appendix A were converted to oxide concentrations by multiplying the values for each element by the gravimetric factor for the corresponding oxide. Some of the elemental concentration measurements were reported as being below the detection limit

of the analytical processes used. In these cases, the value of the detection limit was considered to be the measured value of the analyte during the process of converting to oxide concentrations. This approach was used for the purposes of data review and calculating a sum of oxides for each glass. Those oxides with one or more concentration measurements that were below the associated detection limit (BDL) will be denoted with a less than symbol (<) as the measured compositions are reported.

3.1.2 Measurements in Analytical Sequence

Exhibit A-1 in Appendix A provides plots of the wt % oxide measurements calculated for each sample by oxide and analytical block. The plots are in analytical sequence within each calibration block with different symbols and colors being used to represent each of the study and standard glasses. These plots include the wt% oxide measurements calculated from all of the measurement data from Table A-1 through Table A-3 in Appendix A, with each plotted point identified by its Lab ID (from the analytical study plan[4]). Plotting the data in this format provides an opportunity to identify gross trends in performance of the analytical instruments within and among calibration blocks. A review of these plots did not identify any gross patterns or trends in the analytical process over the course of these measurements. In all cases, the instrument check standards were within specification. Any minor calibration effects typical of ICP-OES analyses are mitigated by taking the average of the measurements for each analyte.

3.1.3 Composition Measurements by Glass Identifier

Exhibit A-2 in Appendix A provides plots of the oxide concentration measurements by the PNNL Glass ID (including the LRM reference glasses) by Lab ID grouped by targeted concentration. Different symbols and colors are used to represent the different glasses. These plots show the individual measurements across the duplicates of each preparation method and the two instrument calibrations for each glass. Plotting the data in this format provides an opportunity to review the values for each individual glass as a function of the duplicate preparations and duplicate measurements. A review of the plots presented in these exhibits reveals the repeatability of the four individual values for each oxide for each glass. Some degree of scatter among the Al_2O_3, B_2O_3, CaO, Li_2O, P_2O_5, and SiO_2 measurements was noted for the Set 1 glasses. Two duplicate samples for LP4-09-Q had low phosphorus (P) and zirconium (Zr) measurements due to possible preparation difficulties and were not included in determining a representative measured composition for this glass. Two duplicate samples for LP4-10-Q were determined to have possible measurement errors for boron (B) and were not included in determining the representative measured composition of this glass. There were no other indications of errors in preparation or measurement that had to be addressed in treatment of the data.

3.1.4 Results for the LRM Standard

Exhibit A-3 in Appendix A provides a comparison of the LRM results to their acceptability limits utilized by SRNL.[9] The review is in the form of plots of the measurements arranged by preparation method and element, framed by upper and lower acceptability limits for the concentration of the element in question. The results show that all the measurements for the elements present in the LRM standard glass were within the acceptability limits utilized by SRNL in conducting instrument and procedure assessments during the execution of these analyses.

3.1.5 Measured versus Targeted Compositions

All of the measurements for each oxide for each glass (i.e., all of the measurements in Table A-1 through Table A-3 in Appendix A) were averaged to determine a representative chemical composition for each glass. A sum of oxides was also computed for each glass based upon the averaged, measured values. Exhibit A-4 in Appendix A provides plots showing the result for each glass for each oxide to allow PNNL to draw comparisons between the measured and targeted values. The following observations are offered from a review of these plots:

- The measured concentrations of B_2O_3 and SiO_2 were higher than the targeted values for most of the glasses.
- Measured concentrations for MgO and P_2O_5 were generally low for the glasses.
- The measured concentrations of ZrO_2 are both below and above the targeted values for the glasses.
- The measured concentrations of chlorine and fluorine are below the targeted values for most of the study glasses, likely because of volatility during melting.

Table A-4 in Appendix A provides a summary of the average compositions as well as the targeted compositions and some associated differences and relative differences. The measured sums of oxides for all glasses fall within the interval of 95 to 105 wt %, indicating acceptable recovery of the glass components.[13] Entries in Table A-4 show the relative differences between the measured values and the targeted values for the oxides with targeted values above 5 wt %. The relative differences are shaded if they are 10% or more.[a] The highlighted cells are consistent with the observations listed above.

3.2 Review and Evaluation of the Set 2 Quenched Glass Composition Measurements

Table B-1 in Appendix B provides the elemental concentration measurements in weight percent (wt %) for the glasses as prepared by the PF method. Table B-2 in Appendix B provides the elemental concentration measurements in wt % for the glasses as prepared by the AD method. Table B-3 in Appendix B provides the elemental concentration measurements in wt % for the glasses as prepared by the KH method. Elemental measurements for samples of the LRM reference glasses are also included in the tables of Appendix B. These unprocessed data are provided so that the values are readily available should they be of interest for future reviews.

3.2.1 Treatment of Detection Limits

Detection limits for the analysis of the Set 2 glasses were treated as described in Section 3.1.1.

3.2.2 Measurements in Analytical Sequence

Exhibit B-1 in Appendix B provides plots of the wt % measurements generated for each sample by oxide and analytical block. The plots are in analytical sequence within each calibration block with different symbols and colors being used to represent each of the study and standard glasses. These plots include all of the measurement data from Table B-1 through Table B-3 in Appendix B, with each plotted point identified by its Lab ID (from the analytical study plan[5]). Plotting the data in this format provides an opportunity to identify gross trends in performance of the analytical instruments within and among calibration blocks. A review of these plots did not identify any gross patterns or trends in the analytical process over the course of these measurements. In all cases, the instrument check standards were within specification. Any minor calibration effects typical of ICP-OES analyses are mitigated by taking the average of the measurements for each analyte.

3.2.3 Composition Measurements by Glass Identifier

Exhibit B-2 in Appendix B provides plots of the oxide concentration measurements by the PNNL Glass ID (including the LRM reference glass) by Lab ID grouped by targeted concentration. Different symbols and colors are used to represent the different glasses. These plots show the individual measurements across the duplicates of each preparation method and the two instrument calibrations for each glass. Plotting the data in this format provides an opportunity to review the values for each individual glass as a function of the duplicate preparations and duplicate measurements. A review of the plots presented in these exhibits reveals the repeatability of the four individual values for each oxide for each glass. Some degree of scatter among the B_2O_3, Na_2O, P_2O_5, and SiO_2 measurements was noted for the glasses. One duplicate for LP4-06-2-Q

[a] These criteria were selected arbitrarily for the purpose of highlighting differences from targeted concentrations that may be of practical concern.

was determined to have possible measurement errors for Cl and F and was not included in determining the representative measured composition of this glass. There were no other indications of errors in preparation or measurement that had to be addressed in treatment of the data.

3.2.4 Results for the LRM Standard

Exhibit B-3 in Appendix B provides a comparison of the LRM results to their acceptability limits utilized by SRNL.[9] The review is in the form of plots of the measurements arranged by preparation method and element, framed by upper and lower acceptability limits for the concentration of the element in question. The results show that all the measurements for the elements present in the LRM standard glass were within the acceptability limits utilized by SRNL in conducting instrument and procedure assessments during the execution of these analyses.

3.2.5 Measured versus Targeted Compositions

All of the measurements for each oxide for each glass (i.e., all of the measurements in Table B-1 through Table B-3 in Appendix B were averaged to determine a representative chemical composition for each glass. A sum of oxides was also computed for each glass based upon the averaged, measured values. Exhibit B-4 in Appendix B provides plots showing the result for each glass for each oxide to allow PNNL to draw comparisons between the measured and targeted values. The following observations are offered from a review of these plots:

- The measured concentrations of Al_2O_3, B_2O_3 and P_2O_5, and SiO_2 are low relative to the targeted values for some of the glasses.
- The measured concentrations of ZrO_2 are below the targeted values for most glasses.
- The measured concentrations of chlorine, fluorine, and SO_3 are below the targeted values for most of the study glasses, likely because of volatility during melting.

Table B-4 in Appendix B provides a summary of the average compositions as well as the targeted compositions and some associated differences and relative differences. The measured sums of oxides for all of the glasses fall within the interval of 95 to 105 wt %, indicating acceptable recovery of the glass components.[13] Entries in Table B-4 show the relative differences between the measured values and the targeted values for the oxides with targeted values above 5 wt %. The relative differences are shaded if they are 10% or more.[b] The highlighted cells are consistent with the observations listed above.

4.0 Summary

In this report, SRNL provides results from the analyses of glass compositions for a series of simulated nuclear waste glasses fabricated at PNNL. The series included quenched versions of the glasses. These data will be used in the development of enhanced property/composition models for waste vitrification at Hanford.

Chemical analyses were performed on a representative sample of each of the quenched glasses to allow for comparisons with the targeted compositions. For the quenched glasses from Set 1, measured concentrations of B_2O_3 and SiO_2 were generally above the targeted values. Measured concentrations for MgO and P_2O_5 were generally below the targeted values for glasses. Measured concentrations of ZrO_2 were both below and above the targeted values for glasses. For the quenched glasses from Set 2, measured concentrations of Al_2O_3, B_2O_3, P_2O_5, SiO_2, and ZrO_2 were generally below the targeted values. Measured concentrations of Na_2O were both below and above the targeted values for glasses. The measured concentrations of chlorine, fluorine, and SO_3 were below the targeted values for most of the study glasses, likely because of volatility during melting. Overall, there were no indications of errors in batching of the simulated waste glasses.

[b] These criteria were selected arbitrarily for the purpose of highlighting differences from targeted concentrations that may be of practical concern.

These results can be used in further characterization of this series of glasses, including the normalization of Product Consistency Test results.

5.0 References

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Appendix A. Tables and Exhibits Supporting the Set 1 Glass Composition Measurements

Table A-1. PF Measurements of the Set 1 Glasses

Glass ID	Block	Sub-Block	Sequence	Lab ID	Al (wt%)	B (wt%)	Si (wt%)	Sn (wt%)
LRM	1	1	1	LRMPF111	5.22	2.45	25.4	<0.100
ARG	1	1	2	ARGPF111	2.50	2.53	22.3	<0.100
LP4-20-Q	1	1	3	S-11225PF11	3.76	4.36	17.0	3.10
LP4-14-Q	1	1	4	S-11220PF11	3.24	4.21	17.4	0.707
LP4-15-Q	1	1	5	S-11221PF11	5.46	2.98	19.0	1.16
LP4-10-Q	1	1	6	S-11217PF11	2.18	2.53	20.9	0.665
LP4-15-Q	1	1	7	S-11221PF21	5.46	3.05	19.2	1.16
LRM	1	1	8	LRMPF112	5.43	2.48	26.0	<0.100
ARG	1	1	9	ARGPF112	2.63	2.69	23.2	<0.100
LP4-16-Q	1	1	10	S-11222PF11	3.03	3.76	21.3	3.03
LP4-11-Q	1	1	11	S-11218PF11	4.94	4.06	21.0	2.92
LP4-12-Q	1	1	12	S-11219PF11	2.18	3.29	22.3	3.46
LP4-18-Q	1	1	13	S-11224PF11	2.31	2.01	21.8	2.54
LP4-17-Q	1	1	14	S-11223PF11	2.14	3.52	20.3	<0.100
LRM	1	1	15	LRMPF113	5.48	2.47	26.2	<0.100
ARG	1	1	16	ARGPF113	2.62	2.67	23.2	<0.100
LRM	1	2	1	LRMPF121	4.76	2.66	27.2	<0.100
ARG	1	2	2	ARGPF121	2.62	2.78	24.1	<0.100
LP4-20-Q	1	2	3	S-11225PF12	3.80	4.44	18.1	3.24
LP4-18-Q	1	2	4	S-11224PF12	2.33	2.11	22.7	2.72
LP4-16-Q	1	2	5	S-11222PF12	3.12	3.82	22.5	3.25
LP4-11-Q	1	2	6	S-11218PF12	5.08	4.20	22.2	3.11
LP4-17-Q	1	2	7	S-11223PF12	2.13	3.58	21.1	<0.100
LRM	1	2	8	LRMPF122	4.73	2.58	27.2	<0.100
ARG	1	2	9	ARGPF122	2.65	2.78	24.3	<0.100
LP4-15-Q	1	2	10	S-11221PF12	5.73	3.20	20.1	1.26
LP4-10-Q	1	2	11	S-11217PF12	2.27	2.73	22.6	0.702
LP4-15-Q	1	2	12	S-11221PF22	5.59	3.18	20.0	1.26
LP4-14-Q	1	2	13	S-11220PF12	3.32	4.36	18.5	0.705
LP4-12-Q	1	2	14	S-11219PF12	2.24	3.39	23.4	3.71
LRM	1	2	15	LRMPF123	4.75	2.58	27.8	<0.100
ARG	1	2	16	ARGPF123	2.66	2.78	24.4	<0.100
LRM	2	1	1	LRMPF211	5.36	2.63	25.1	<0.100
ARG	2	1	2	ARGPF211	2.58	2.80	22.4	<0.100
LP4-20-Q	2	1	3	S-11225PF21	3.79	4.64	17.1	3.15
LP4-05-Q	2	1	4	S-11215PF11	5.64	4.00	17.8	<0.100
LP4-18-Q	2	1	5	S-11224PF21	2.32	2.14	20.8	2.51
LP4-17-Q	2	1	6	S-11223PF21	2.15	3.62	20.2	<0.100
LP4-12-Q	2	1	7	S-11219PF21	2.21	3.39	22.0	3.54
LRM	2	1	8	LRMPF212	5.37	2.52	25.4	<0.100
ARG	2	1	9	ARGPF212	2.60	2.76	22.2	<0.100
LP4-21-Q	2	1	10	S-11226PF11	2.45	4.51	22.2	3.10
LP4-10-Q	2	1	11	S-11217PF21	2.42	10.7	23.5	0.681
LP4-09-Q	2	1	12	S-11216PF11	2.55	4.28	17.0	2.40
LP4-11-Q	2	1	13	S-11218PF21	4.97	4.13	19.9	2.90
LP4-01-Q	2	1	14	S-11212PF11	3.45	4.66	16.1	2.80
LRM	2	1	15	LRMPF213	5.37	2.54	24.8	<0.100
ARG	2	1	16	ARGPF213	2.57	2.76	22.0	<0.100
LRM	2	2	1	LRMPF221	5.43	2.63	25.9	<0.100
ARG	2	2	2	ARGPF221	2.56	2.73	23.3	<0.100
LP4-10-Q	2	2	3	S-11217PF22	2.40	10.5	24.9	0.669
LP4-17-Q	2	2	4	S-11223PF22	2.11	3.57	20.6	<0.100
LP4-21-Q	2	2	5	S-11226PF12	2.43	4.35	23.1	3.09
LP4-05-Q	2	2	6	S-11215PF12	5.73	4.03	18.6	<0.100

Table A-1. PF Measurements of the Set 1 Glasses (continued)

Glass ID	Block	Sub-Block	Sequence	Lab ID	Al (wt%)	B (wt%)	Si (wt%)	Sn (wt%)
LP4-12-Q	2	2	7	S-11219PF22	2.23	3.40	23.0	3.49
LRM	2	2	8	LRMPF222	5.43	2.53	25.9	<0.100
ARG	2	2	9	ARGPF222	2.56	2.71	23.5	<0.100
LP4-09-Q	2	2	10	S-11216PF12	2.50	4.24	17.8	2.50
LP4-11-Q	2	2	11	S-11218PF22	4.91	4.05	21.1	2.97
LP4-01-Q	2	2	12	S-11212PF12	3.45	4.65	16.9	2.85
LP4-20-Q	2	2	13	S-11225PF22	3.85	4.45	17.8	3.24
LP4-18-Q	2	2	14	S-11224PF22	2.28	2.09	21.9	2.53
LRM	2	2	15	LRMPF223	5.38	2.61	26.0	<0.100
ARG	2	2	16	ARGPF223	2.55	2.75	23.1	<0.100
LRM	3	1	1	LRMPF311	5.26	2.64	25.7	<0.100
ARG	3	1	2	ARGPF311	2.51	2.77	23.4	<0.100
LP4-02-Q	3	1	3	S-11213PF11	6.83	2.23	19.6	0.154
LP4-21-Q	3	1	4	S-11226PF21	2.24	4.04	21.4	3.01
LP4-03-Q	3	1	5	S-11214PF11	5.08	4.26	17.2	1.71
LP4-14-Q	3	1	6	S-11220PF21	3.03	4.00	16.4	0.689
LP4-02-Q	3	1	7	S-11213PF21	6.90	2.20	19.8	0.100
LRM	3	1	8	LRMPF312	5.36	2.53	25.6	<0.100
ARG	3	1	9	ARGPF312	2.59	2.73	23.3	<0.100
LP4-01-Q	3	1	10	S-11212PF21	3.16	4.28	15.6	2.76
LP4-16-Q	3	1	11	S-11222PF21	2.82	3.59	20.4	3.03
LP4-09-Q	3	1	12	S-11216PF21	2.29	3.84	16.4	2.41
LP4-05-Q	3	1	13	S-11215PF21	5.26	3.74	17.3	<0.100
LP4-03-Q	3	1	14	S-11214PF21	5.07	4.19	17.1	1.67
LRM	3	1	15	LRMPF313	5.42	2.51	25.8	<0.100
ARG	3	1	16	ARGPF313	2.60	2.72	23.2	<0.100
LRM	3	2	1	LRMPF321	5.34	2.55	26.0	<0.100
ARG	3	2	2	ARGPF321	2.57	2.73	23.5	<0.100
LP4-14-Q	3	2	3	S-11220PF22	3.03	3.98	16.8	0.671
LP4-16-Q	3	2	4	S-11222PF22	2.79	3.55	20.7	3.01
LP4-03-Q	3	2	5	S-11214PF12	5.03	4.14	17.4	1.65
LP4-21-Q	3	2	6	S-11226PF22	2.22	4.06	22.0	2.95
LP4-01-Q	3	2	7	S-11212PF22	3.17	4.24	16.0	2.79
LRM	3	2	8	LRMPF322	5.37	2.52	26.0	<0.100
ARG	3	2	9	ARGPF322	2.58	2.71	23.6	<0.100
LP4-03-Q	3	2	10	S-11214PF22	5.19	4.36	17.9	1.70
LP4-05-Q	3	2	11	S-11215PF22	5.34	3.73	17.9	<0.100
LP4-02-Q	3	2	12	S-11213PF22	6.85	2.16	20.1	<0.100
LP4-09-Q	3	2	13	S-11216PF22	2.30	3.84	16.8	2.35
LP4-02-Q	3	2	14	S-11213PF12	6.78	2.13	19.9	0.129
LRM	3	2	15	LRMPF323	5.45	2.54	26.2	<0.100
ARG	3	2	16	ARGPF323	2.59	2.68	23.4	<0.100

Table A-2. AD Measurements of the Set 1 Glasses

Glass ID	Blk	Sub-Blk	Seq	Lab ID	Ca (wt%)	Cr (wt%)	Fe (wt%)	K (wt%)	Li (wt%)	Mg (wt%)	Na (wt%)	Ni (wt%)	P (wt%)	Pb (wt%)	S (wt%)	Ti (wt%)	V (wt%)	Zn (wt%)	Zr (wt%
LRM	1	1	1	LRMAD111	0.362	0.138	0.999	1.25	<0.100	<0.100	15.8	0.170	0.215	<0.100	0.0994	<0.100	<0.100	<0.100	0.767
ARG	1	1	2	ARGAD111	1.02	<0.100	9.63	2.34	1.47	0.481	8.68	0.796	0.11	<0.100	<0.0500	0.678	<0.100	<0.100	0.112
LP4-21-Q	1	1	3	S-11226AD11	3.75	0.229	0.809	1.30	1.21	0.143	7.46	<0.100	0.571	<0.100	0.425	0.935	<0.100	0.441	2.83
LP4-16-Q	1	1	4	S-11222AD11	0.344	<0.100	0.360	1.79	2.22	0.743	9.67	<0.100	0.135	<0.100	0.248	1.16	2.15	0.418	1.62
LP4-20-Q	1	1	5	S-11225AD11	1.37	0.388	0.996	3.31	0.467	1.93	12.8	<0.100	0.256	<0.100	0.350	0.879	2.13	0.519	1.26
LP4-01-Q	1	1	6	S-11212AD11	1.86	0.208	1.07	<0.100	<0.100	<0.100	18.9	<0.100	<0.100	<0.100	0.427	<0.100	<0.100	2.94	4
LP4-15-Q	1	1	7	S-11221AD11	3.52	0.317	0.432	0.890	<0.100	0.378	16.3	<0.100	0.286	<0.100	0.220	<0.100	0.559	2.20	2.04
LRM	1	1	8	LRMAD112	0.362	0.139	1.01	1.28	<0.100	<0.100	15.1	0.168	0.214	<0.100	0.0994	<0.100	<0.100	<0.100	0.76
ARG	1	1	9	ARGAD112	1.02	<0.100	9.68	2.30	1.47	0.478	8.43	0.797	0.116	<0.100	<0.0500	0.675	<0.100	<0.100	0.111
LP4-15-Q	1	1	10	S-11221AD21	3.48	0.310	0.432	0.878	<0.100	0.373	16.3	<0.100	0.279	<0.100	0.203	<0.100	0.554	2.19	2.03
LP4-10-Q	1	1	11	S-11217AD21	3.40	0.383	0.838	4.90	2.12	1.95	9.88	<0.100	0.199	<0.100	0.133	1.10	<0.100	0.166	3.18
LP4-17-Q	1	1	12	S-11223AD11	5.80	0.399	0.429	2.51	1.44	1.37	7.93	<0.100	0.844	<0.100	0.537	0.714	2.20	0.189	2.82
LP4-10-Q	1	1	13	S-11217AD11	3.37	0.380	0.828	4.85	2.09	1.93	9.72	<0.100	0.194	<0.100	0.121	1.09	<0.100	0.164	3.15
LP4-18-Q	1	1	14	S-11224AD11	8.10	0.136	0.350	<0.100	0.817	1.89	11.0	<0.100	0.88	<0.100	0.278	1.14	0.500	<0.100	1.39
LRM	1	1	15	LRMAD113	0.362	0.136	1.01	1.28	<0.100	<0.100	15.1	0.168	0.214	<0.100	0.104	<0.100	<0.100	<0.100	0.759
ARG	1	1	16	ARGAD113	1.01	<0.100	9.73	2.34	1.50	0.475	8.25	0.792	0.113	<0.100	<0.0500	0.672	<0.100	<0.100	0.11
LRM	1	2	1	LRMAD121	0.364	0.139	1.00	1.23	<0.100	<0.100	15.8	0.163	0.213	<0.100	0.102	<0.100	<0.100	<0.100	0.734
ARG	1	2	2	ARGAD121	1.03	<0.100	9.62	2.27	1.41	0.501	8.68	0.787	0.105	<0.100	<0.0500	0.677	<0.100	<0.100	0.104
LP4-21-Q	1	2	3	S-11226AD12	3.76	0.226	0.809	1.26	1.16	0.147	7.80	<0.100	0.58	<0.100	0.442	0.928	<0.100	0.437	2.7
LP4-20-Q	1	2	4	S-11225AD12	1.36	0.383	0.988	3.22	0.444	1.99	13.2	<0.100	0.243	<0.100	0.358	0.869	2.11	0.505	1.2
LP4-16-Q	1	2	5	S-11222AD12	0.345	<0.100	0.361	1.74	2.14	0.776	9.99	<0.100	0.133	<0.100	0.246	1.17	2.15	0.413	1.56
LP4-10-Q	1	2	6	S-11217AD12	3.44	0.385	0.829	4.74	2.01	2.04	10.3	<0.100	0.203	<0.100	0.121	1.10	<0.100	0.165	3.06
LP4-01-Q	1	2	7	S-11212AD12	1.87	0.205	1.05	<0.100	<0.100	<0.100	19.4	<0.100	<0.100	<0.100	0.431	<0.100	<0.100	2.90	3.81
LRM	1	2	8	LRMAD122	0.364	0.137	1.01	1.24	<0.100	<0.100	15.6	0.164	0.215	<0.100	0.0904	<0.100	<0.100	<0.100	0.726
ARG	1	2	9	ARGAD122	1.02	<0.100	9.56	2.24	1.40	0.496	8.67	0.783	0.111	<0.100	<0.0500	0.671	<0.100	<0.100	0.104
LP4-10-Q	1	2	10	S-11217AD22	3.45	0.387	0.829	4.75	2.00	2.04	10.4	<0.100	0.194	<0.100	0.116	1.11	<0.100	0.165	3.07
LP4-18-Q	1	2	11	S-11224AD12	8.17	0.137	0.345	<0.100	0.768	1.97	11.4	<0.100	0.881	<0.100	0.289	1.14	0.500	<0.100	1.32
LP4-15-Q	1	2	12	S-11221AD22	3.49	0.311	0.425	0.849	<0.100	0.386	16.9	<0.100	0.28	<0.100	0.227	<0.100	0.551	2.16	1.93
LP4-15-Q	1	2	13	S-11221AD12	3.54	0.316	0.427	0.848	<0.100	0.390	16.9	<0.100	0.287	<0.100	0.208	<0.100	0.557	2.21	1.95
LP4-17-Q	1	2	14	S-11223AD12	5.82	0.394	0.422	2.39	1.36	1.42	8.35	<0.100	0.852	<0.100	0.538	0.707	2.18	0.189	2.69
LRM	1	2	15	LRMAD123	0.361	0.136	0.995	1.23	<0.100	<0.100	15.6	0.160	0.209	<0.100	0.0917	<0.100	<0.100	<0.100	0.719
ARG	1	2	16	ARGAD123	1.02	<0.100	9.48	2.23	1.40	0.494	8.60	0.778	0.109	<0.100	<0.0500	0.668	<0.100	<0.100	0.103
LRM	2	1	1	LRMAD211	0.354	0.134	1.02	1.25	<0.100	<0.100	15.6	0.153	0.209	<0.100	0.105	<0.100	<0.100	<0.100	0.755
ARG	2	1	2	ARGAD211	1.05	<0.100	9.89	2.27	1.50	0.477	8.55	0.783	0.106	<0.100	<0.0500	0.678	<0.100	<0.100	0.109
LP4-12-Q	2	1	3	S-11219AD11	0.560	0.177	0.256	4.50	0.973	1.68	8.76	<0.100	0.231	<0.100	0.160	0.421	2.30	0.599	2.88
LP4-02-Q	2	1	4	S-11213AD11	1.15	0.112	0.767	2.76	2.18	1.16	7.49	<0.100	0.712	<0.100	0.193	0.477	1.47	2.40	1.86
LP4-05-Q	2	1	5	S-11215AD11	5.82	0.339	0.716	0.151	<0.100	0.588	15.5	<0.100	0.122	<0.100	0.401	<0.100	0.569	2.37	1.52
LP4-01-Q	2	1	6	S-11212AD21	1.98	0.208	1.07	<0.100	<0.100	<0.100	19.7	<0.100	<0.100	<0.100	0.392	<0.100	<0.100	2.95	4.04
LP4-12-Q	2	1	7	S-11219AD21	0.552	0.175	0.256	4.62	0.985	1.66	8.68	<0.100	0.234	<0.100	0.162	0.414	2.27	0.593	2.84
LRM	2	1	8	LRMAD212	0.355	0.134	1.02	1.26	<0.100	<0.100	15.6	0.151	0.214	<0.100	0.0988	<0.100	<0.100	<0.100	0.753

Table A-2. AD Measurements of the Set 1 Glasses (continued)

Glass ID	Blk	Sub-Blk	Seq	Lab ID	Ca (wt%)	Cr (wt%)	Fe (wt%)	K (wt%)	Li (wt%)	Mg (wt%)	Na (wt%)	Ni (wt%)	P (wt%)	Pb (wt%)	S (wt%)	Ti (wt%)	V (wt%)	Zn (wt%)	Zr (wt%)
ARG	2	1	9	ARGAD212	1.05	<0.100	9.98	2.33	1.52	0.478	8.62	0.785	0.106	<0.100	<0.0500	0.679	<0.100	<0.100	0.108
LP4-20-Q	2	1	10	S-11225AD21	1.42	0.394	1.00	3.23	0.466	1.95	13.1	<0.100	0.258	<0.100	0.313	0.894	2.18	0.516	1.27
LP4-11-Q	2	1	11	S-11218AD11	0.472	0.314	<0.100	3.48	0.624	1.23	10.6	<0.100	0.244	<0.100	0.0678	1.01	0.427	0.795	1.73
LP4-03-Q	2	1	12	S-11214AD11	4.29	0.372	0.203	3.88	2.08	0.421	8.00	<0.100	0.806	<0.100	0.491	0.218	0.418	0.354	3.14
LP4-14-Q	2	1	13	S-11220AD11	7.85	0.392	1.03	2.87	1.51	1.64	8.52	<0.100	0.727	<0.100	0.410	0.184	0.735	1.20	2.17
LP4-18-Q	2	1	14	S-11224AD21	8.75	0.133	0.346	<0.100	0.810	1.93	11.4	<0.100	0.897	<0.100	0.266	1.17	0.514	<0.100	1.41
LRM	2	1	15	LRMAD213	0.357	0.134	1.01	1.24	<0.100	<0.100	15.5	0.150	0.201	<0.100	0.0885	<0.100	<0.100	<0.100	0.757
ARG	2	1	16	ARGAD213	1.06	<0.100	9.86	2.29	1.50	0.479	8.64	0.787	0.11	<0.100	<0.0500	0.684	<0.100	<0.100	0.109
LRM	2	2	1	LRMAD221	0.366	0.134	1.01	1.23	<0.100	<0.100	15.6	0.153	0.206	<0.100	0.0825	<0.100	<0.100	<0.100	0.767
ARG	2	2	2	ARGAD221	1.07	<0.100	9.85	2.25	1.52	0.495	8.65	0.796	0.114	<0.100	<0.0500	0.694	<0.100	<0.100	0.11
LP4-02-Q	2	2	3	S-11213AD12	1.17	0.112	0.788	2.82	2.28	1.20	7.51	<0.100	0.71	<0.100	0.174	0.488	1.48	2.44	1.9
LP4-12-Q	2	2	4	S-11219AD22	0.568	0.175	0.255	4.43	0.976	1.72	8.60	<0.100	0.237	<0.100	0.173	0.425	2.29	0.600	2.91
LP4-12-Q	2	2	5	S-11219AD12	0.571	0.175	0.255	4.46	0.983	1.73	8.65	<0.100	0.231	<0.100	0.174	0.428	2.30	0.605	2.92
LP4-14-Q	2	2	6	S-11220AD12	7.98	0.3905	0.995	2.76	1.48	1.70	8.43	<0.100	0.73	<0.100	0.402	0.188	0.735	1.19	2.2
LP4-01-Q	2	2	7	S-11212AD22	2.03	0.206	1.08	<0.100	<0.100	<0.100	19.7	<0.100	<0.100	<0.100	0.426	<0.100	<0.100	2.98	4.15
LRM	2	2	8	LRMAD222	0.368	0.134	1.01	1.23	<0.100	<0.100	15.5	0.153	0.206	<0.100	0.0864	<0.100	<0.100	<0.100	0.768
ARG	2	2	9	ARGAD222	1.08	<0.100	9.73	2.27	1.52	0.496	8.62	0.793	0.113	<0.100	<0.0500	0.698	<0.100	<0.100	0.11
LP4-03-Q	2	2	10	S-11214AD12	4.38	0.370	0.212	3.94	2.16	0.436	7.95	<0.100	0.808	<0.100	0.494	0.224	0.419	0.357	3.21
LP4-18-Q	2	2	11	S-11224AD22	8.96	0.134	0.351	<0.100	0.832	2.01	11.3	<0.100	0.901	<0.100	0.264	1.20	0.517	<0.100	1.44
LP4-05-Q	2	2	12	S-11215AD12	6.01	0.342	0.719	0.145	<0.100	0.617	15.3	<0.100	0.125	<0.100	0.416	<0.100	0.580	2.42	1.56
LP4-11-Q	2	2	13	S-11218AD12	0.489	0.314	<0.100	3.46	0.644	1.28	10.6	<0.100	0.246	<0.100	0.0704	1.03	0.431	0.800	1.76
LP4-20-Q	2	2	14	S-11225AD22	1.47	0.392	0.997	3.17	0.478	2.03	13.3	<0.100	0.261	<0.100	0.338	0.918	2.20	0.527	1.3
LRM	2	2	15	LRMAD223	0.369	0.135	1.00	1.20	<0.100	<0.100	15.6	0.152	0.215	<0.100	0.0949	<0.100	<0.100	<0.100	0.769
ARG	2	2	16	ARGAD223	1.09	<0.100	9.73	2.23	1.51	0.497	8.56	0.799	0.107	<0.100	<0.0500	0.700	<0.100	<0.100	0.11
LRM	3	1	1	LRMAD311	0.320	0.134	1.01	1.23	<0.100	<0.100	15.7	0.146	0.2	<0.100	0.0999	<0.100	<0.100	<0.100	0.727
ARG	3	1	2	ARGAD311	0.940	<0.100	9.91	2.32	1.41	0.453	8.72	0.773	0.101	<0.100	<0.0500	0.641	<0.100	<0.100	0.138
LP4-03-Q	3	1	3	S-11214AD21	3.78	0.365	0.214	4.01	1.98	0.396	8.04	<0.100	0.77	<0.100	0.527	0.205	0.385	0.348	2.88
LP4-11-Q	3	1	4	S-11218AD21	0.420	0.307	<0.100	3.62	0.598	1.15	10.6	<0.100	0.233	<0.100	<0.0500	0.944	0.392	0.778	1.6
LP4-17-Q	3	1	5	S-11223AD21	5.48	0.392	0.431	2.45	1.35	1.30	8.13	<0.100	0.826	<0.100	0.524	0.680	2.06	0.187	2.62
LP4-09-Q	3	1	6	S-11216AD11	0.225	<0.100	<0.100	4.74	1.52	0.907	11.2	<0.100	0.85	<0.100	0.334	0.978	1.86	2.12	2.84
LP4-09-Q	3	1	7	S-11216AD21	0.224	<0.100	<0.100	4.79	1.55	0.910	11.2	<0.100	0.849	<0.100	0.362	0.981	1.87	2.14	2.86
LRM	3	1	8	LRMAD312	0.319	0.132	1.01	1.24	<0.100	<0.100	15.7	0.151	0.205	<0.100	0.107	<0.100	<0.100	<0.100	0.725
ARG	3	1	9	ARGAD312	0.932	<0.100	9.85	2.26	1.40	0.450	8.55	0.766	0.109	<0.100	<0.0500	0.638	<0.100	<0.100	0.138
LP4-02-Q	3	1	10	S-11213AD21	1.02	0.111	0.776	2.79	2.07	1.09	7.57	<0.100	0.688	<0.100	0.197	0.449	1.37	2.37	1.74
LP4-21-Q	3	1	11	S-11226AD21	3.50	0.222	0.794	1.27	1.14	0.134	7.66	<0.100	0.558	<0.100	0.432	0.881	<0.100	0.430	2.6
LP4-16-Q	3	1	12	S-11222AD21	0.304	<0.100	0.363	1.73	2.09	0.700	9.97	<0.100	0.127	<0.100	0.258	1.10	2.02	0.406	1.51
LP4-14-Q	3	1	13	S-11220AD21	6.87	0.378	1.01	2.81	1.38	1.53	8.48	<0.100	0.698	<0.100	0.408	0.171	0.674	1.14	1.99
LP4-05-Q	3	1	14	S-11215AD21	5.21	0.334	0.718	0.144	<0.100	0.559	15.5	<0.100	0.115	<0.100	0.432	<0.100	0.533	2.34	1.43
LRM	3	1	15	LRMAD313	0.352	0.133	1.01	1.23	<0.100	<0.100	15.4	0.151	0.204	<0.100	0.118	<0.100	<0.100	<0.100	0.801
ARG	3	1	16	ARGAD313	1.01	<0.100	9.76	2.31	1.41	0.466	8.66	0.776	0.108	<0.100	0.0568	0.683	<0.100	<0.100	0.145
LRM	3	2	1	LRMAD321	0.351	0.128	1.01	1.22	<0.100	<0.100	15.5	0.151	0.199	<0.100	0.110	<0.100	<0.100	<0.100	0.754
ARG	3	2	2	ARGAD321	1.04	<0.100	9.76	2.30	1.42	0.484	8.70	0.776	0.102	<0.100	<0.0500	0.678	<0.100	<0.100	0.11

Table A-2. AD Measurements of the Set 1 Glasses (continued)

Glass ID	Blk	Sub-Blk	Seq	Lab ID	Ca (wt%)	Cr (wt%)	Fe (wt%)	K (wt%)	Li (wt%)	Mg (wt%)	Na (wt%)	Ni (wt%)	P (wt%)	Pb (wt%)	S (wt%)	Ti (wt%)	V (wt%)	Zn (wt%)	Zr (wt%)
LP4-05-Q	3	2	3	S-11215AD22	5.42	0.328	0.724	0.145	<0.100	0.581	15.6	<0.100	0.116	<0.100	0.431	<0.100	0.531	2.28	1.42
LP4-16-Q	3	2	4	S-11222AD22	0.313	<0.100	0.372	1.77	2.16	0.730	10.0	<0.100	0.127	<0.100	0.238	1.10	2.00	0.392	1.5
LP4-17-Q	3	2	5	S-11223AD22	5.73	0.384	0.429	2.43	1.36	1.36	8.34	<0.100	0.819	<0.100	0.531	0.680	2.05	0.184	2.64
LP4-14-Q	3	2	6	S-11220AD22	7.16	0.370	1.02	2.84	1.41	1.59	8.63	<0.100	0.695	<0.100	0.424	0.171	0.670	1.13	1.99
LP4-11-Q	3	2	7	S-11218AD22	0.433	0.298	<0.100	3.61	0.609	1.20	10.8	<0.100	0.226	<0.100	0.0576	0.940	0.390	0.754	1.59
LRM	3	2	8	LRMAD322	0.349	0.126	1.02	1.25	<0.100	<0.100	15.6	0.149	0.207	<0.100	0.0963	<0.100	<0.100	<0.100	0.749
ARG	3	2	9	ARGAD322	1.03	<0.100	9.84	2.29	1.42	0.479	8.62	0.771	0.101	<0.100	<0.0500	0.671	<0.100	<0.100	0.109
LP4-02-Q	3	2	10	S-11213AD22	1.06	0.106	0.781	2.81	2.10	1.14	7.72	<0.100	0.689	<0.100	0.180	0.451	1.37	2.31	1.74
LP4-09-Q	3	2	11	S-11216AD12	0.231	<0.100	<0.100	4.83	1.58	0.956	11.1	<0.100	0.856	<0.100	0.352	0.989	1.87	2.11	2.91
LP4-09-Q	3	2	12	S-11216AD22	0.229	<0.100	<0.100	4.79	1.56	0.942	11.1	<0.100	0.852	<0.100	0.345	0.976	1.84	2.06	2.86
LP4-21-Q	3	2	13	S-11226AD22	3.69	0.219	0.793	1.26	1.15	0.142	7.72	<0.100	0.557	<0.100	0.433	0.891	<0.100	0.421	2.66
LP4-03-Q	3	2	14	S-11214AD22	3.99	0.358	0.218	4.06	2.04	0.417	8.11	<0.100	0.78	<0.100	0.517	0.208	0.388	0.341	2.94
LRM	3	2	15	LRMAD323	0.352	0.126	1.03	1.27	<0.100	<0.100	15.7	0.149	0.196	<0.100	0.0924	<0.100	<0.100	<0.100	0.756
ARG	3	2	16	ARGAD323	1.04	<0.100	9.84	2.36	1.45	0.481	8.84	0.767	0.105	<0.100	<0.0500	0.677	<0.100	<0.100	0.11

Table A-3. KH Measurements of the Set 1 Glasses

Glass ID	Block	Sub-Blk	Sequence	Lab ID	Cl (wt%)	F (wt%)
LRM	1	1	1	LRMKH111	<0.0250	0.902
LP4-14-Q	1	1	2	S-11220KH11	0.433	0.171
LP4-17-Q	1	1	3	S-11223KH11	0.208	0.877
LP4-01-Q	1	1	4	S-11212KH21	0.0678	0.0765
LP4-10-Q	1	1	5	S-11217KH11	0.393	0.389
LP4-18-Q	1	1	6	S-11224KH11	0.128	0.254
LRM	1	1	7	LRMKH112	<0.0250	0.904
LP4-02-Q	1	1	8	S-11213KH11	0.377	0.891
LP4-21-Q	1	1	9	S-11226KH11	0.161	0.263
LP4-01-Q	1	1	10	S-11212KH11	0.0806	0.0775
LP4-15-Q	1	1	11	S-11221KH11	0.197	0.282
LP4-05-Q	1	1	12	S-11215KH11	0.277	0.133
LRM	1	1	13	LRMKH113	<0.0250	0.911
LRM	1	2	1	LRMKH121	<0.0250	0.914
LP4-17-Q	1	2	2	S-11223KH12	0.214	0.892
LP4-18-Q	1	2	3	S-11224KH12	0.132	0.261
LP4-02-Q	1	2	4	S-11213KH12	0.391	0.900
LP4-14-Q	1	2	5	S-11220KH12	0.450	0.177
LP4-05-Q	1	2	6	S-11215KH12	0.288	0.137
LRM	1	2	7	LRMKH122	<0.0250	0.918
LP4-21-Q	1	2	8	S-11226KH12	0.170	0.269
LP4-01-Q	1	2	9	S-11212KH22	0.0696	0.0808
LP4-10-Q	1	2	10	S-11217KH12	0.416	0.401
LP4-01-Q	1	2	11	S-11212KH12	0.0859	0.0812
LP4-15-Q	1	2	12	S-11221KH12	0.207	0.290
LRM	1	2	13	LRMKH123	<0.0250	0.923
LRM	2	1	1	LRMKH221	<0.0250	0.898
LP4-18-Q	2	1	2	S-11224KH21	0.116	0.275
LP4-03-Q	2	1	3	S-11214KH11	0.0895	0.717
LP4-16-Q	2	1	4	S-11222KH11	0.407	0.845
LP4-09-Q	2	1	5	S-11216KH11	0.174	0.678
LP4-12-Q	2	1	6	S-11219KH11	0.105	0.354
LRM	2	1	7	LRMKH212	<0.0250	0.902
LP4-05-Q	2	1	8	S-11215KH21	0.271	0.133
LP4-02-Q	2	1	9	S-11213KH21	0.378	0.885
LP4-20-Q	2	1	10	S-11225KH11	0.117	0.555
LP4-15-Q	2	1	11	S-11221KH21	0.189	0.279
LP4-10-Q	2	1	12	S-11217KH21	0.394	0.394
LRM	2	1	13	LRMKH213	<0.0250	0.896
LRM	2	2	1	LRMKH121	<0.0250	0.916
LP4-02-Q	2	2	2	S-11213KH22	0.388	0.916
LP4-09-Q	2	2	3	S-11216KH12	0.178	0.692
LP4-05-Q	2	2	4	S-11215KH22	0.275	0.136
LP4-16-Q	2	2	5	S-11222KH12	0.414	0.854
LP4-18-Q	2	2	6	S-11224KH22	0.119	0.279
LRM	2	2	7	LRMKH222	<0.0250	0.906
LP4-15-Q	2	2	8	S-11221KH22	0.195	0.289
LP4-10-Q	2	2	9	S-11217KH22	0.400	0.400
LP4-20-Q	2	2	10	S-11225KH12	0.119	0.564
LP4-12-Q	2	2	11	S-11219KH12	0.107	0.358
LP4-03-Q	2	2	12	S-11214KH12	0.0910	0.726
LRM	2	2	13	LRMKH122	<0.0250	0.908
LRM	3	1	1	LRMKH311	<0.0250	0.897
LP4-11-Q	3	1	2	S-11218KH11	0.418	0.118
LP4-12-Q	3	1	3	S-11219KH21	0.0881	0.349
LP4-16-Q	3	1	4	S-11222KH21	0.408	0.844

Table A-3. KH Measurements of the Set 1 Glasses

Glass ID	Block	Sub-Blk	Sequence	Lab ID	Cl (wt%)	F (wt%)
LP4-17-Q	3	1	5	S-11223KH21	0.204	0.886
LP4-14-Q	3	1	6	S-11220KH21	0.430	0.171
LRM	3	1	7	LRMKH312	<0.0250	0.899
LP4-21-Q	3	1	8	S-11226KH21	0.166	0.266
LP4-20-Q	3	1	9	S-11225KH21	0.116	0.552
LP4-09-Q	3	1	10	S-11216KH21	0.177	0.674
LP4-03-Q	3	1	11	S-11214KH21	0.0906	0.717
LP4-11-Q	3	1	12	S-11218KH21	0.413	0.118
LRM	3	1	13	LRMKH313	<0.0250	0.900
LRM	3	2	1	LRMKH321	<0.0250	0.900
LP4-03-Q	3	2	2	S-11214KH22	0.0883	0.717
LP4-11-Q	3	2	3	S-11218KH22	0.410	0.118
LP4-17-Q	3	2	4	S-11223KH22	0.200	0.886
LP4-09-Q	3	2	5	S-11216KH22	0.174	0.677
LP4-16-Q	3	2	6	S-11222KH22	0.401	0.847
LRM	3	2	7	LRMKH322	<0.0250	0.901
LP4-12-Q	3	2	8	S-11219KH22	0.0837	0.348
LP4-20-Q	3	2	9	S-11225KH22	0.114	0.552
LP4-11-Q	3	2	10	S-11218KH12	0.413	0.118
LP4-21-Q	3	2	11	S-11226KH22	0.163	0.265
LP4-14-Q	3	2	12	S-11220KH22	0.421	0.168
LRM	3	2	13	LRMKH323	<0.0250	0.902

Table A-4. Comparison of Measured versus Targeted Compositions of the Set 1 Glasses

Glass ID	Oxide	BDL (<)	Measured (wt %)	Targeted (wt %)	Difference of Measured versus Targeted	% Difference of Measured versus Targeted
LP4-01-Q	Al2O3		6.25	6.11	0.140	2.3%
LP4-01-Q	B2O3		14.353	14.01	0.343	2.5%
LP4-01-Q	CaO		2.707	2.63	0.077	
LP4-01-Q	Cl		0.076	0.06	0.016	
LP4-01-Q	Cr2O3		0.302	0.31	-0.008	
LP4-01-Q	F		0.079	0.1	-0.021	
LP4-01-Q	Fe2O3		1.526	1.53	-0.004	
LP4-01-Q	K2O	<	0.12	0	0.120	
LP4-01-Q	Li2O	<	0.215	0	0.215	
LP4-01-Q	MgO	<	0.166	0	0.166	
LP4-01-Q	Na2O		26.185	26.49	-0.305	-1.2%
LP4-01-Q	NiO	<	0.127	0	0.127	
LP4-01-Q	P2O5	<	0.229	0.2	0.029	
LP4-01-Q	PbO	<	0.108	0	0.108	
LP4-01-Q	SiO2		34.55	35.57	-1.020	-2.9%
LP4-01-Q	SnO2		3.555	3.57	-0.015	
LP4-01-Q	SO3		1.046	1.03	0.016	
LP4-01-Q	TiO2	<	0.167	0	0.167	
LP4-01-Q	V2O5	<	0.179	0	0.179	
LP4-01-Q	ZnO		3.663	3.67	-0.007	
LP4-01-Q	ZrO2		5.403	4.72	0.683	14.5%
LP4-01-Q	Sum Oxide		101.006	100	1.006	1.0%
LP4-02-Q	Al2O3		12.924	13.76	-0.836	-6.1%
LP4-02-Q	B2O3		7.019	7.22	-0.201	-2.8%
LP4-02-Q	CaO		1.539	1.52	0.019	
LP4-02-Q	Cl		0.384	0.51	-0.127	
LP4-02-Q	Cr2O3		0.161	0.17	-0.009	-5.2%
LP4-02-Q	F		0.898	1.06	-0.162	
LP4-02-Q	Fe2O3		1.112	1.11	0.002	
LP4-02-Q	K2O		3.367	3.4	-0.033	
LP4-02-Q	Li2O		4.645	4.66	-0.015	
LP4-02-Q	MgO		1.903	2.06	-0.157	-7.6%
LP4-02-Q	Na2O		10.208	10.25	-0.042	-0.4%
LP4-02-Q	NiO	<	0.127	0	0.127	
LP4-02-Q	P2O5		1.603	1.71	-0.107	-6.2%
LP4-02-Q	PbO	<	0.108	0	0.108	
LP4-02-Q	SiO2		42.465	43.31	-0.845	-2.0%
LP4-02-Q	SnO2	<	0.153	0.13	0.023	
LP4-02-Q	SO3		0.464	0.51	-0.046	
LP4-02-Q	TiO2		0.778	0.78	-0.002	
LP4-02-Q	V2O5		2.539	2.61	-0.071	
LP4-02-Q	ZnO		2.963	3.04	-0.077	
LP4-02-Q	ZrO2		2.445	2.19	0.255	11.6%
LP4-02-Q	Sum Oxide		97.805	100	-2.195	-2.2%
LP4-03-Q	Al2O3		9.622	9.86	-0.238	-2.4%
LP4-03-Q	B2O3		13.644	13.91	-0.266	-1.9%
LP4-03-Q	CaO		5.751	5.75	0.001	
LP4-03-Q	Cl		0.09	0.15	-0.060	
LP4-03-Q	Cr2O3		0.535	0.55	-0.015	
LP4-03-Q	F		0.719	0.91	-0.191	
LP4-03-Q	Fe2O3		0.303	0.28	0.023	8.1%
LP4-03-Q	K2O		4.785	4.81	-0.025	

Table A-4. Comparison of Measured versus Targeted Compositions of the Set 1 Glasses (continued)

Glass ID	Oxide	BDL (<)	Measured (wt %)	Targeted (wt %)	Difference of Measured versus Targeted	% Difference of Measured versus Targeted
LP4-03-Q	Li2O		4.446	4.46	-0.014	
LP4-03-Q	MgO		0.692	0.72	-0.028	
LP4-03-Q	Na2O		10.818	10.79	0.028	0.3%
LP4-03-Q	NiO	<	0.127	0	0.127	
LP4-03-Q	P2O5		1.812	1.92	-0.108	-5.6%
LP4-03-Q	PbO	<	0.108	0	0.108	
LP4-03-Q	SiO2		37.224	37.11	0.114	0.3%
LP4-03-Q	SnO2		2.136	2.17	-0.034	
LP4-03-Q	SO3		1.267	1.39	-0.123	-8.9%
LP4-03-Q	TiO2		0.357	0.35	0.007	
LP4-03-Q	V2O5		0.719	0.74	-0.021	
LP4-03-Q	ZnO		0.436	0.45	-0.014	
LP4-03-Q	ZrO2		4.11	3.68	0.430	11.7%
LP4-03-Q	Sum Oxide		99.701	100	-0.299	-0.3%
LP4-05-Q	Al2O3		10.378	10.25	0.128	1.3%
LP4-05-Q	B2O3		12.477	12.15	0.327	2.7%
LP4-05-Q	CaO		7.857	8.09	-0.233	-2.9%
LP4-05-Q	Cl		0.278	0.33	-0.052	
LP4-05-Q	Cr2O3		0.491	0.5	-0.009	
LP4-05-Q	F		0.135	0.17	-0.035	
LP4-05-Q	Fe2O3		1.028	1.01	0.018	
LP4-05-Q	K2O		0.176	0.16	0.016	10.1%
LP4-05-Q	Li2O	<	0.215	0	0.215	
LP4-05-Q	MgO		0.972	1.01	-0.038	
LP4-05-Q	Na2O		20.86	21.18	-0.320	-1.5%
LP4-05-Q	NiO	<	0.127	0.04	0.087	
LP4-05-Q	P2O5		0.274	0.29	-0.016	-5.6%
LP4-05-Q	PbO	<	0.108	0.01	0.098	
LP4-05-Q	SiO2		38.293	37.47	0.823	2.2%
LP4-05-Q	SnO2	<	0.127	0	0.127	
LP4-05-Q	SO3		1.049	1.07	-0.021	
LP4-05-Q	TiO2	<	0.167	0	0.167	
LP4-05-Q	V2O5		0.988	1.01	-0.022	
LP4-05-Q	ZnO		2.928	3.03	-0.102	
LP4-05-Q	ZrO2		2.003	2.16	-0.157	-7.3%
LP4-05-Q	Sum Oxide		100.931	99.93	1.001	1.0%
LP4-09-Q	Al2O3		4.554	4.45	0.104	2.3%
LP4-09-Q	B2O3		13.041	12.96	0.081	0.6%
LP4-09-Q	CaO		0.318	0.33	-0.012	
LP4-09-Q	Cl		0.176	0.22	-0.044	
LP4-09-Q	Cr2O3	<	0.146	0.05	0.096	
LP4-09-Q	F		0.68	0.82	-0.140	
LP4-09-Q	Fe2O3	<	0.143	0.05	0.093	
LP4-09-Q	K2O		5.767	5.77	-0.003	-0.1%
LP4-09-Q	Li2O		3.342	3.51	-0.168	
LP4-09-Q	MgO		1.54	1.72	-0.180	-10.5%
LP4-09-Q	Na2O		15.03	14.96	0.070	0.5%
LP4-09-Q	NiO	<	0.127	0	0.127	
LP4-09-Q	P2O5		1.952	2.12	-0.168	-7.9%
LP4-09-Q	PbO	<	0.108	0	0.108	
LP4-09-Q	SiO2		36.368	36.62	-0.252	-0.7%

Table A-4. Comparison of Measured versus Targeted Compositions of the Set 1 Glasses (continued)

Glass ID	Oxide	BDL (<)	Measured (wt %)	Targeted (wt %)	Difference of Measured versus Targeted	% Difference of Measured versus Targeted
LP4-09-Q	SnO2		3.066	3.16	-0.094	
LP4-09-Q	SO3		0.87	0.85	0.020	
LP4-09-Q	TiO2		1.636	1.74	-0.104	-6.0%
LP4-09-Q	V2O5		3.32	3.54	-0.220	-6.2%
LP4-09-Q	ZnO		2.623	2.76	-0.137	-5.0%
LP4-09-Q	ZrO2		3.873	4.37	-0.497	-11.4%
LP4-09-Q	Sum Oxide		98.68	100	-1.320	-1.3%
LP4-10-Q	Al2O3		4.204	4.08	0.124	3.0%
LP4-10-Q	B2O3		8.468	8.34	0.128	1.5%
LP4-10-Q	CaO		4.778	4.78	-0.002	
LP4-10-Q	Cl		0.401	0.58	-0.179	
LP4-10-Q	Cr2O3		0.561	0.58	-0.019	
LP4-10-Q	F		0.396	0.46	-0.064	
LP4-10-Q	Fe2O3		1.188	1.18	0.008	
LP4-10-Q	K2O		5.794	5.83	-0.036	-0.6%
LP4-10-Q	Li2O		4.424	4.41	0.014	
LP4-10-Q	MgO		3.3	3.53	-0.230	-6.5%
LP4-10-Q	Na2O		13.581	13.93	-0.349	-2.5%
LP4-10-Q	NiO	<	0.127	0	0.127	
LP4-10-Q	P2O5		0.453	0.47	-0.017	
LP4-10-Q	PbO	<	0.108	0	0.108	
LP4-10-Q	SiO2		46.53	44.85	1.680	3.8%
LP4-10-Q	SnO2		0.868	0.85	0.018	
LP4-10-Q	SO3		0.306	0.23	0.076	33.3%
LP4-10-Q	TiO2		1.835	1.87	-0.035	
LP4-10-Q	V2O5	<	0.179	0.05	0.129	
LP4-10-Q	ZnO		0.205	0.21	-0.005	
LP4-10-Q	ZrO2		4.208	3.77	0.438	11.6%
LP4-10-Q	Sum Oxide		101.914	100	1.914	1.9%
LP4-11-Q	Al2O3		9.4	9.17	0.230	2.5%
LP4-11-Q	B2O3		13.234	12.75	0.484	3.8%
LP4-11-Q	CaO		0.635	0.63	0.005	
LP4-11-Q	Cl		0.414	0.6	-0.187	
LP4-11-Q	Cr2O3		0.451	0.46	-0.009	
LP4-11-Q	F		0.118	0.17	-0.052	
LP4-11-Q	Fe2O3	<	0.143	0.06	0.083	
LP4-11-Q	K2O		4.267	4.33	-0.063	
LP4-11-Q	Li2O		1.332	1.44	-0.108	-7.5%
LP4-11-Q	MgO		2.015	2.18	-0.165	-7.6%
LP4-11-Q	Na2O		14.356	14.47	-0.114	-0.8%
LP4-11-Q	NiO	<	0.127	0	0.127	
LP4-11-Q	P2O5		0.544	0.59	-0.046	-7.9%
LP4-11-Q	PbO	<	0.108	0	0.108	
LP4-11-Q	SiO2		45.032	43.37	1.662	3.8%
LP4-11-Q	SnO2		3.777	3.77	0.007	
LP4-11-Q	SO3	<	0.153	0.11	0.043	
LP4-11-Q	TiO2		1.636	1.68	-0.044	
LP4-11-Q	V2O5		0.732	0.77	-0.038	
LP4-11-Q	ZnO		0.973	1.01	-0.037	
LP4-11-Q	ZrO2		2.256	2.44	-0.184	-7.6%
LP4-11-Q	Sum Oxide		101.703	100	1.703	1.7%

Table A-4. Comparison of Measured versus Targeted Compositions of the Set 1 Glasses (continued)

Glass ID	Oxide	BDL (<)	Measured (wt %)	Targeted (wt %)	Difference of Measured versus Targeted	% Difference of Measured versus Targeted
LP4-12-Q	Al2O3		4.185	3.91	0.275	7.0%
LP4-12-Q	B2O3		10.843	10.36	0.483	**4.7%**
LP4-12-Q	CaO		0.787	0.74	0.047	6.4%
LP4-12-Q	Cl		0.096	0.13	-0.034	
LP4-12-Q	Cr2O3		0.257	0.26	-0.003	
LP4-12-Q	F		0.352	0.49	-0.138	
LP4-12-Q	Fe2O3		0.365	0.36	0.005	
LP4-12-Q	K2O		5.424	5.56	-0.136	-2.5%
LP4-12-Q	Li2O		2.108	2.15	-0.042	
LP4-12-Q	MgO		2.815	2.97	-0.155	-5.2%
LP4-12-Q	Na2O		11.691	11.48	0.211	1.8%
LP4-12-Q	NiO	<	0.127	0	0.127	
LP4-12-Q	P2O5		0.534	0.57	-0.036	-6.2%
LP4-12-Q	PbO	<	0.108	0	0.108	
LP4-12-Q	SiO2		48.509	46.55	1.959	4.2%
LP4-12-Q	SnO2		4.507	4.47	0.037	
LP4-12-Q	SO3		0.418	0.48	-0.062	-13.0%
LP4-12-Q	TiO2		0.704	0.68	0.024	
LP4-12-Q	V2O5		4.088	4.05	0.038	
LP4-12-Q	ZnO		0.746	0.74	0.006	
LP4-12-Q	ZrO2		3.9	4.05	-0.150	
LP4-12-Q	Sum Oxide		102.564	100	2.564	2.6%
LP4-14-Q	Al2O3		5.961	5.99	-0.029	-0.5%
LP4-14-Q	B2O3		13.322	13.35	-0.028	-0.2%
LP4-14-Q	CaO		10.445	10.81	-0.365	-3.4%
LP4-14-Q	Cl		0.434	0.61	-0.177	
LP4-14-Q	Cr2O3		0.559	0.57	-0.011	
LP4-14-Q	F		0.172	0.22	-0.048	
LP4-14-Q	Fe2O3		1.449	1.44	0.009	
LP4-14-Q	K2O		3.397	3.47	-0.073	
LP4-14-Q	Li2O		3.111	3.2	-0.089	
LP4-14-Q	MgO		2.678	2.87	-0.192	-6.7%
LP4-14-Q	Na2O		11.478	11.46	0.018	0.2%
LP4-14-Q	NiO	<	0.127	0	0.127	
LP4-14-Q	P2O5		1.633	1.73	-0.097	-5.6%
LP4-14-Q	PbO	<	0.108	0	0.108	
LP4-14-Q	SiO2		36.956	36.2	0.756	2.1%
LP4-14-Q	SnO2		0.88	0.88	0.000	
LP4-14-Q	SO3		1.026	1.05	-0.024	
LP4-14-Q	TiO2		0.298	0.29	0.008	
LP4-14-Q	V2O5		1.256	1.29	-0.034	
LP4-14-Q	ZnO		1.45	1.5	-0.050	
LP4-14-Q	ZrO2		2.82	3.07	-0.250	-8.2%
LP4-14-Q	Sum Oxide		99.56	100	-0.440	-0.4%
LP4-15-Q	Al2O3		10.506	10.12	0.386	3.8%
LP4-15-Q	B2O3		9.99	9.61	0.380	4.0%
LP4-15-Q	CaO		4.908	5.06	-0.152	-3.0%
LP4-15-Q	Cl		0.197	0.21	-0.013	
LP4-15-Q	Cr2O3		0.458	0.46	-0.002	
LP4-15-Q	F		0.285	0.32	-0.035	
LP4-15-Q	Fe2O3		0.613	0.61	0.003	

Table A-4. Comparison of Measured versus Targeted Compositions of the Set 1 Glasses (continued)

Glass ID	Oxide	BDL (<)	Measured (wt %)	Targeted (wt %)	Difference of Measured versus Targeted	% Difference of Measured versus Targeted
LP4-15-Q	K2O		1.043	1.01	0.033	
LP4-15-Q	Li2O	<	0.215	0	0.215	
LP4-15-Q	MgO		0.633	0.66	-0.027	
LP4-15-Q	Na2O		22.377	23.27	-0.893	**-3.8%**
LP4-15-Q	NiO	<	0.127	0	0.127	
LP4-15-Q	P2O5		0.648	0.68	-0.032	
LP4-15-Q	PbO	<	0.108	0	0.108	
LP4-15-Q	SiO2		41.877	39.24	2.637	6.7%
LP4-15-Q	SnO2		1.536	1.52	0.016	
LP4-15-Q	SO3		0.536	0.51	0.026	5.0%
LP4-15-Q	TiO2	<	0.167	0	0.167	
LP4-15-Q	V2O5		0.991	1.01	-0.019	
LP4-15-Q	ZnO		2.726	2.83	-0.104	
LP4-15-Q	ZrO2		2.685	2.88	-0.195	-6.8%
LP4-15-Q	Sum Oxide		102.626	100	2.626	2.6%
LP4-16-Q	Al2O3		5.555	5.52	0.035	0.6%
LP4-16-Q	B2O3		11.849	11.9	-0.051	-0.4%
LP4-16-Q	CaO		0.457	0.44	0.017	
LP4-16-Q	Cl		0.408	0.54	-0.133	
LP4-16-Q	Cr2O3	<	0.146	0.08	0.066	
LP4-16-Q	F		0.848	1.02	-0.173	
LP4-16-Q	Fe2O3		0.52	0.5	0.020	
LP4-16-Q	K2O		2.117	2.07	0.047	
LP4-16-Q	Li2O		4.634	4.7	-0.066	
LP4-16-Q	MgO		1.223	1.33	-0.107	-8.1%
LP4-16-Q	Na2O		13.355	13.32	0.035	0.3%
LP4-16-Q	NiO	<	0.127	0	0.127	
LP4-16-Q	P2O5		0.299	0.32	-0.021	-6.6%
LP4-16-Q	PbO	<	0.108	0	0.108	
LP4-16-Q	SiO2		45.407	44.98	0.427	1.0%
LP4-16-Q	SnO2		3.91	3.98	-0.070	
LP4-16-Q	SO3		0.618	0.63	-0.012	
LP4-16-Q	TiO2		1.889	1.98	-0.091	
LP4-16-Q	V2O5		3.713	3.86	-0.147	
LP4-16-Q	ZnO		0.507	0.53	-0.023	
LP4-16-Q	ZrO2		2.09	2.3	-0.210	-9.1%
LP4-16-Q	Sum Oxide		99.78	100	-0.220	-0.2%
LP4-17-Q	Al2O3		4.029	3.72	0.309	8.3%
LP4-17-Q	B2O3		11.503	10.91	0.593	5.4%
LP4-17-Q	CaO		7.986	8.58	-0.594	-6.9%
LP4-17-Q	Cl		0.207	0.28	-0.074	
LP4-17-Q	Cr2O3		0.573	0.58	-0.007	
LP4-17-Q	F		0.885	1.11	-0.225	
LP4-17-Q	Fe2O3		0.612	0.59	0.022	
LP4-17-Q	K2O		2.945	2.92	0.025	
LP4-17-Q	Li2O		2.966	3.13	-0.164	-5.3%
LP4-17-Q	MgO		2.259	2.43	-0.171	-7.0%
LP4-17-Q	Na2O		11.037	11.09	-0.053	-0.5%
LP4-17-Q	NiO	<	0.127	0	0.127	
LP4-17-Q	P2O5		1.914	2.06	-0.146	-7.1%
LP4-17-Q	PbO	<	0.108	0	0.108	

Table A-4. Comparison of Measured versus Targeted Compositions of the Set 1 Glasses (continued)

Glass ID	Oxide	BDL (<)	Measured (wt %)	Targeted (wt %)	Difference of Measured versus Targeted	% Difference of Measured versus Targeted
LP4-17-Q	SiO2		43.963	41.74	2.223	5.3%
LP4-17-Q	SnO2	<	0.127	0.08	0.047	
LP4-17-Q	SO3		1.33	1.4	-0.070	-5.0%
LP4-17-Q	TiO2		1.16	1.21	-0.050	
LP4-17-Q	V2O5		3.789	3.92	-0.131	
LP4-17-Q	ZnO		0.233	0.24	-0.007	
LP4-17-Q	ZrO2		3.637	4.01	-0.373	-9.3%
LP4-17-Q	Sum Oxide		101.39	100	1.390	1.4%
LP4-18-Q	Al2O3		4.365	4.16	0.205	4.9%
LP4-18-Q	B2O3		6.722	6.4	0.322	5.0%
LP4-18-Q	CaO		11.886	12.23	-0.344	-2.8%
LP4-18-Q	Cl		0.124	0.16	-0.036	
LP4-18-Q	Cr2O3		0.197	0.2	-0.003	
LP4-18-Q	F		0.267	0.36	-0.093	
LP4-18-Q	Fe2O3		0.498	0.48	0.018	
LP4-18-Q	K2O	<	0.12	0.08	0.040	
LP4-18-Q	Li2O		1.737	1.83	-0.093	-5.1%
LP4-18-Q	MgO		3.234	3.37	-0.136	
LP4-18-Q	Na2O		15.199	15.41	-0.211	-1.4%
LP4-18-Q	NiO	<	0.127	0	0.127	
LP4-18-Q	P2O5		2.039	2.12	-0.081	
LP4-18-Q	PbO	<	0.108	0	0.108	
LP4-18-Q	SiO2		46.637	44.37	2.267	5.1%
LP4-18-Q	SnO2		3.269	3.28	-0.011	
LP4-18-Q	SO3		0.685	0.67	0.015	
LP4-18-Q	TiO2		1.939	1.95	-0.011	
LP4-18-Q	V2O5		0.906	0.9	0.006	
LP4-18-Q	ZnO	<	0.124	0.05	0.074	
LP4-18-Q	ZrO2		1.878	1.98	-0.102	-5.2%
LP4-18-Q	Sum Oxide		102.061	100	2.061	2.1%
LP4-20-Q	Al2O3		7.18	6.84	0.340	5.0%
LP4-20-Q	B2O3		14.401	13.53	0.871	6.4%
LP4-20-Q	CaO		1.966	1.87	0.096	5.1%
LP4-20-Q	Cl		0.117	0.16	-0.044	
LP4-20-Q	Cr2O3		0.569	0.58	-0.011	
LP4-20-Q	F		0.556	0.7	-0.144	
LP4-20-Q	Fe2O3		1.423	1.44	-0.017	
LP4-20-Q	K2O		3.894	3.9	-0.006	
LP4-20-Q	Li2O		0.998	1.11	-0.112	-10.1%
LP4-20-Q	MgO		3.275	3.51	-0.235	-6.7%
LP4-20-Q	Na2O		17.659	18.01	-0.351	-2.0%
LP4-20-Q	NiO	<	0.127	0	0.127	
LP4-20-Q	P2O5		0.583	0.61	-0.027	
LP4-20-Q	PbO	<	0.108	0	0.108	
LP4-20-Q	SiO2		37.438	35.09	2.348	6.7%
LP4-20-Q	SnO2		4.041	3.95	0.091	
LP4-20-Q	SO3		0.848	0.86	-0.012	
LP4-20-Q	TiO2		1.485	1.51	-0.025	
LP4-20-Q	V2O5		3.847	3.87	-0.023	
LP4-20-Q	ZnO		0.643	0.66	-0.017	
LP4-20-Q	ZrO2		1.699	1.8	-0.101	-5.6%

Table A-4. Comparison of Measured versus Targeted Compositions of the Set 1 Glasses (continued)

Glass ID	Oxide	BDL (<)	Measured (wt %)	Targeted (wt %)	Difference of Measured versus Targeted	% Difference of Measured versus Targeted
LP4-20-Q	Sum Oxide		102.857	100	2.857	2.9%
LP4-21-Q	Al2O3		4.412	4.3	0.112	
LP4-21-Q	B2O3		13.652	13.41	0.242	**1.8%**
LP4-21-Q	CaO		5.142	5.43	-0.288	-5.3%
LP4-21-Q	Cl		0.165	0.23	-0.065	
LP4-21-Q	Cr2O3		0.327	0.36	-0.033	
LP4-21-Q	F		0.266	0.35	-0.084	
LP4-21-Q	Fe2O3		1.146	1.11	0.036	
LP4-21-Q	K2O		1.533	1.47	0.063	
LP4-21-Q	Li2O		2.508	2.64	-0.132	-5.0%
LP4-21-Q	MgO		0.235	0.23	0.005	
LP4-21-Q	Na2O		10.326	10.26	0.066	0.6%
LP4-21-Q	NiO	<	0.127	0	0.127	
LP4-21-Q	P2O5		1.298	1.37	-0.072	-5.3%
LP4-21-Q	PbO	<	0.108	0	0.108	
LP4-21-Q	SiO2		47.439	47.31	0.129	0.3%
LP4-21-Q	SnO2		3.856	3.9	-0.044	
LP4-21-Q	SO3		1.081	1.46	-0.379	-26.0%
LP4-21-Q	TiO2		1.516	1.56	-0.044	
LP4-21-Q	V2O5	<	0.179	0.05	0.129	
LP4-21-Q	ZnO		0.538	0.56	-0.022	
LP4-21-Q	ZrO2		3.644	4	-0.356	-8.9%
LP4-21-Q	Sum Oxide		99.498	100	-0.502	-0.5%
LRM	Al2O3		9.963	9.51	0.453	4.8%
LRM	B2O3		8.223	7.85	0.373	4.8%
LRM	CaO		0.496	0.54	-0.044	-8.1%
LRM	Cl	<	0.025	0	0.025	
LRM	Cr2O3		0.196	0.19	0.006	
LRM	F		0.905	0.86	0.045	5.3%
LRM	Fe2O3		1.444	1.38	0.064	
LRM	K2O		1.496	1.48	0.016	
LRM	Li2O	<	0.215	0.11	0.105	
LRM	MgO	<	0.166	0.1	0.066	
LRM	Na2O		20.969	20.03	0.939	**4.7%**
LRM	NiO		0.198	0.19	0.008	
LRM	P2O5		0.476	0.54	-0.064	-11.8%
LRM	PbO	<	0.108	0.1	0.008	7.7%
LRM	SiO2		55.646	54.2	1.446	**2.7%**
LRM	SnO2	<	0.127	0	0.127	
LRM	SO3		0.245	0.3	-0.055	-18.3%
LRM	TiO2	<	0.167	0.1	0.067	
LRM	V2O5	<	0.179	0	0.179	
LRM	ZnO	<	0.124	0	0.124	
LRM	ZrO2		1.017	0.93	0.087	9.3%
LRM	Sum Oxide		102.385	98.41	3.975	4.0%

Exhibit A-1. Plots of Oxide Measurements in Analytical Sequence for the Set 1 Glasses

Oxide=Al_2O_3, Prep Method=PF
Variability Chart for Measured (wt%)

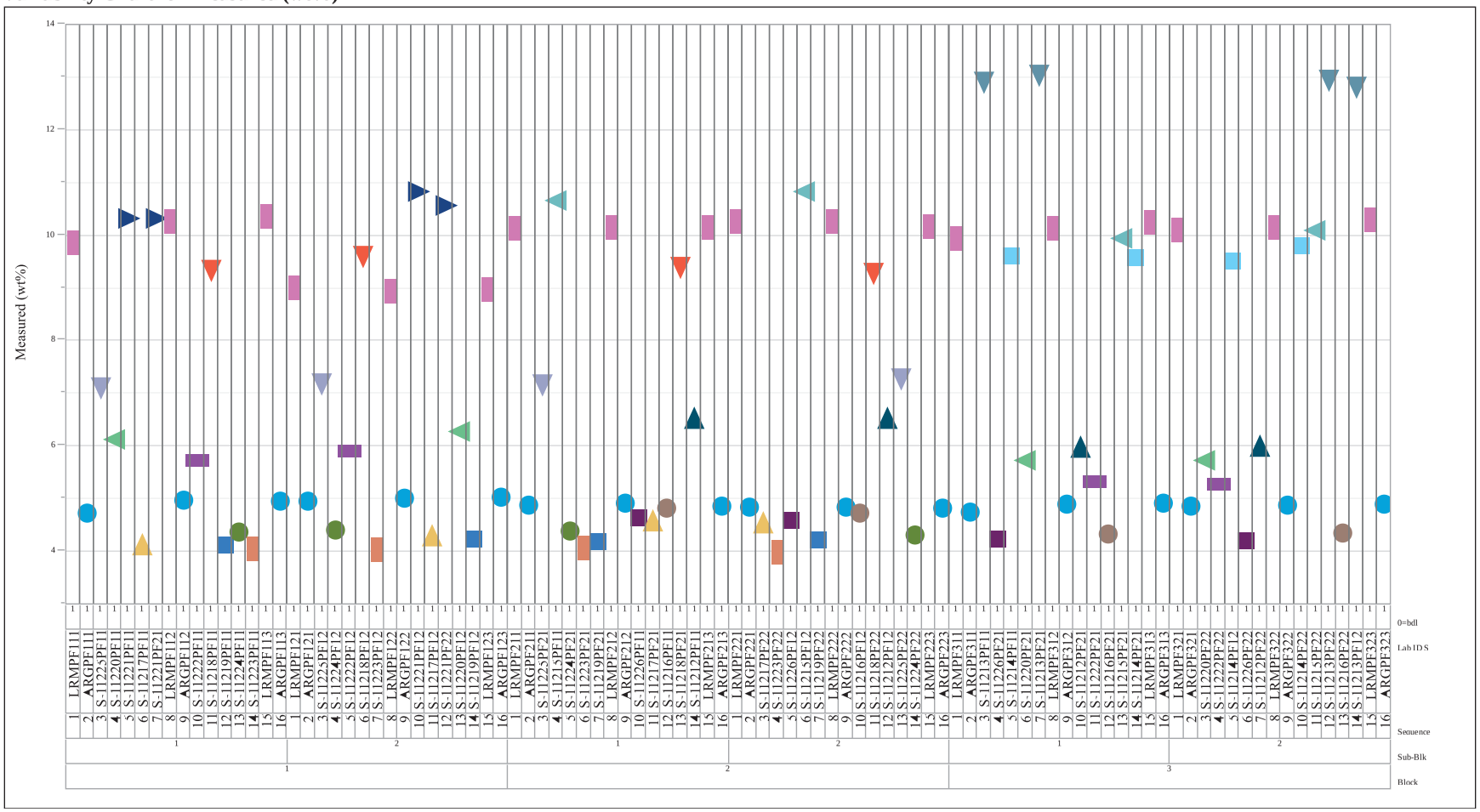


Exhibit A-1. Plots of Oxide Measurements in Analytical Sequence for the Set 1 Glasses (continued)

Oxide=B_2O_3, Prep Method=PF
Variability Chart for Measured (wt%)

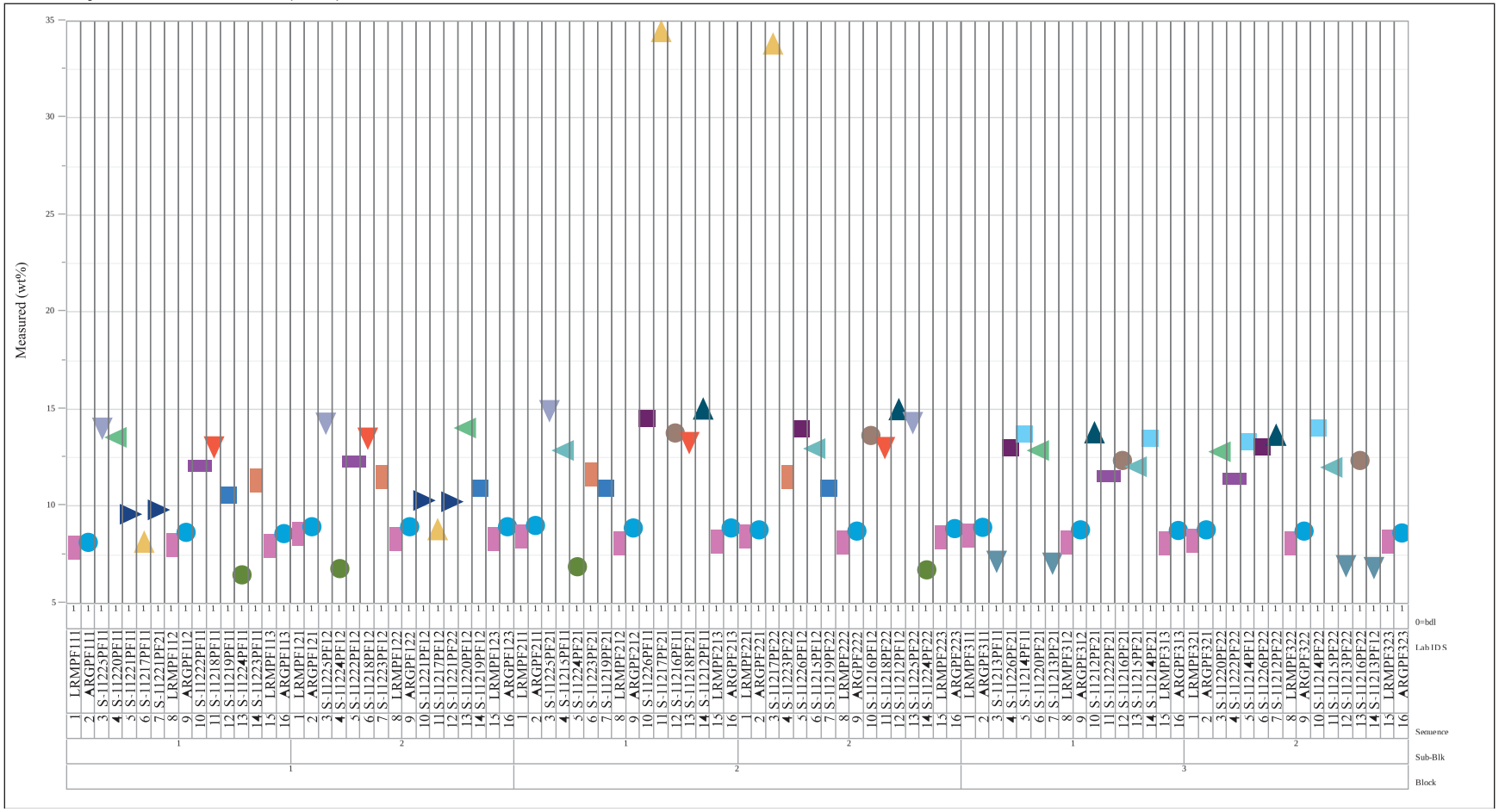


Exhibit A-1. Plots of Oxide Measurements in Analytical Sequence for the Set 1 Glasses (continued)

Oxide=CaO, Prep Method=AD
Variability Chart for Measured (wt%)

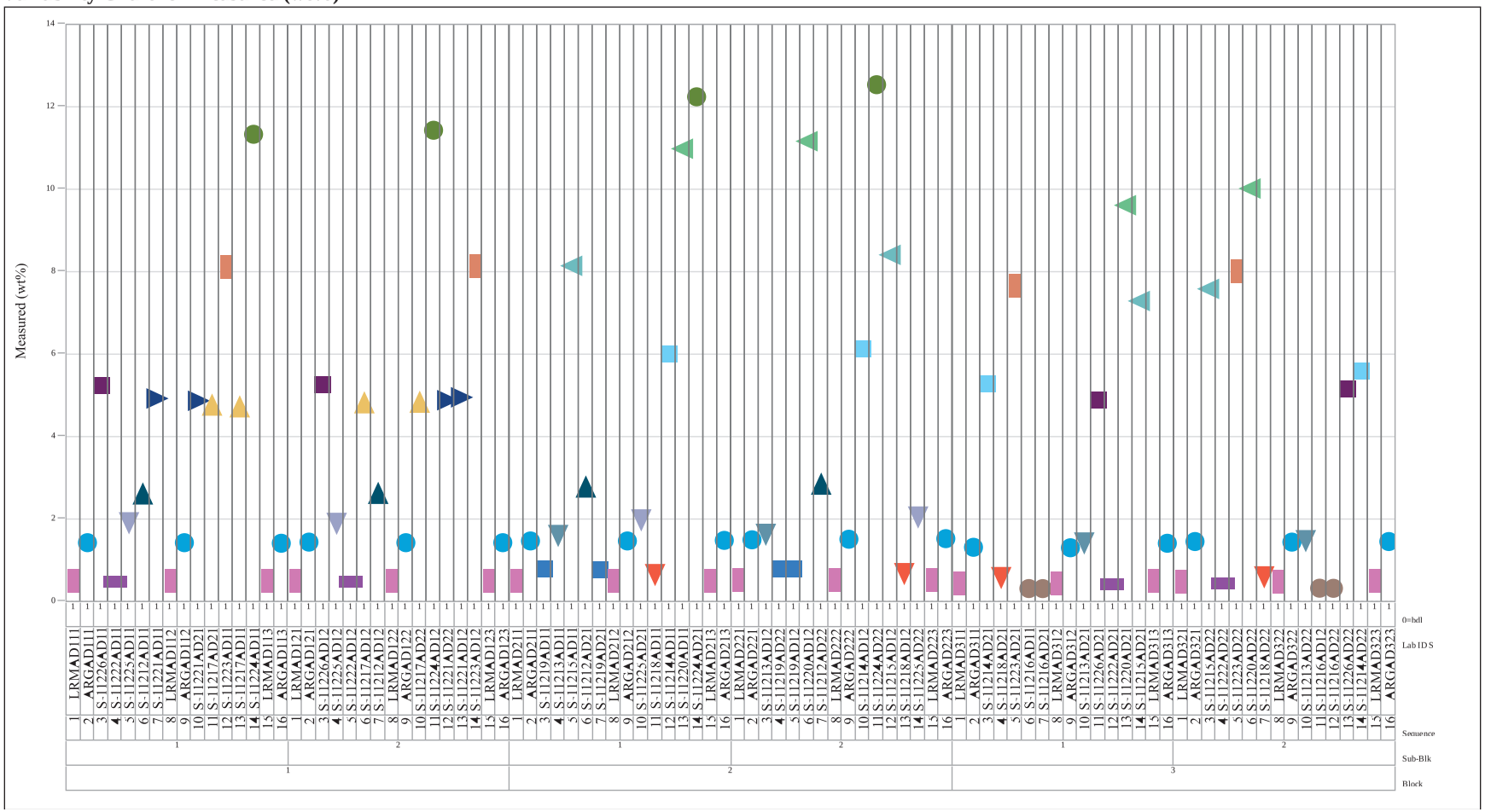


Exhibit A-1. Plots of Oxide Measurements in Analytical Sequence for the Set 1 Glasses (continued)

Oxide=Cl, Prep Method=KH
Variability Chart for Measured (wt%)

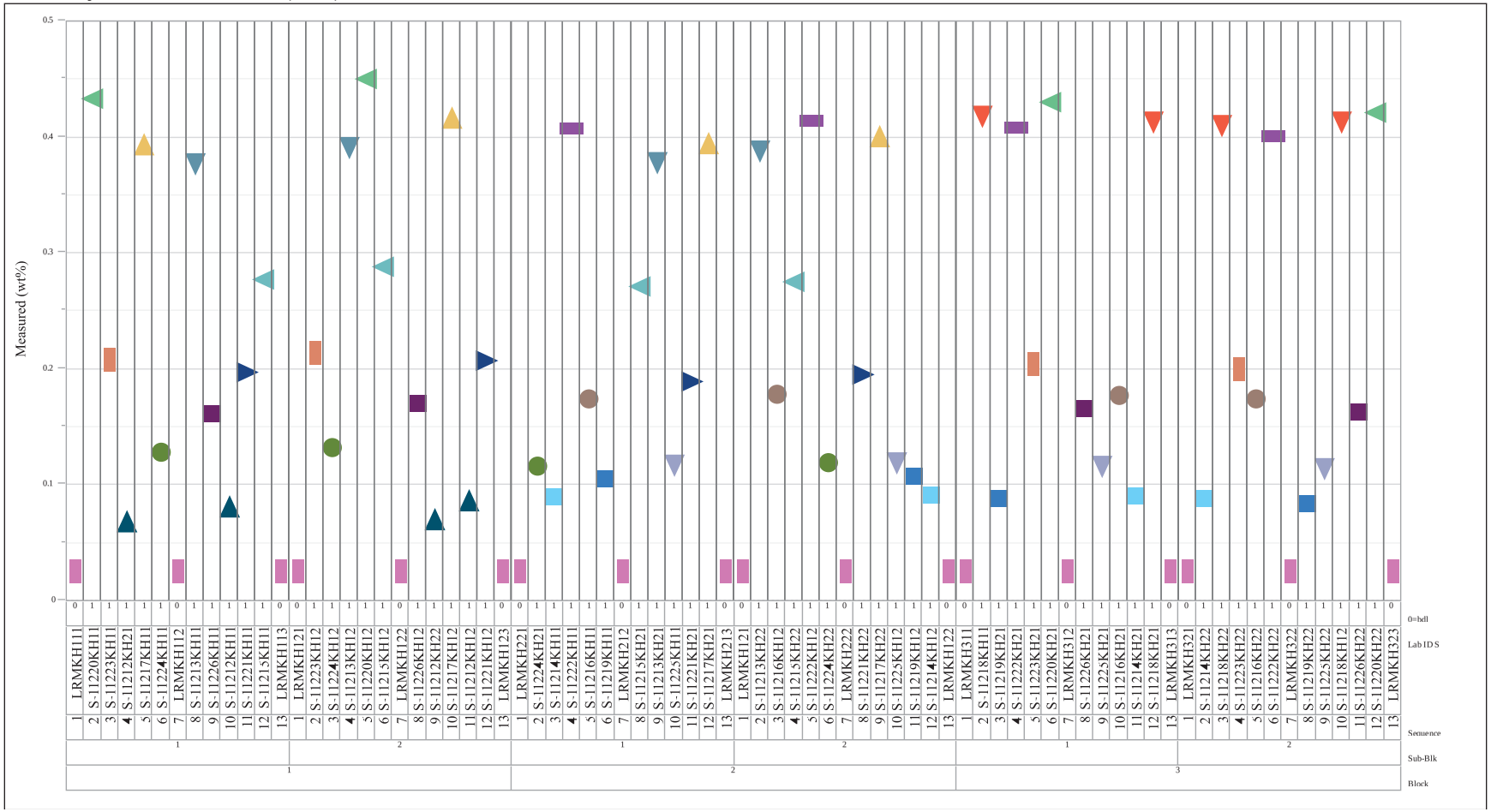


Exhibit A-1. Plots of Oxide Measurements in Analytical Sequence for the Set 1 Glasses (continued)

Oxide=Cr_2O_3, Prep Method=AD
Variability Chart for Measured (wt%)

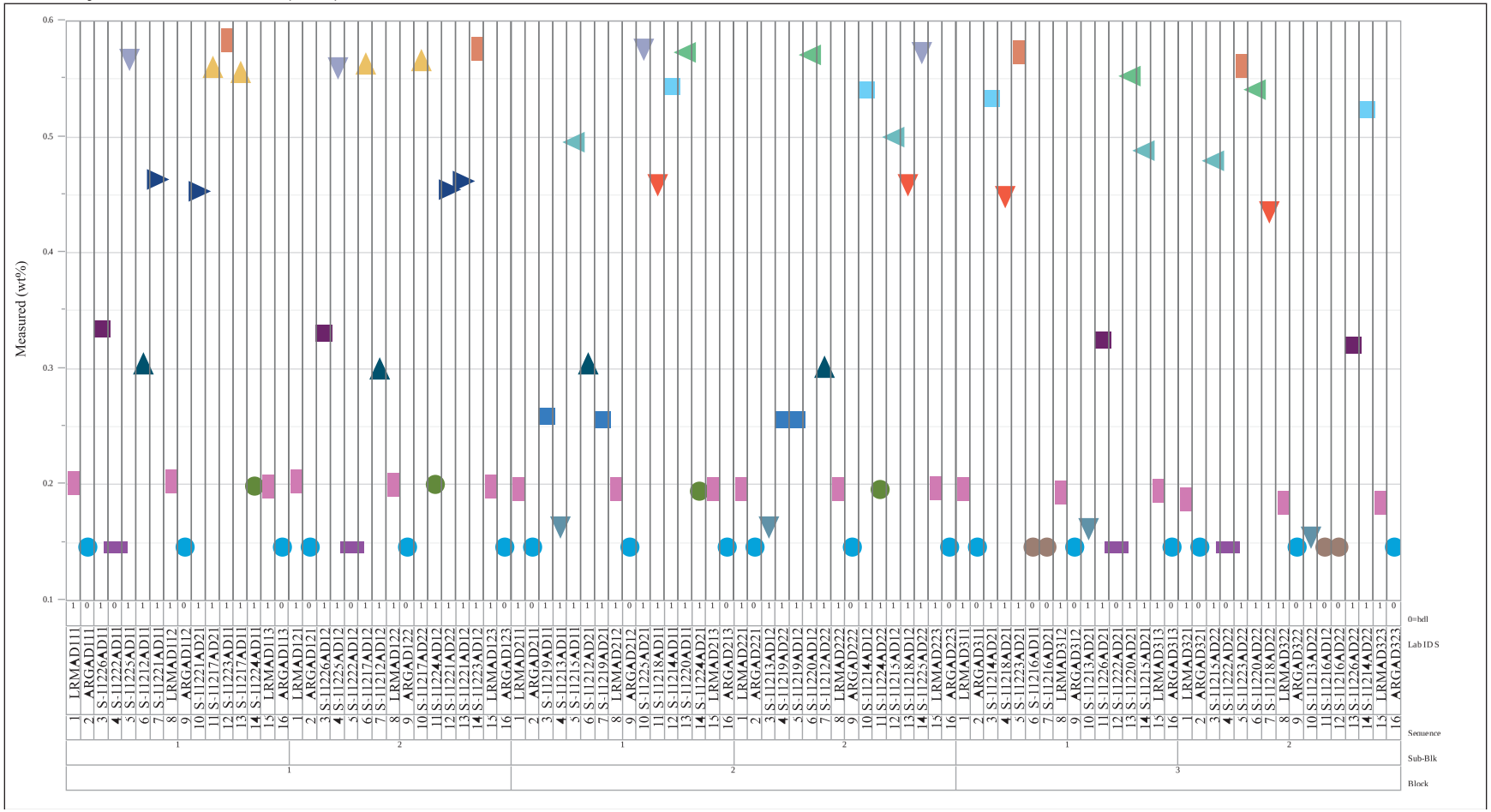


Exhibit A-1. Plots of Oxide Measurements in Analytical Sequence for the Set 1 Glasses (continued)

Oxide=F, Prep Method=KH
Variability Chart for Measured (wt%)

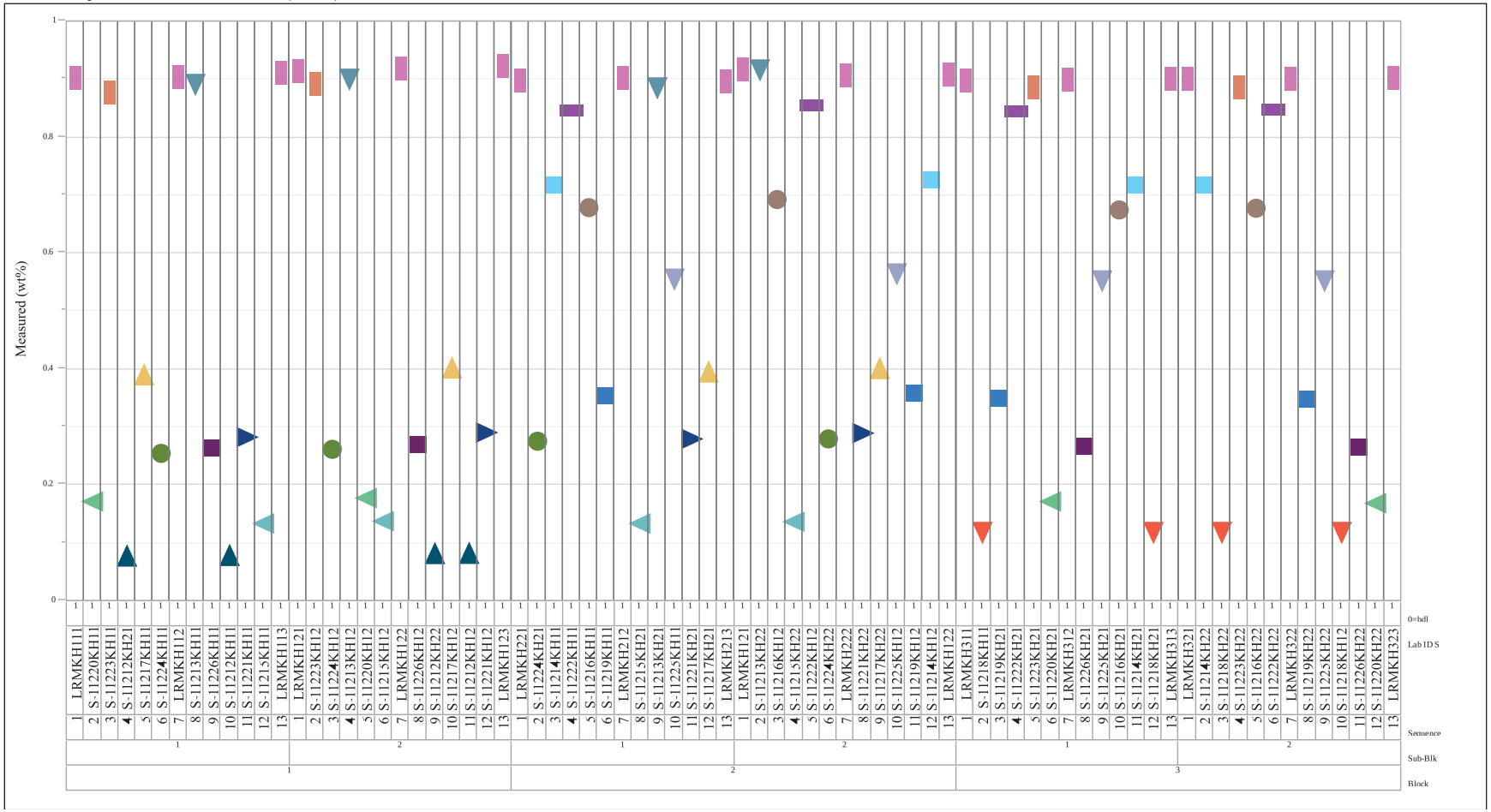


Exhibit A-1. Plots of Oxide Measurements in Analytical Sequence for the Set 1 Glasses (continued)

Oxide=Fe_2O_3, Prep Method=AD
Variability Chart for Measured (wt%)

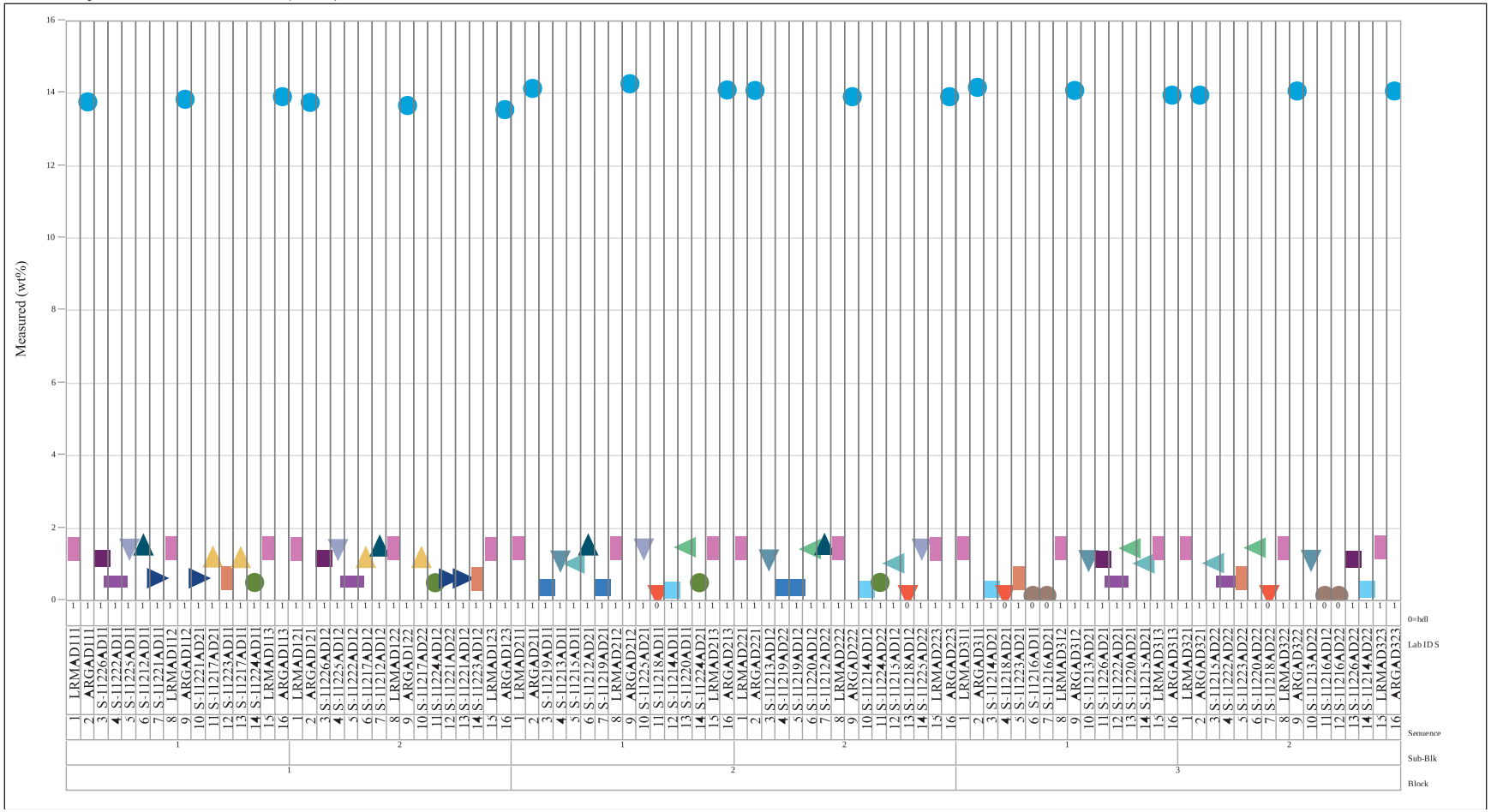


Exhibit A-1. Plots of Oxide Measurements in Analytical Sequence for the Set 1 Glasses (continued)

Oxide=K_2O, Prep Method=AD
Variability Chart for Measured (wt%)

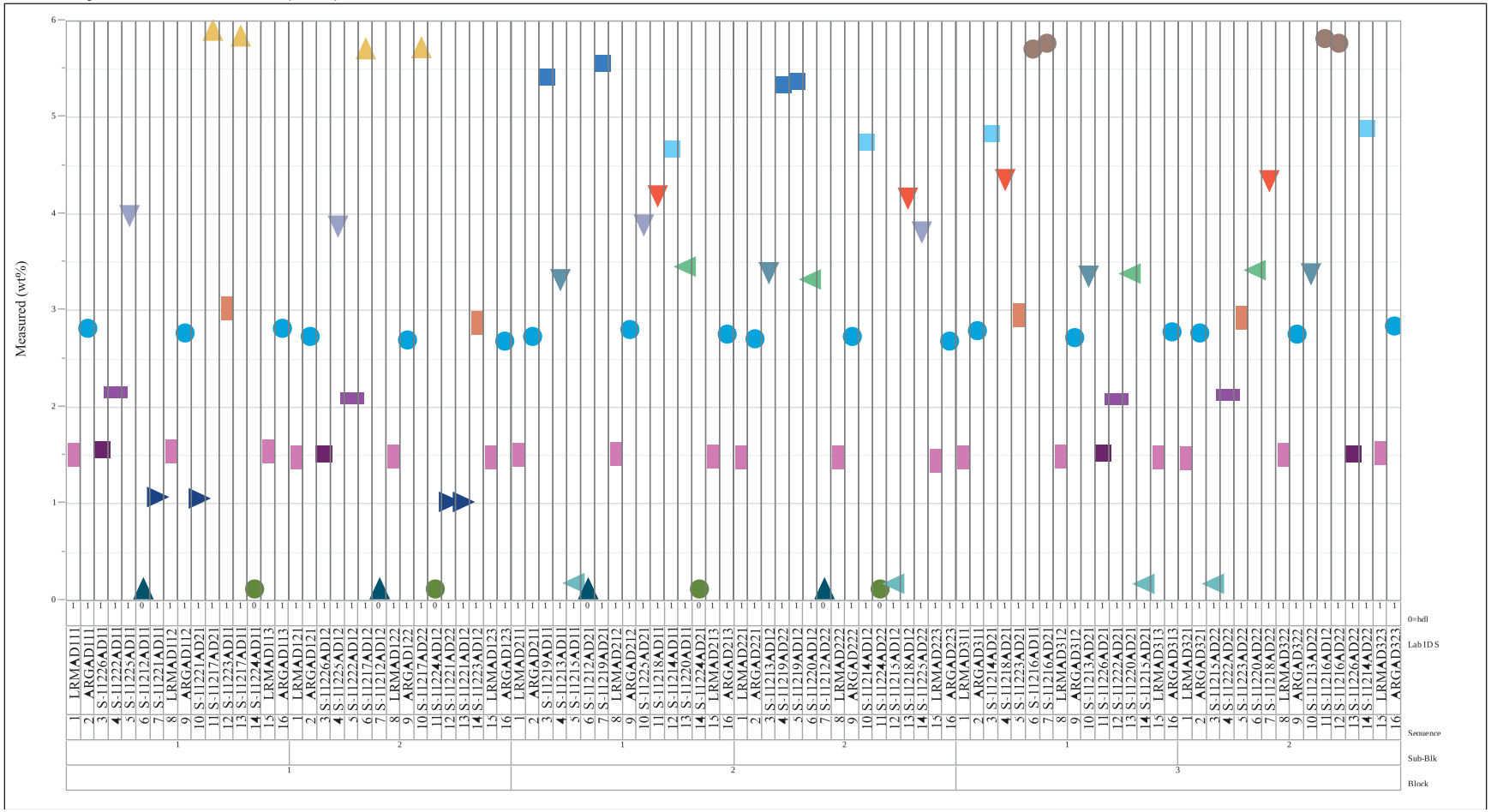


Exhibit A-1. Plots of Oxide Measurements in Analytical Sequence for the Set 1 Glasses (continued)

Oxide=Li_2O, Prep Method=AD
Variability Chart for Measured (wt%)

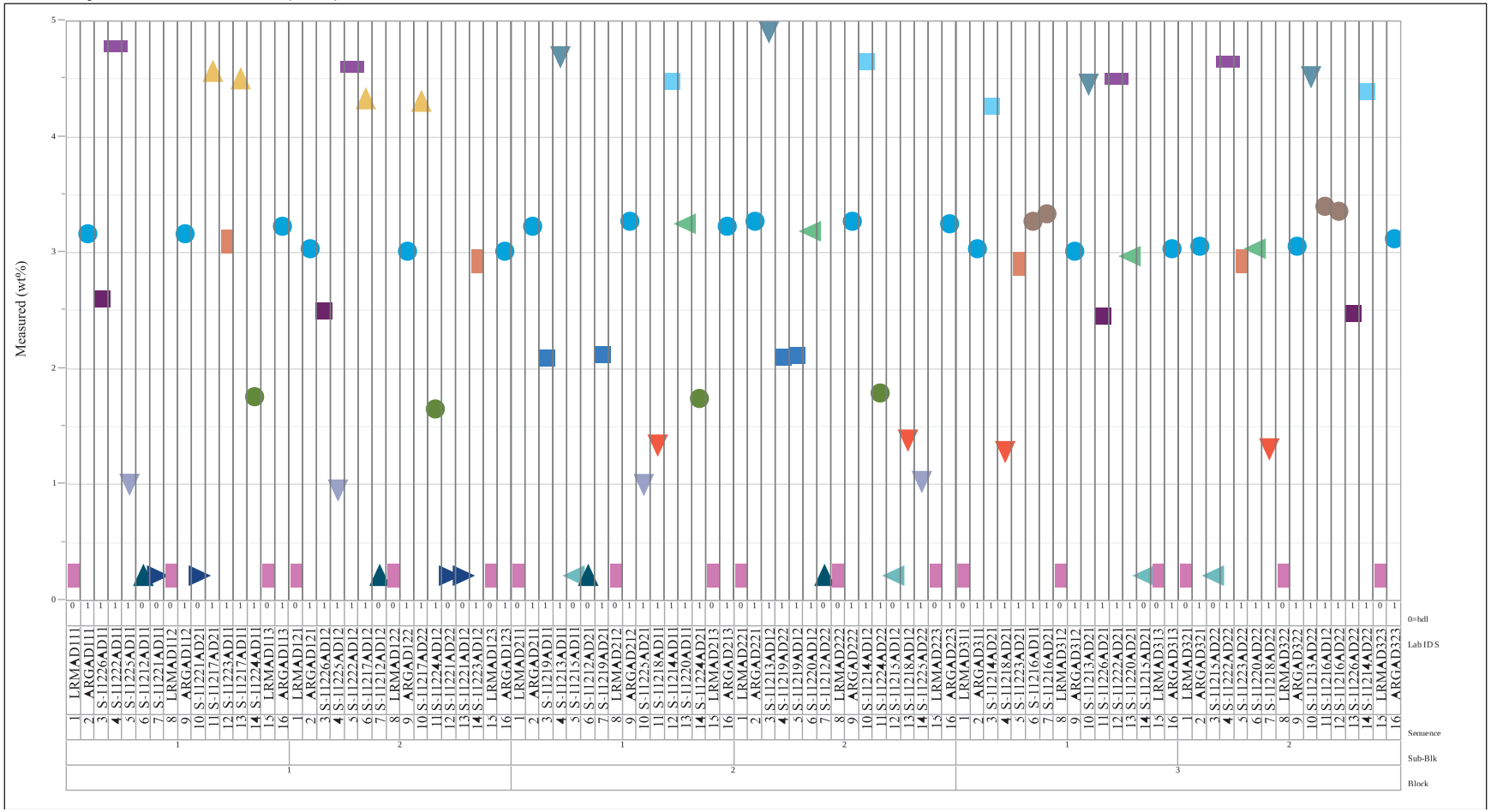


Exhibit A-1. Plots of Oxide Measurements in Analytical Sequence for the Set 1 Glasses (continued)

Oxide=MgO, Prep Method=AD
Variability Chart for Measured (wt%)

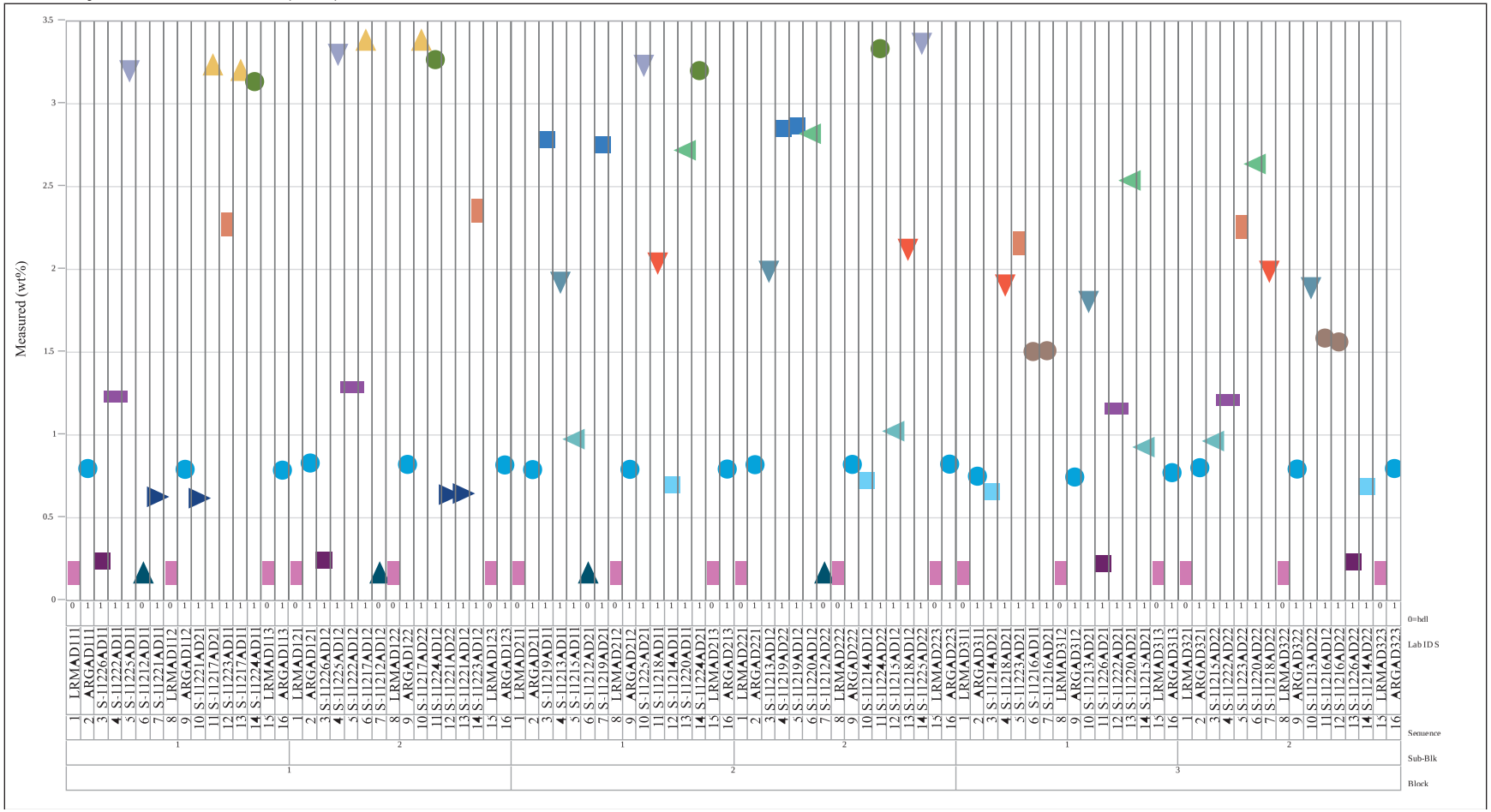


Exhibit A-1. Plots of Oxide Measurements in Analytical Sequence for the Set 1 Glasses (continued)

Oxide=Na_2O, Prep Method=AD
Variability Chart for Measured (wt%)

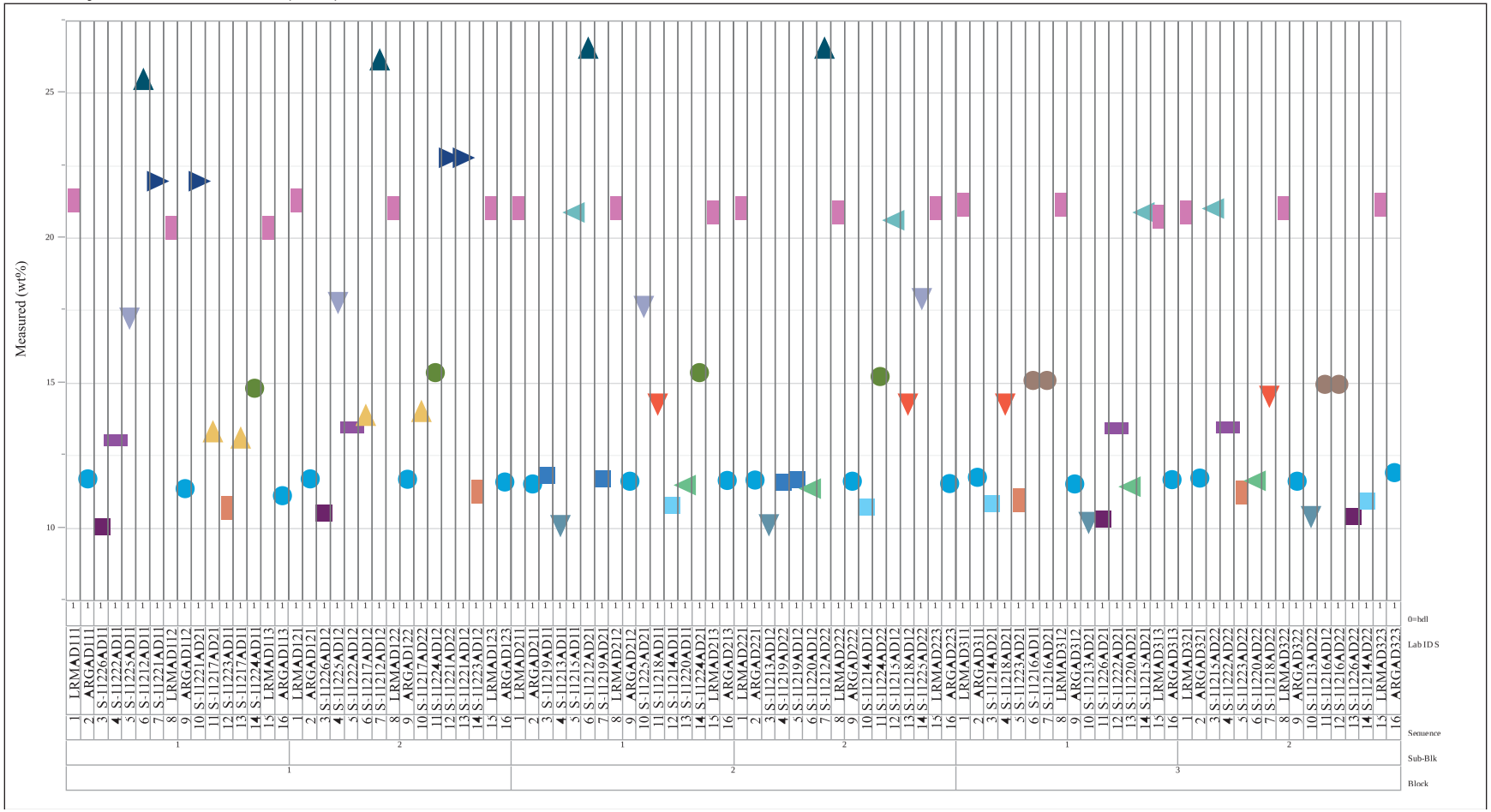


Exhibit A-1. Plots of Oxide Measurements in Analytical Sequence for the Set 1 Glasses (continued)

Oxide=NiO, Prep Method=AD
Variability Chart for Measured (wt%)

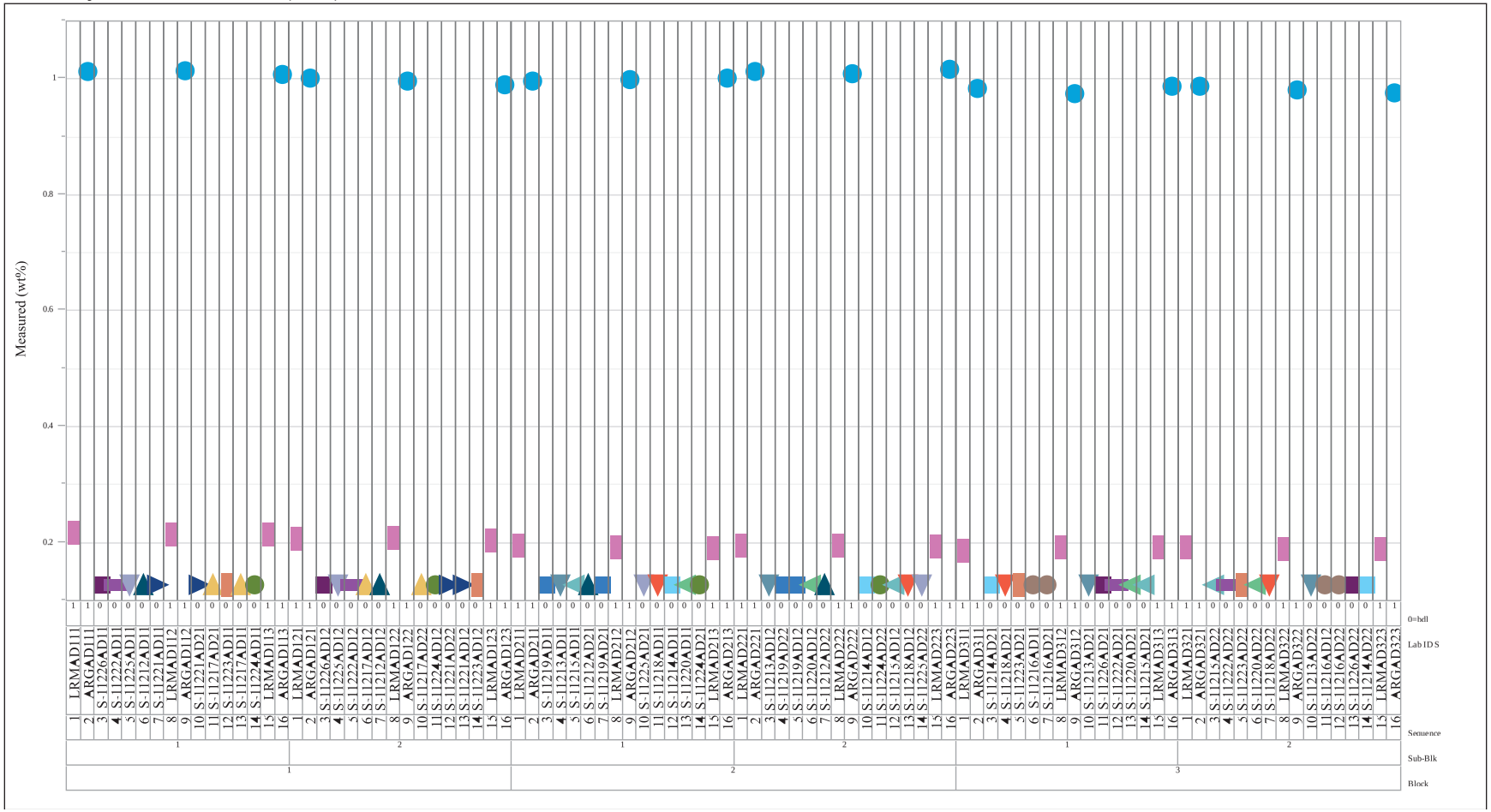


Exhibit A-1. Plots of Oxide Measurements in Analytical Sequence for the Set 1 Glasses (continued)

Oxide=P_2O_5, Prep Method=AD
Variability Chart for Measured (wt%)

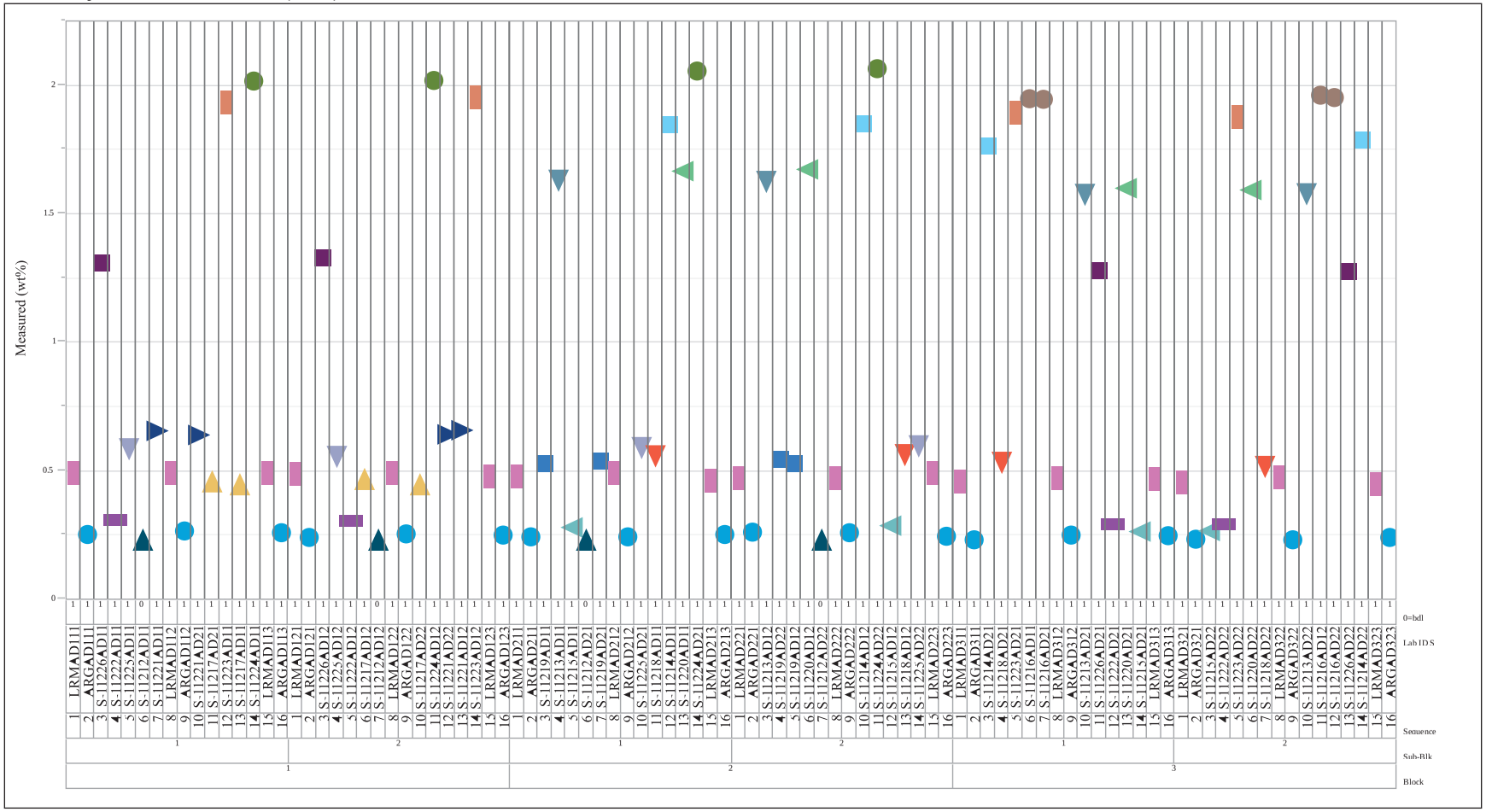


Exhibit A-1. Plots of Oxide Measurements in Analytical Sequence for the Set 1 Glasses (continued)

Oxide=PbO, Prep Method=AD
Variability Chart for Measured (wt%)

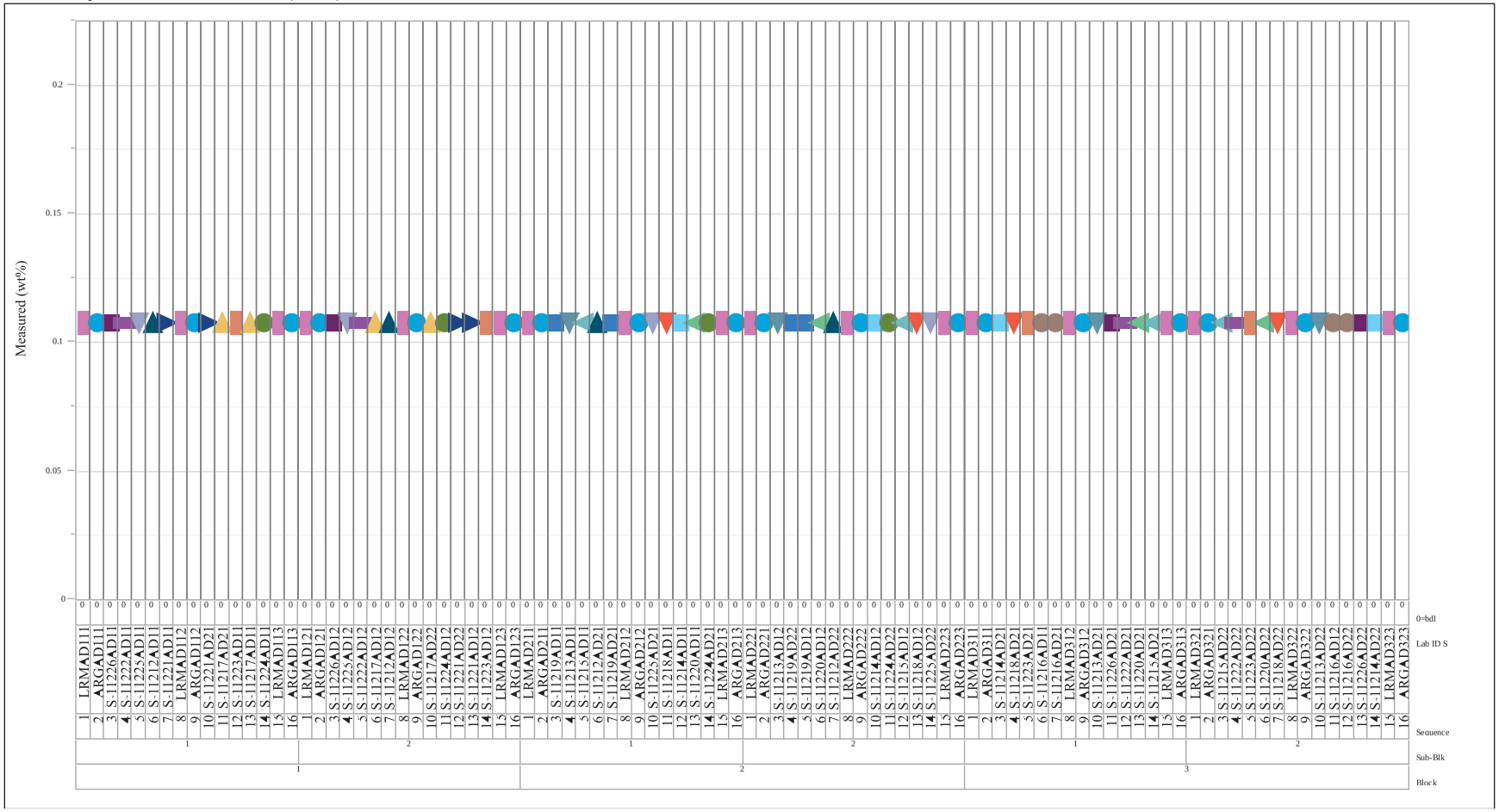


Exhibit A-1. Plots of Oxide Measurements in Analytical Sequence for the Set 1 Glasses (continued)

Oxide=SiO_2, Prep Method=PF
Variability Chart for Measured (wt%)

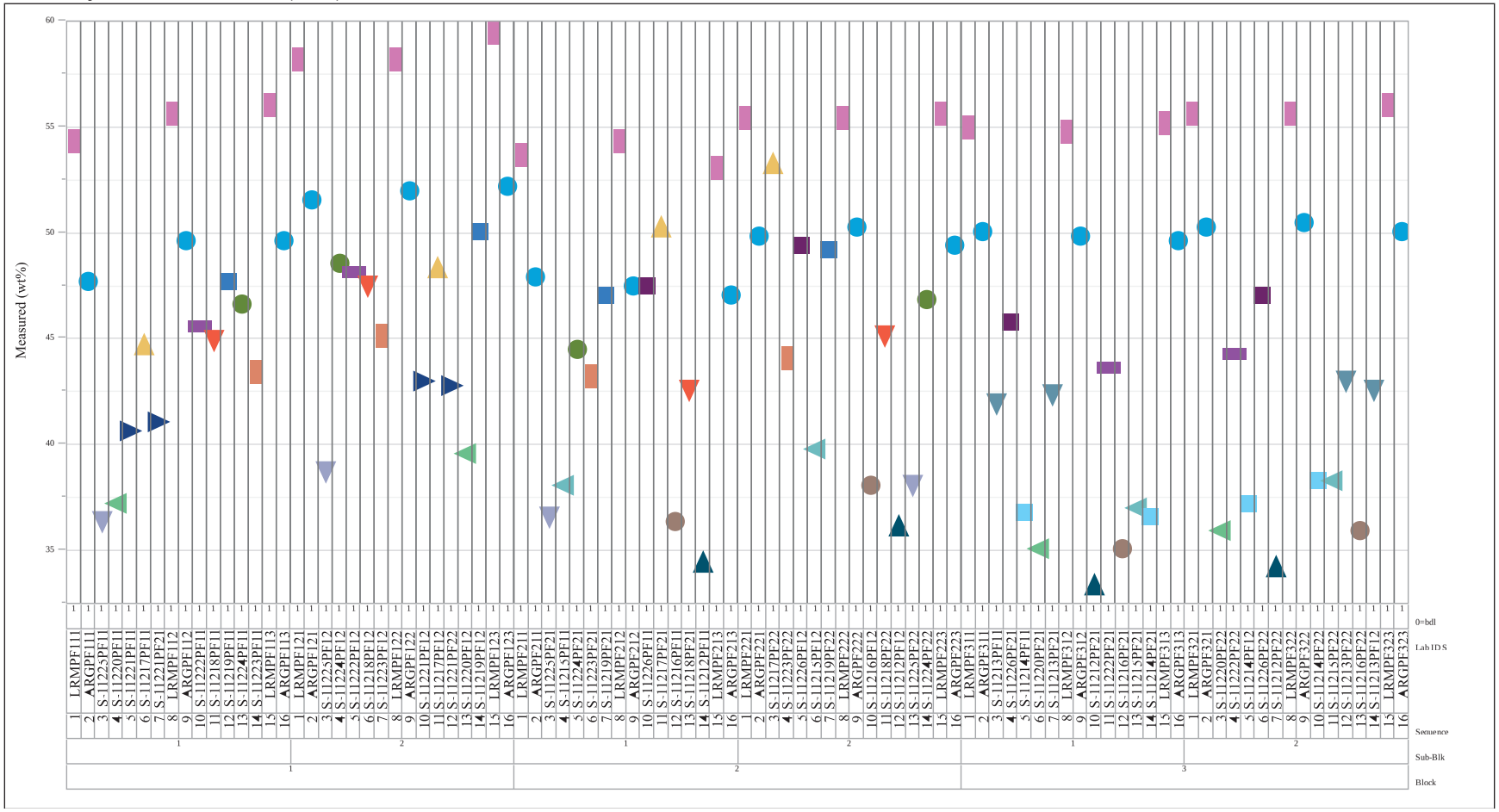


Exhibit A-1. Plots of Oxide Measurements in Analytical Sequence for the Set 1 Glasses (continued)

Oxide=SnO_2, Prep Method=PF
Variability Chart for Measured (wt%)

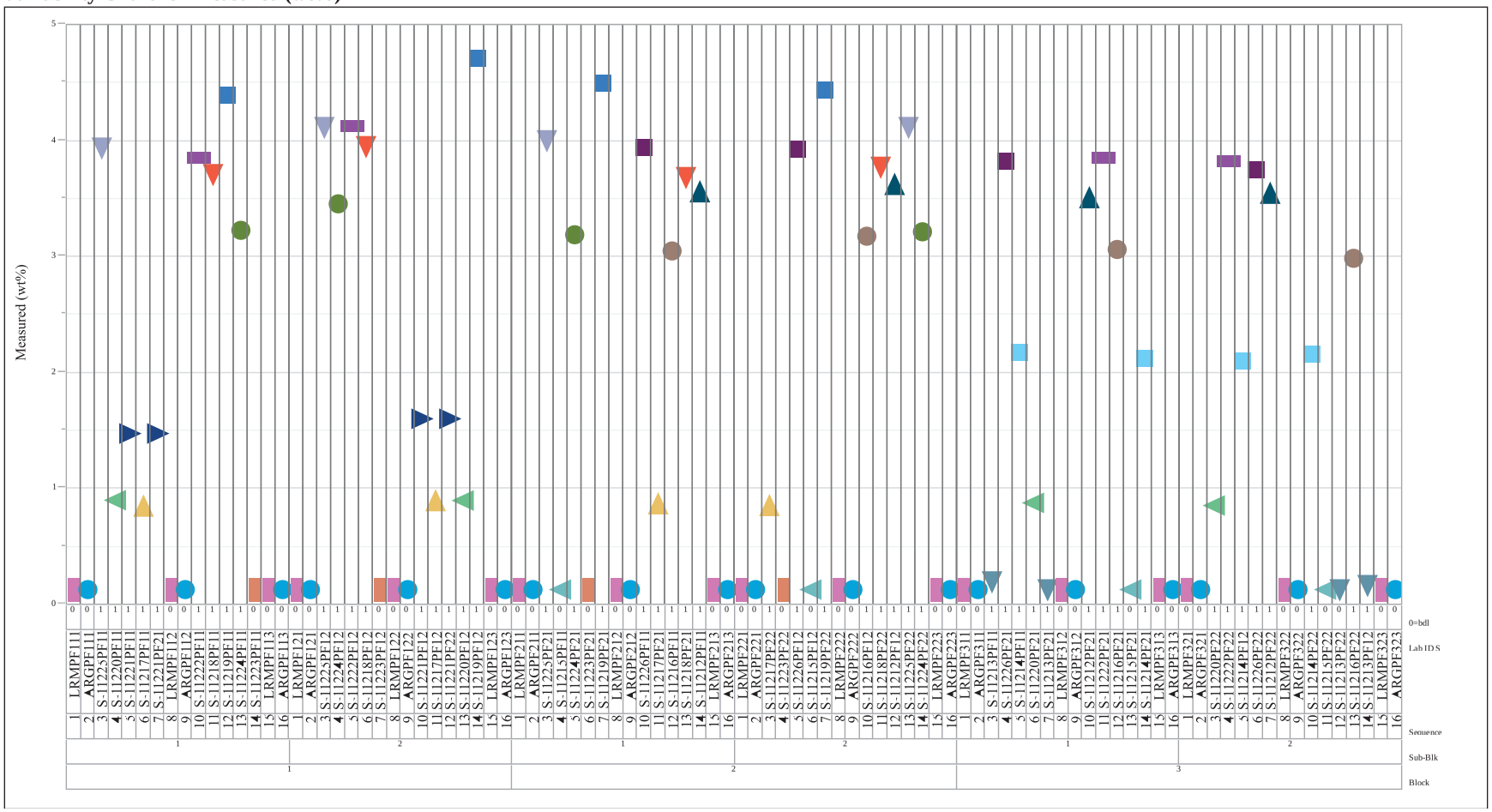


Exhibit A-1. Plots of Oxide Measurements in Analytical Sequence for the Set 1 Glasses (continued)

Oxide=SO_3, Prep Method=AD
Variability Chart for Measured (wt%)

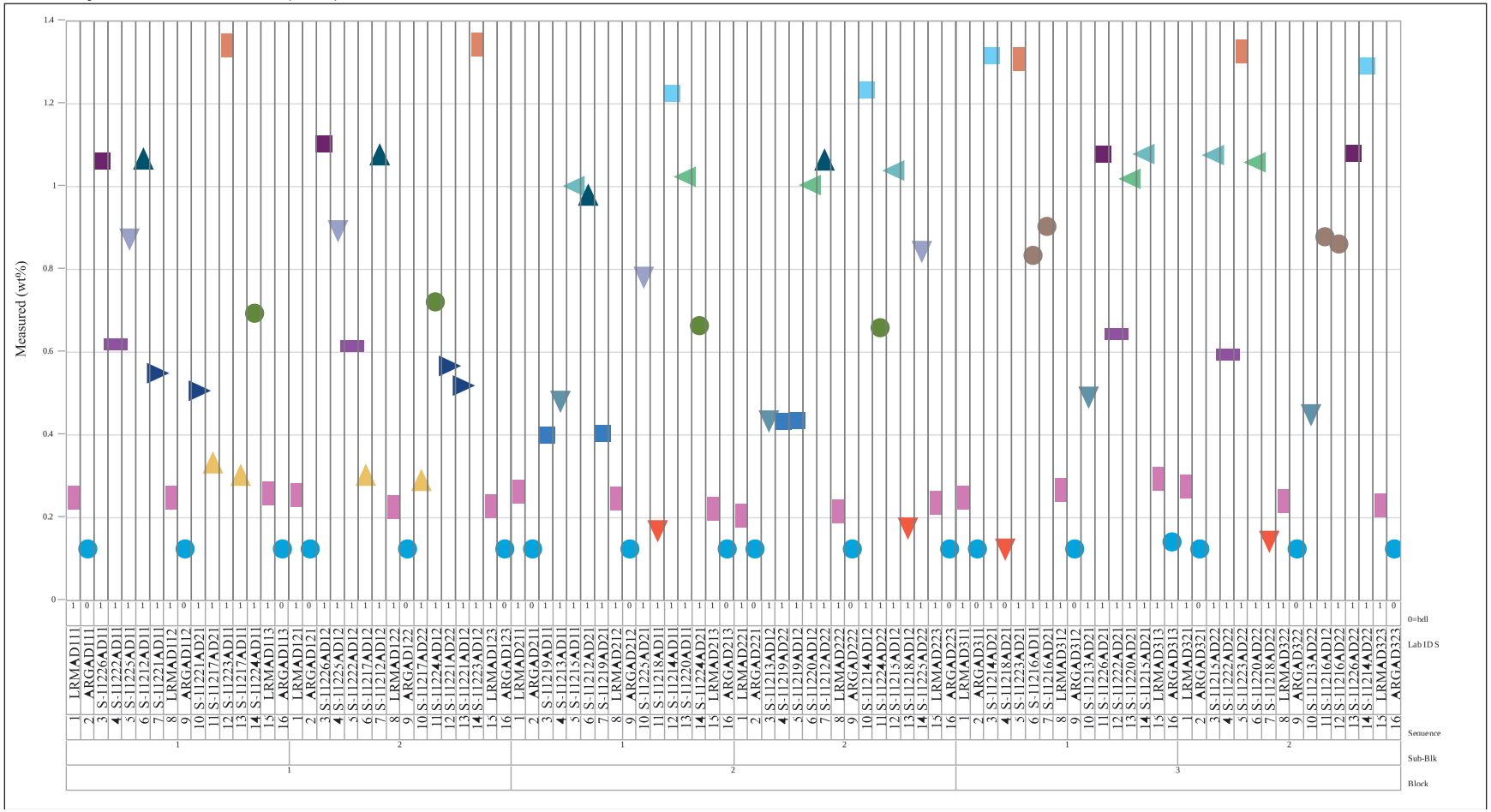


Exhibit A-1. Plots of Oxide Measurements in Analytical Sequence for the Set 1 Glasses (continued)

Oxide=TiO_2, Prep Method=AD
Variability Chart for Measured (wt%)

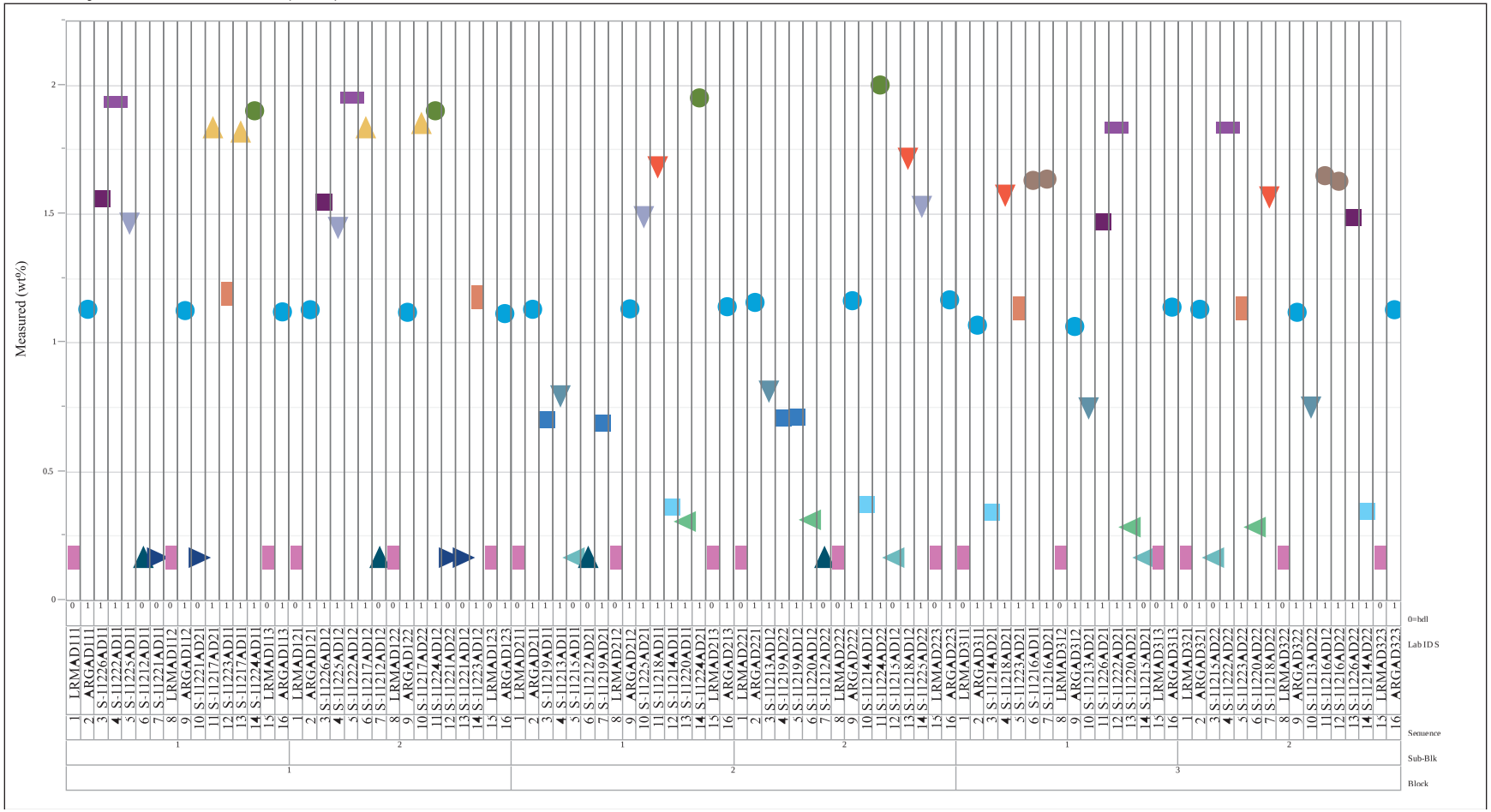


Exhibit A-1. Plots of Oxide Measurements in Analytical Sequence for the Set 1 Glasses (continued)

Oxide=V_2O_5, Prep Method=AD
Variability Chart for Measured (wt%)

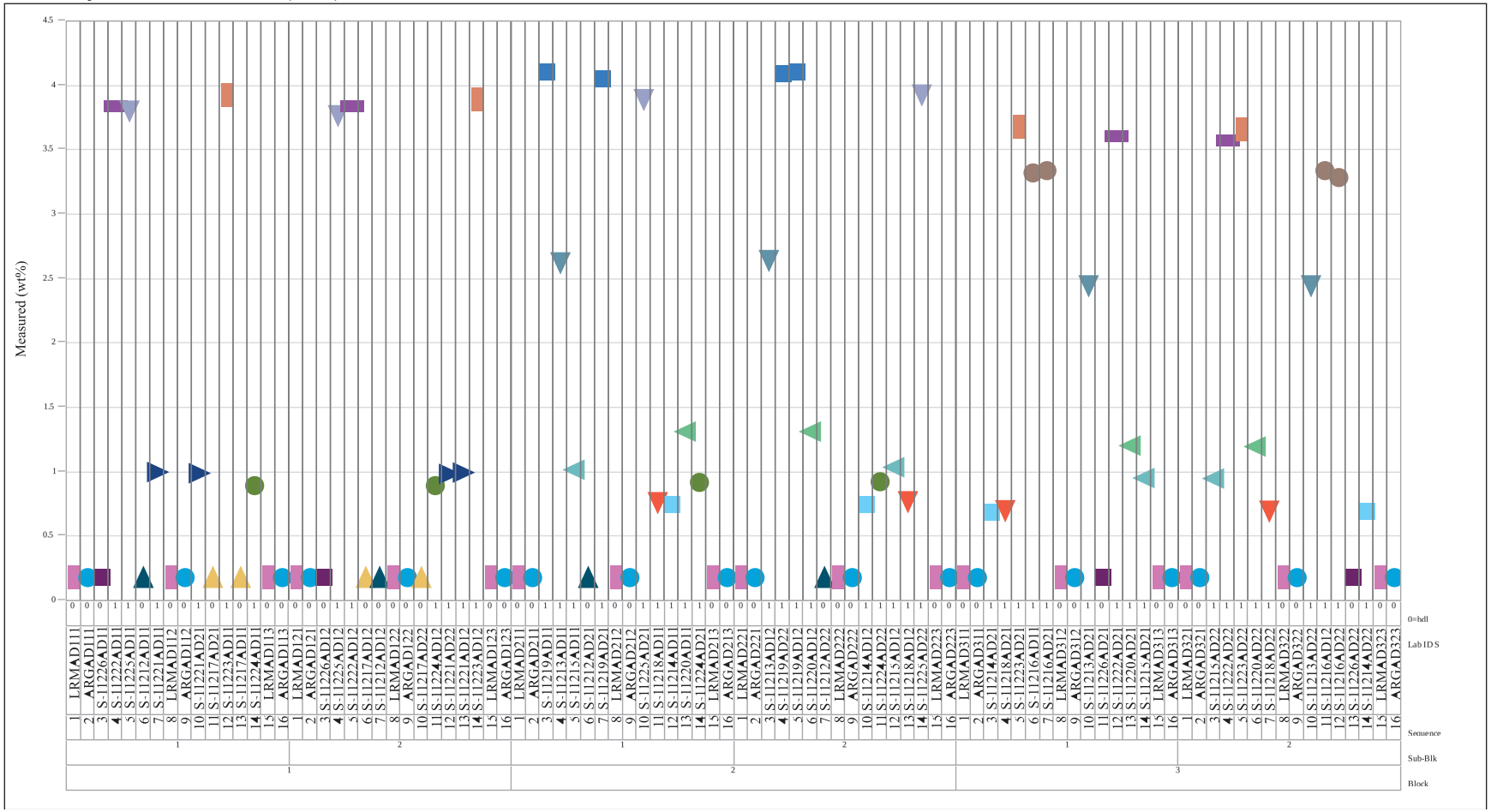


Exhibit A-1. Plots of Oxide Measurements in Analytical Sequence for the Set 1 Glasses (continued)

Oxide=ZnO, Prep Method=AD
Variability Chart for Measured (wt%)

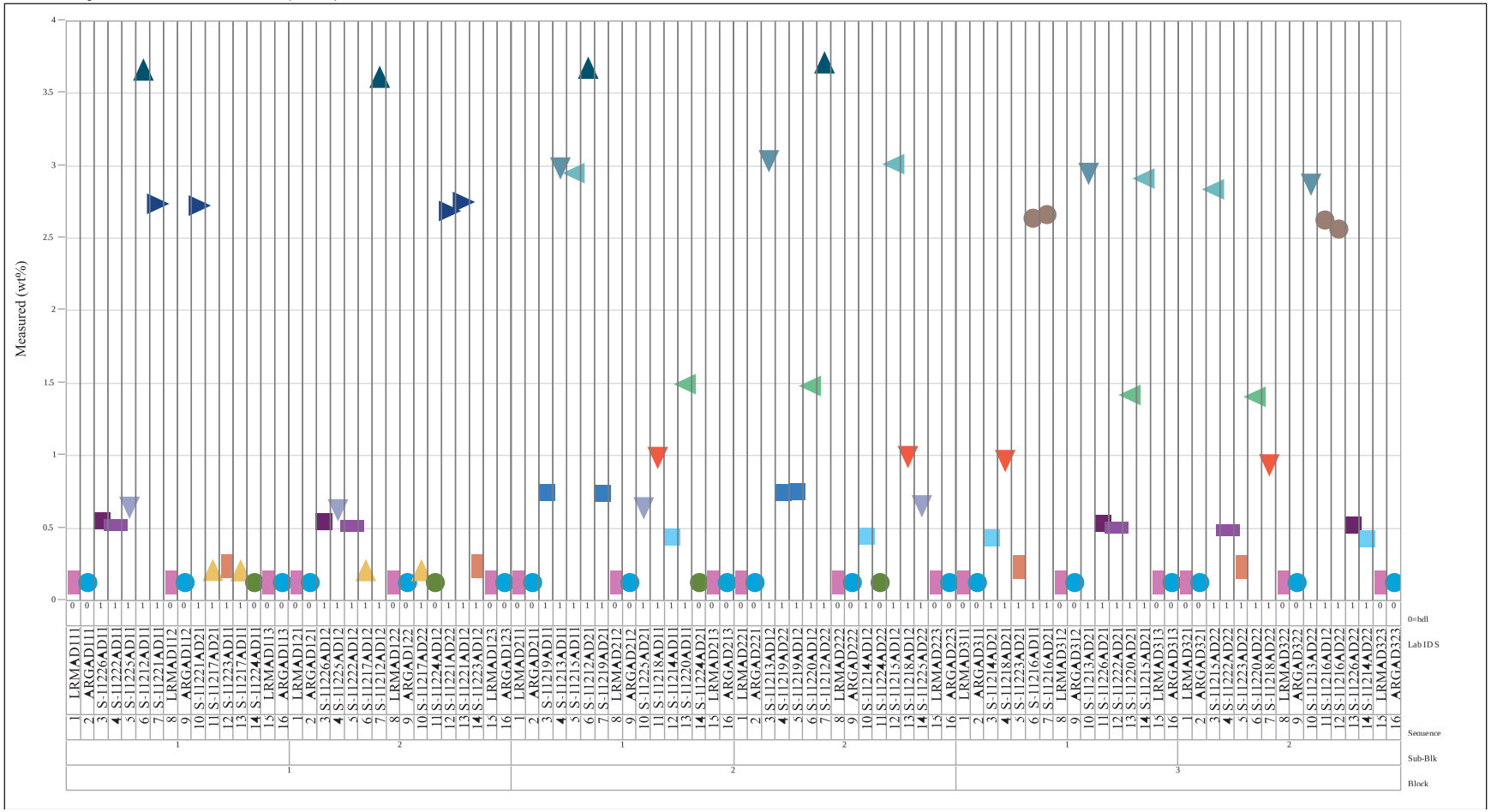


Exhibit A-1. Plots of Oxide Measurements in Analytical Sequence for the Set 1 Glasses (continued)

Oxide=ZrO_2, Prep Method=AD
Variability Chart for Measured (wt%)

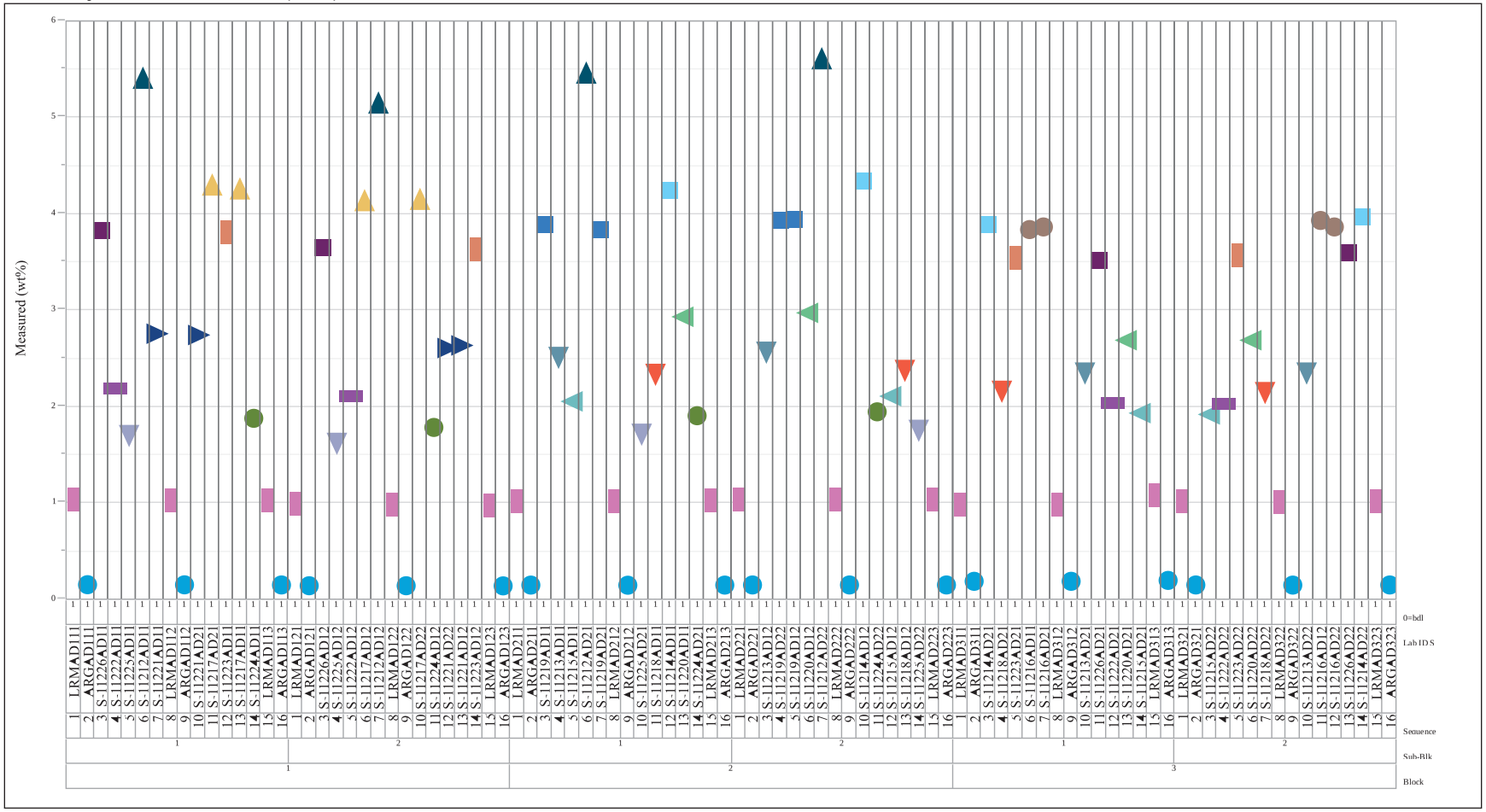


Exhibit A-2. Plots of Oxide Measurements by Set 1 Glass Identifier Grouped by Target Concentrations

Oxide=Al_2O_3, Prep Method=PF
Variability Chart for Measured (wt%)

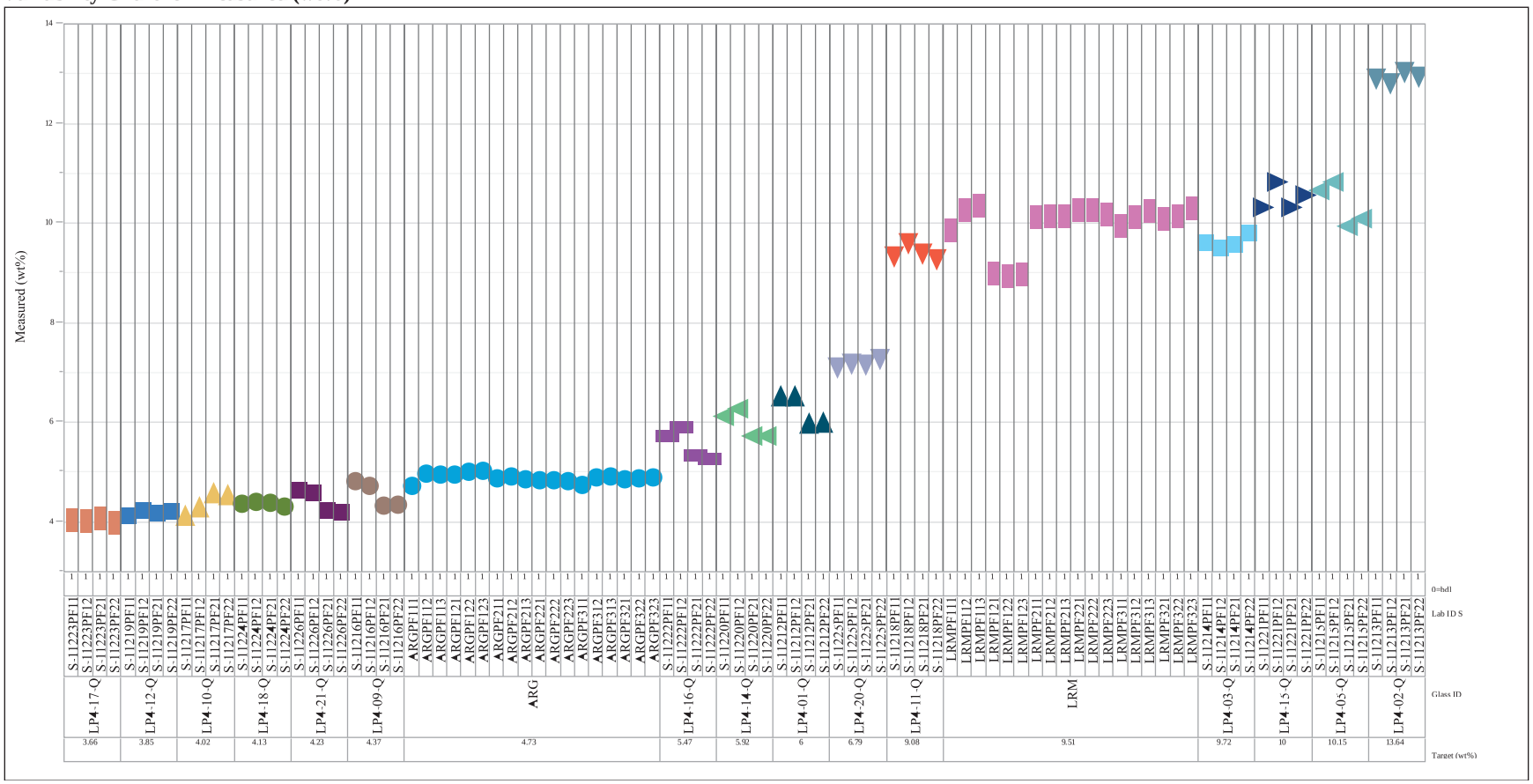


Exhibit A-2. Plots of Oxide Measurements by Set 1 Glass Identifier Grouped by Target Concentrations (continued)

Oxide=B_2O_3, Prep Method=PF
Variability Chart for Measured (wt%)

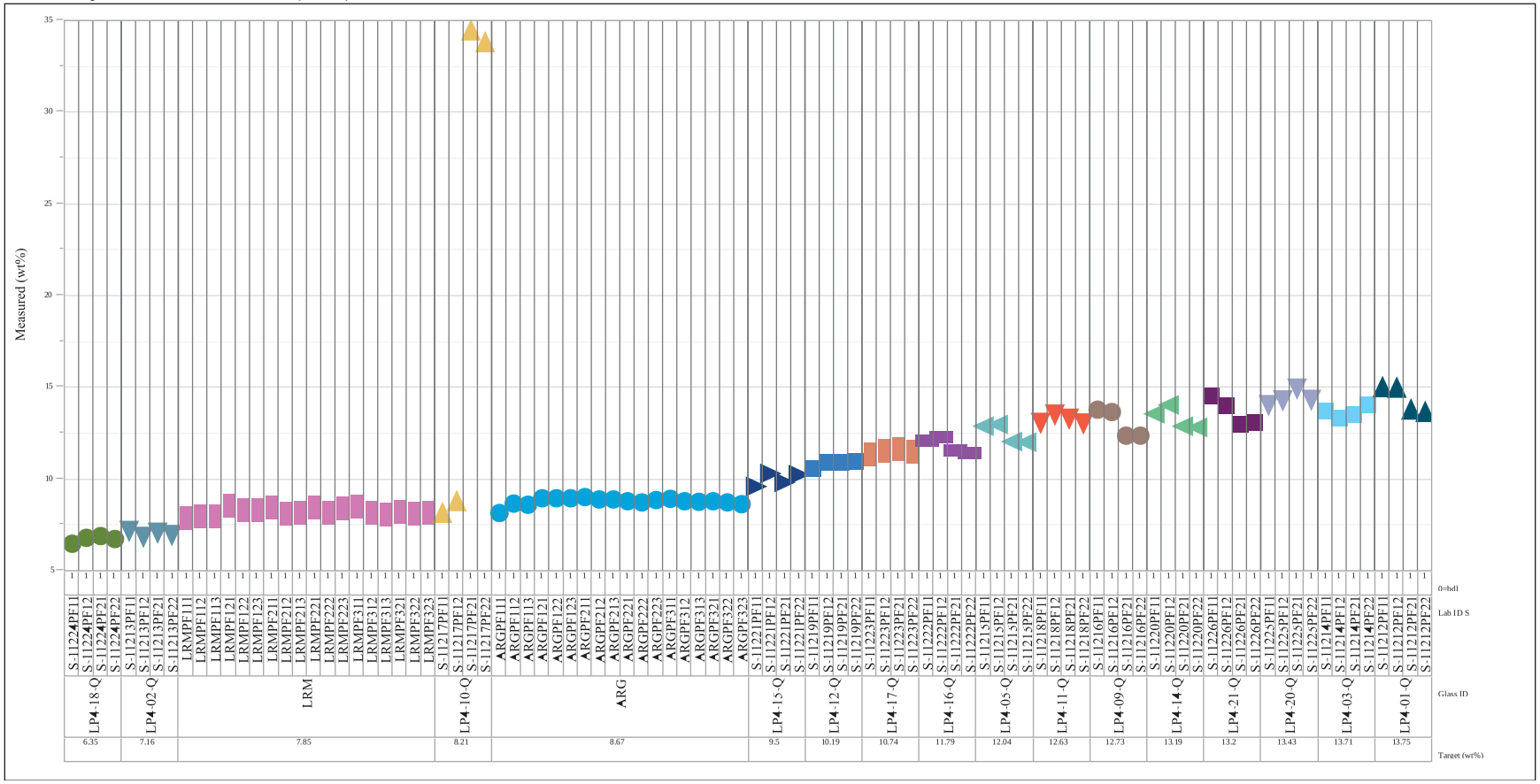


Exhibit A-2. Plots of Oxide Measurements by Set 1 Glass Identifier Grouped by Target Concentrations (continued)

Oxide=CaO, Prep Method=AD
Variability Chart for Measured (wt%)

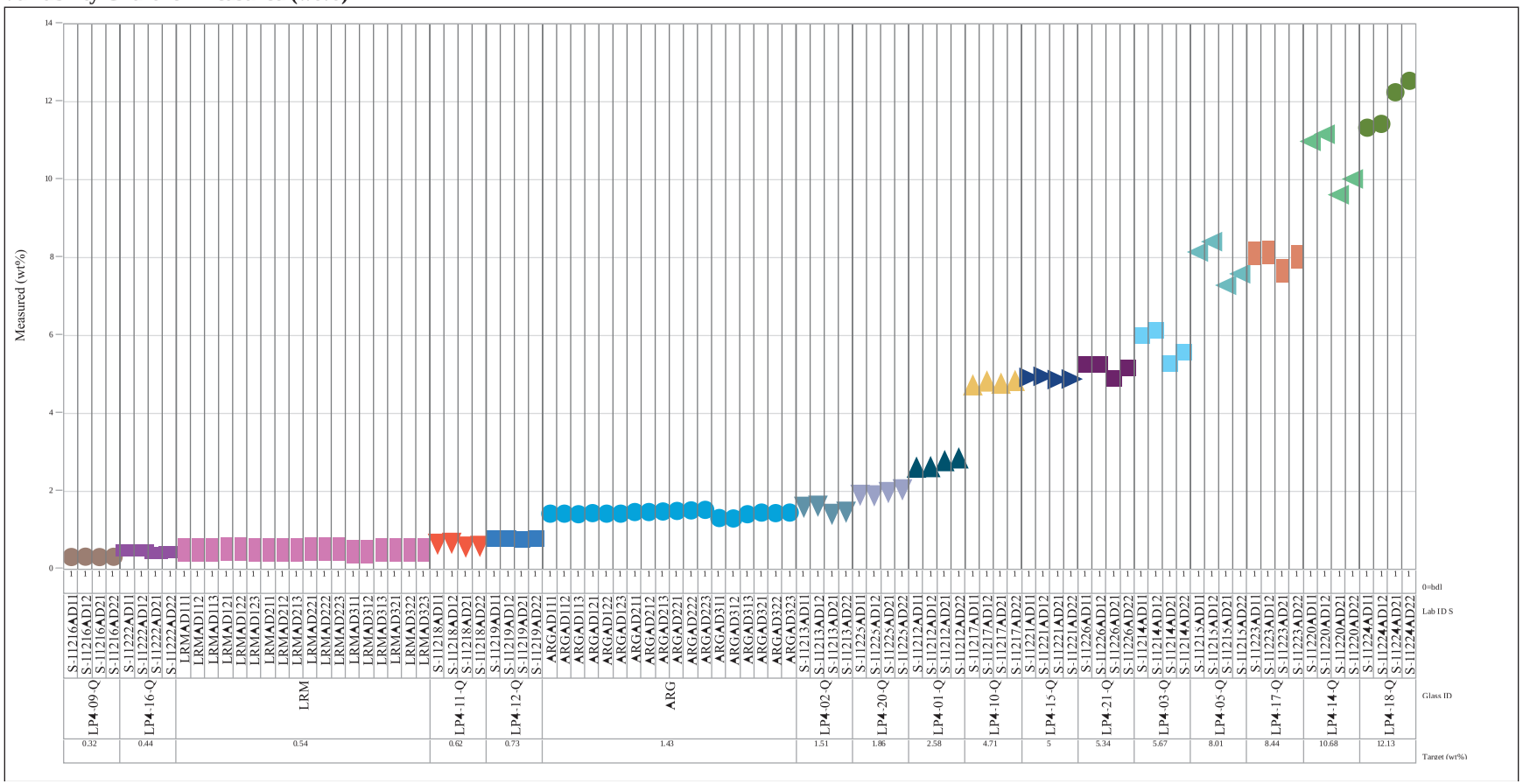


Exhibit A-2. Plots of Oxide Measurements by Set 1 Glass Identifier Grouped by Target Concentrations (continued)

Oxide=Cl, Prep Method=KH
Variability Chart for Measured (wt%)

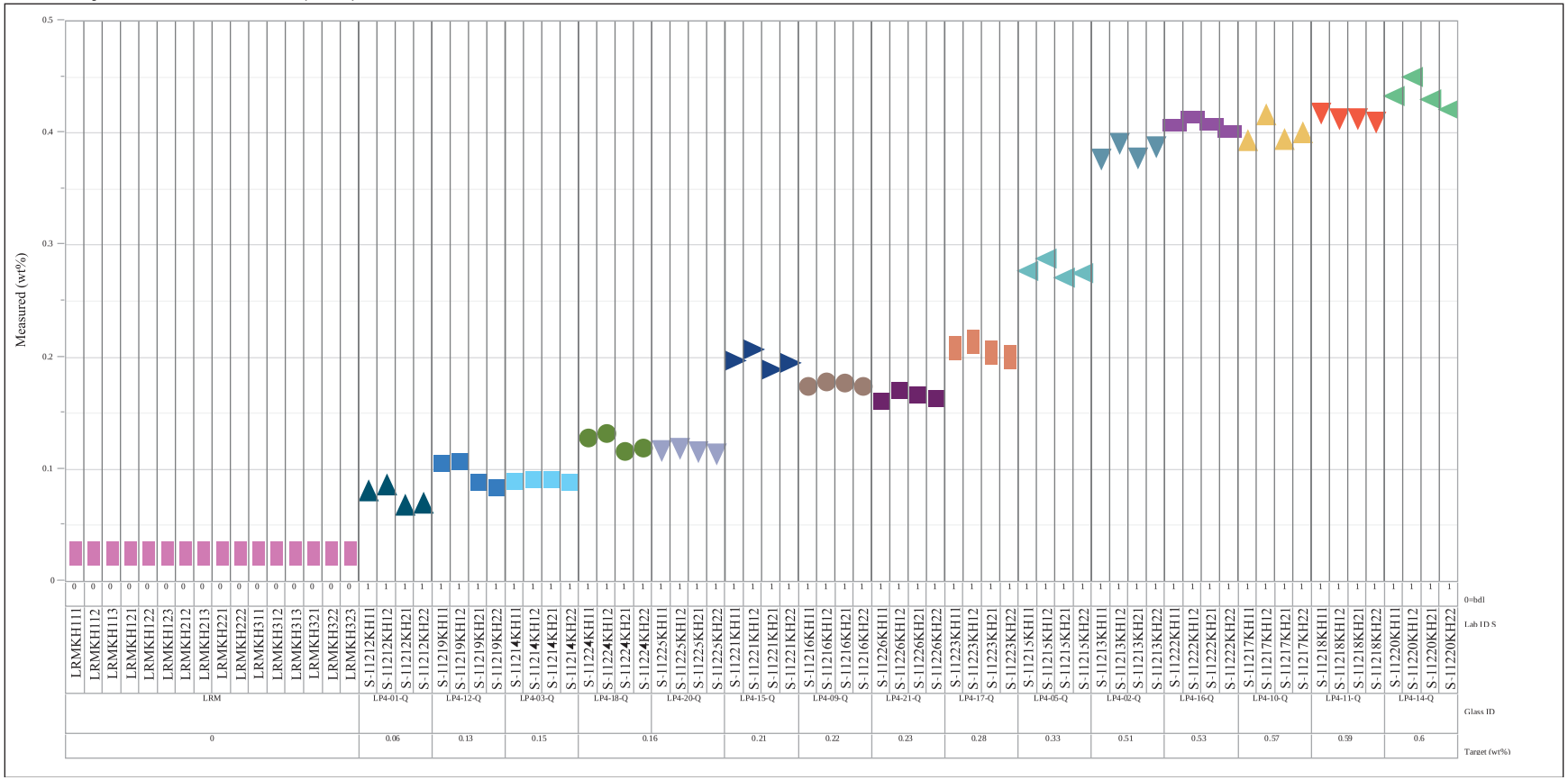


Exhibit A-2. Plots of Oxide Measurements by Set 1 Glass Identifier Grouped by Target Concentrations (continued)

Oxide=Cr_2O_3, Prep Method=AD
Variability Chart for Measured (wt%)

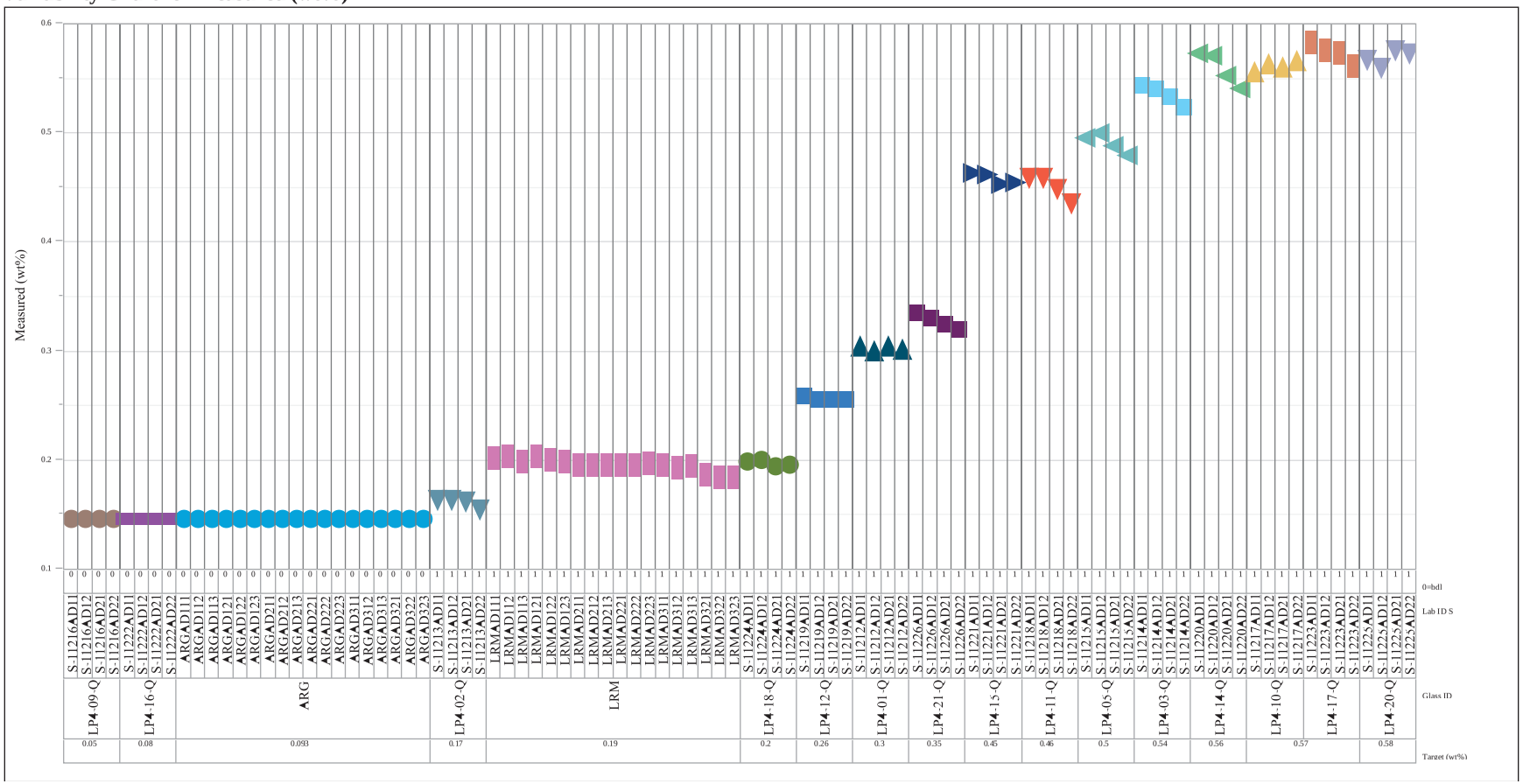


Exhibit A-2. Plots of Oxide Measurements by Set 1 Glass Identifier Grouped by Target Concentrations (continued)

Oxide=F, Prep Method=KH
Variability Chart for Measured (wt%)

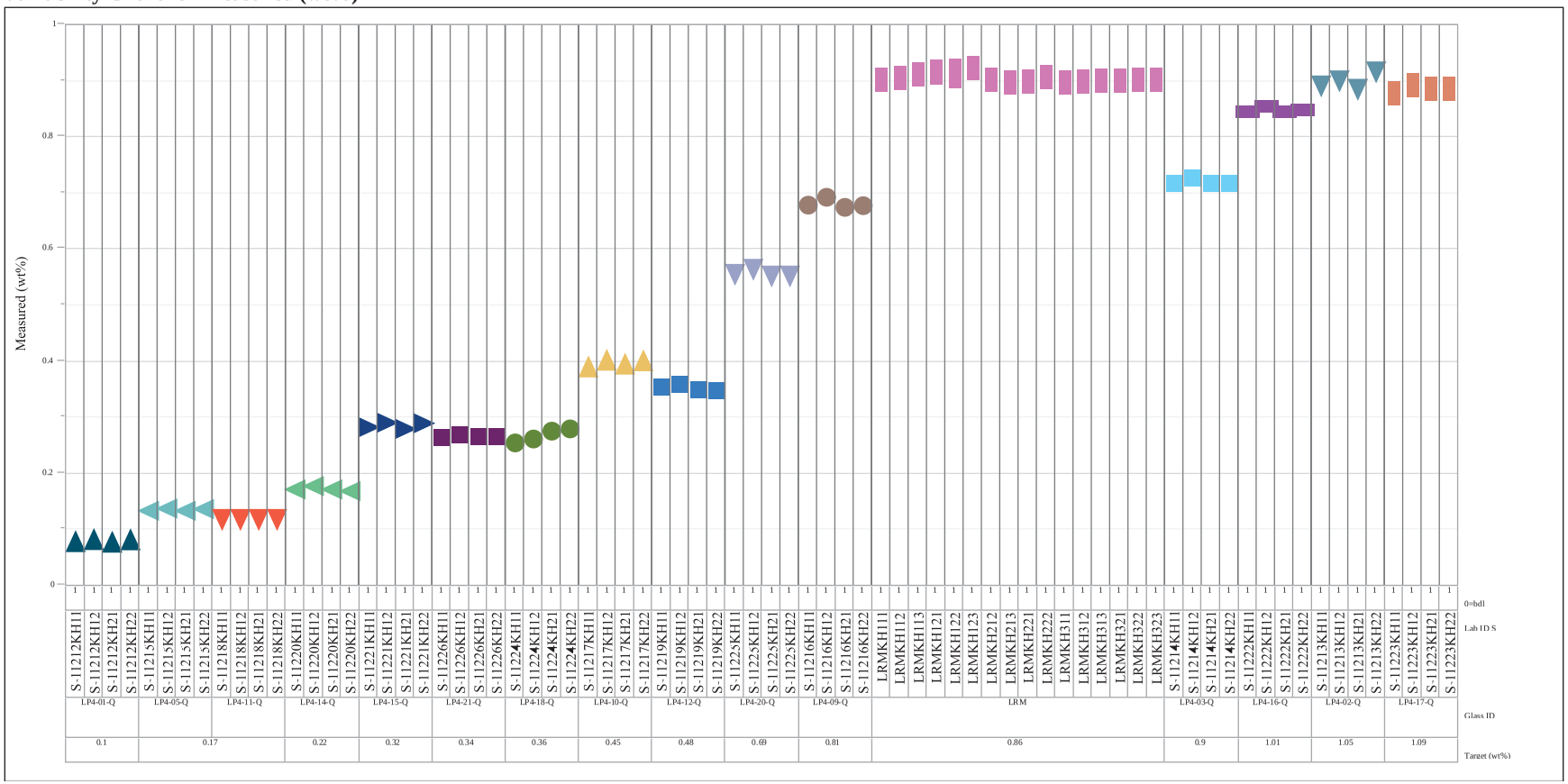


Exhibit A-2. Plots of Oxide Measurements by Set 1 Glass Identifier Grouped by Target Concentrations (continued)

Oxide=Fe_2O_3, Prep Method=AD
Variability Chart for Measured (wt%)

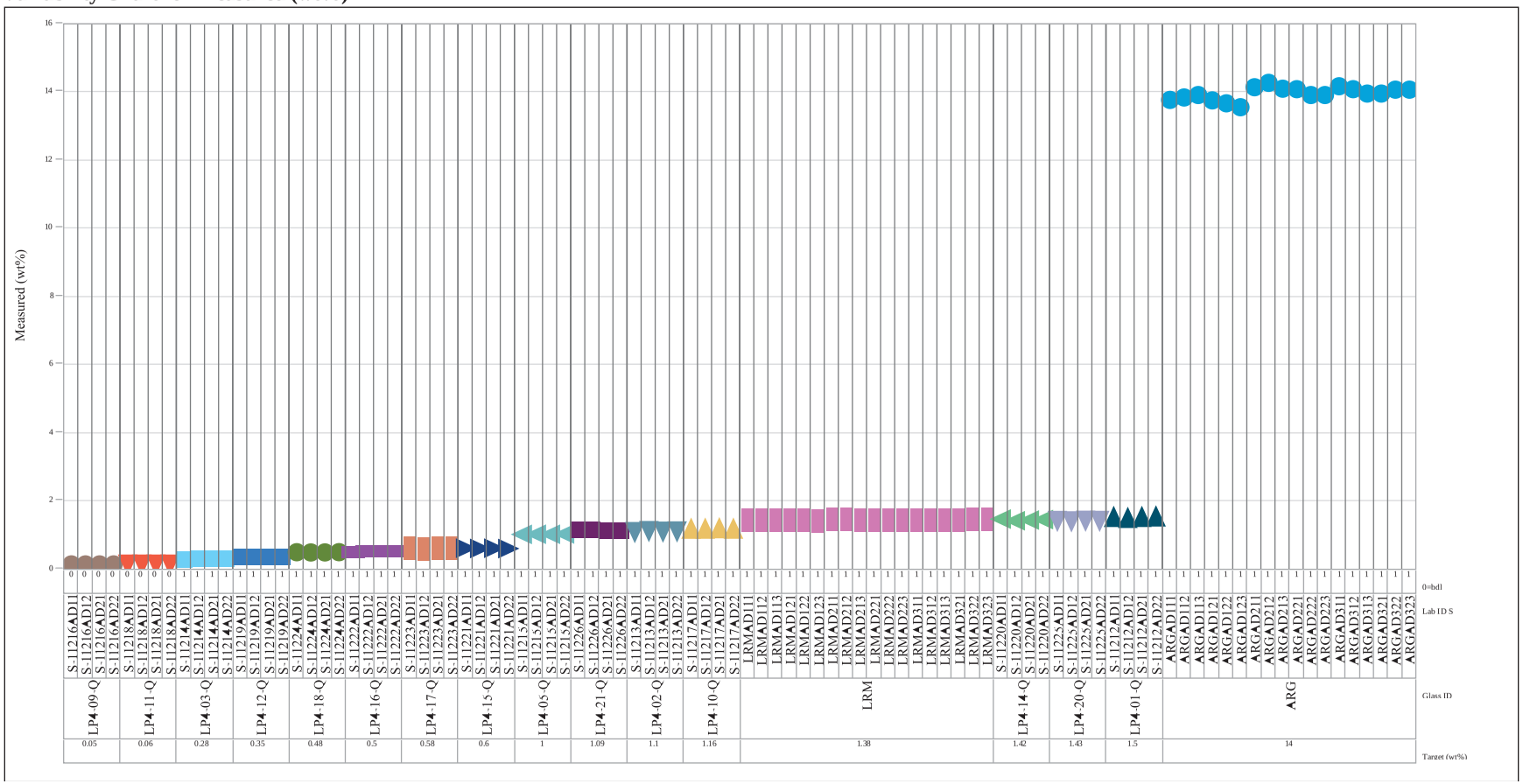


Exhibit A-2. Plots of Oxide Measurements by Set 1 Glass Identifier Grouped by Target Concentrations (continued)

Oxide=K_2O, Prep Method=AD
Variability Chart for Measured (wt%)

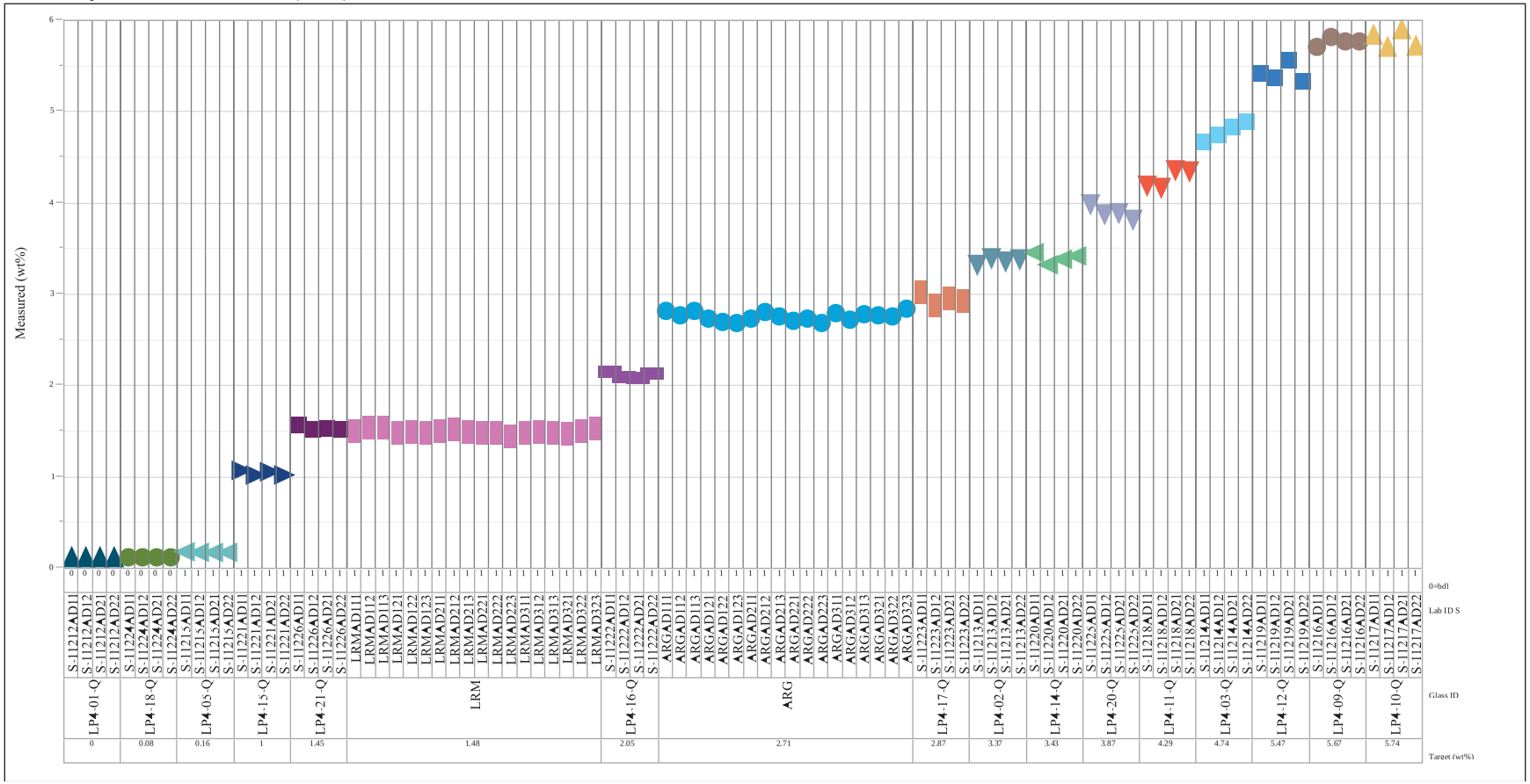


Exhibit A-2. Plots of Oxide Measurements by Set 1 Glass Identifier Grouped by Target Concentrations (continued)

Oxide=Li_2O, Prep Method=AD
Variability Chart for Measured (wt%)

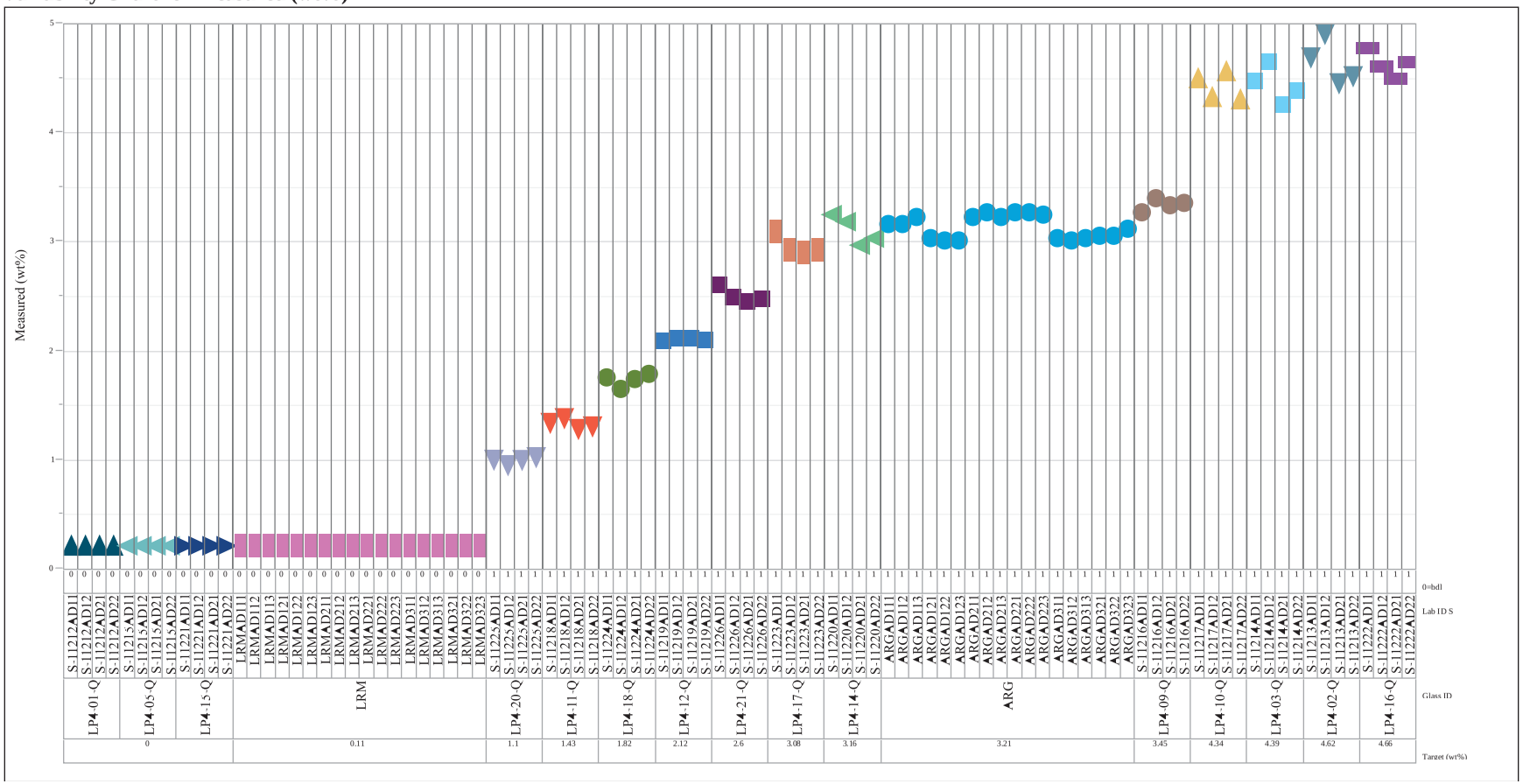


Exhibit A-2. Plots of Oxide Measurements by Set 1 Glass Identifier Grouped by Target Concentrations (continued)

Oxide=MgO, Prep Method=AD
Variability Chart for Measured (wt%)

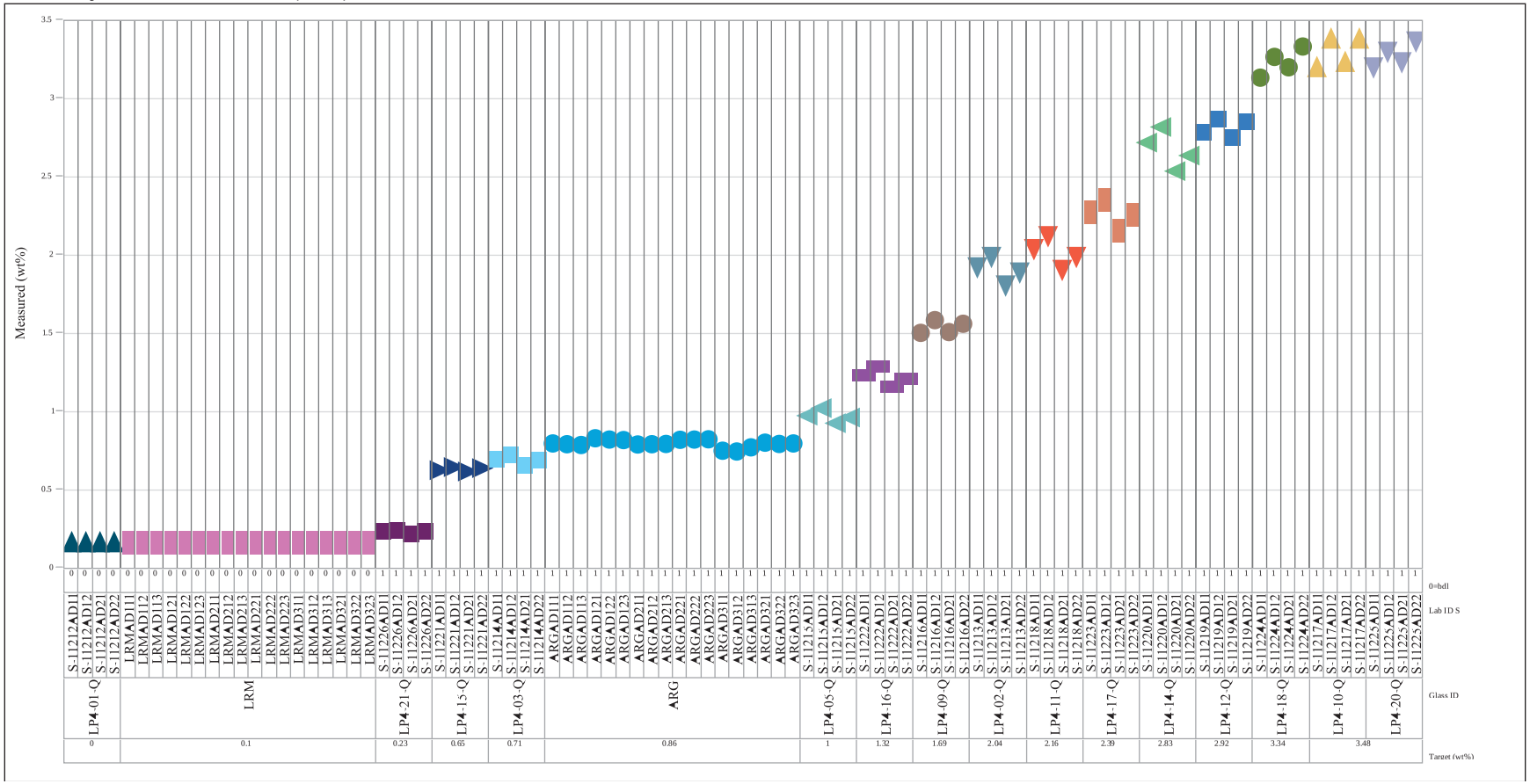


Exhibit A-2. Plots of Oxide Measurements by Set 1 Glass Identifier Grouped by Target Concentrations (continued)

Oxide=Na_2O, Prep Method=AD
Variability Chart for Measured (wt%)

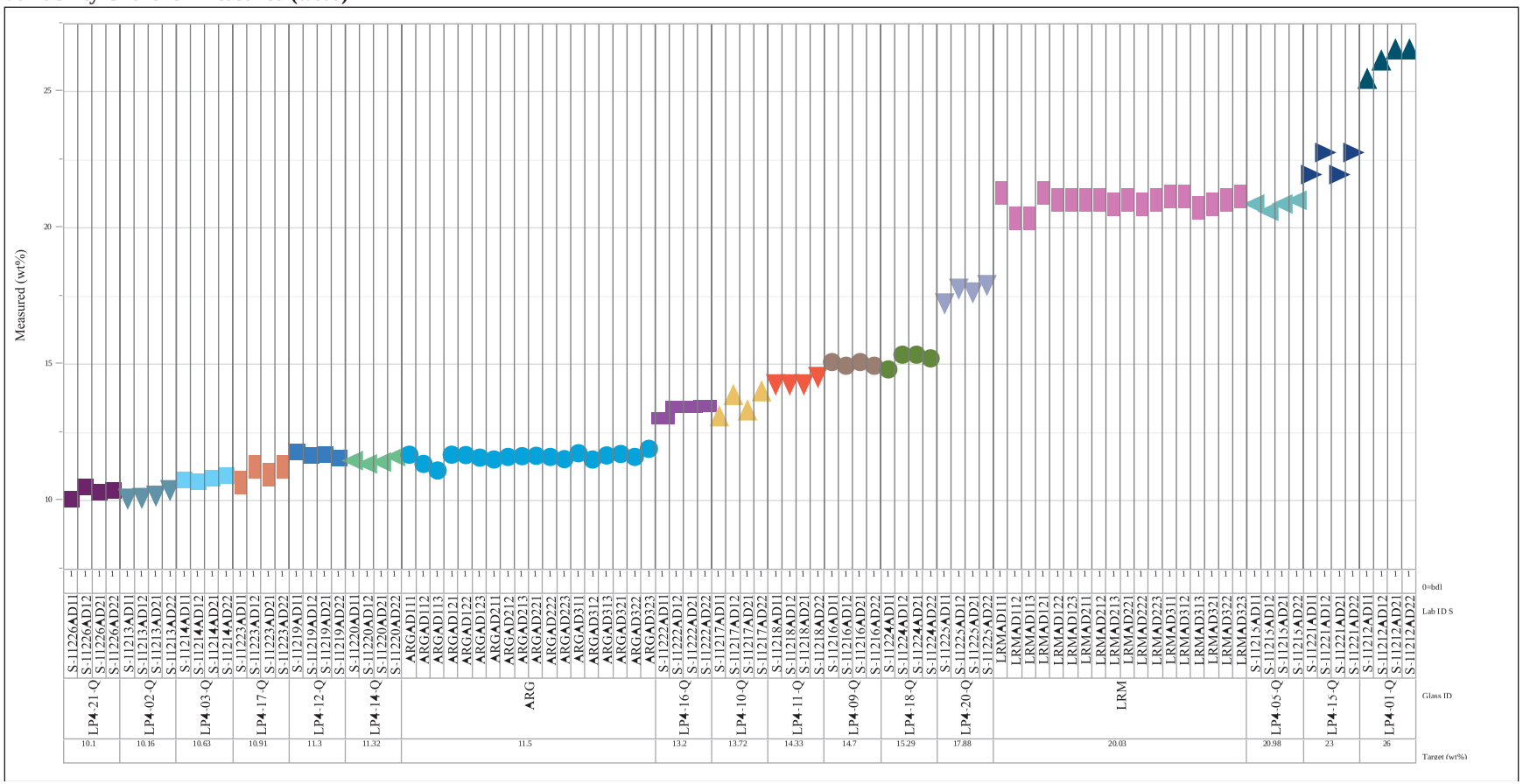


Exhibit A-2. Plots of Oxide Measurements by Set 1 Glass Identifier Grouped by Target Concentrations (continued)

Oxide=NiO, Prep Method=AD
Variability Chart for Measured (wt%)

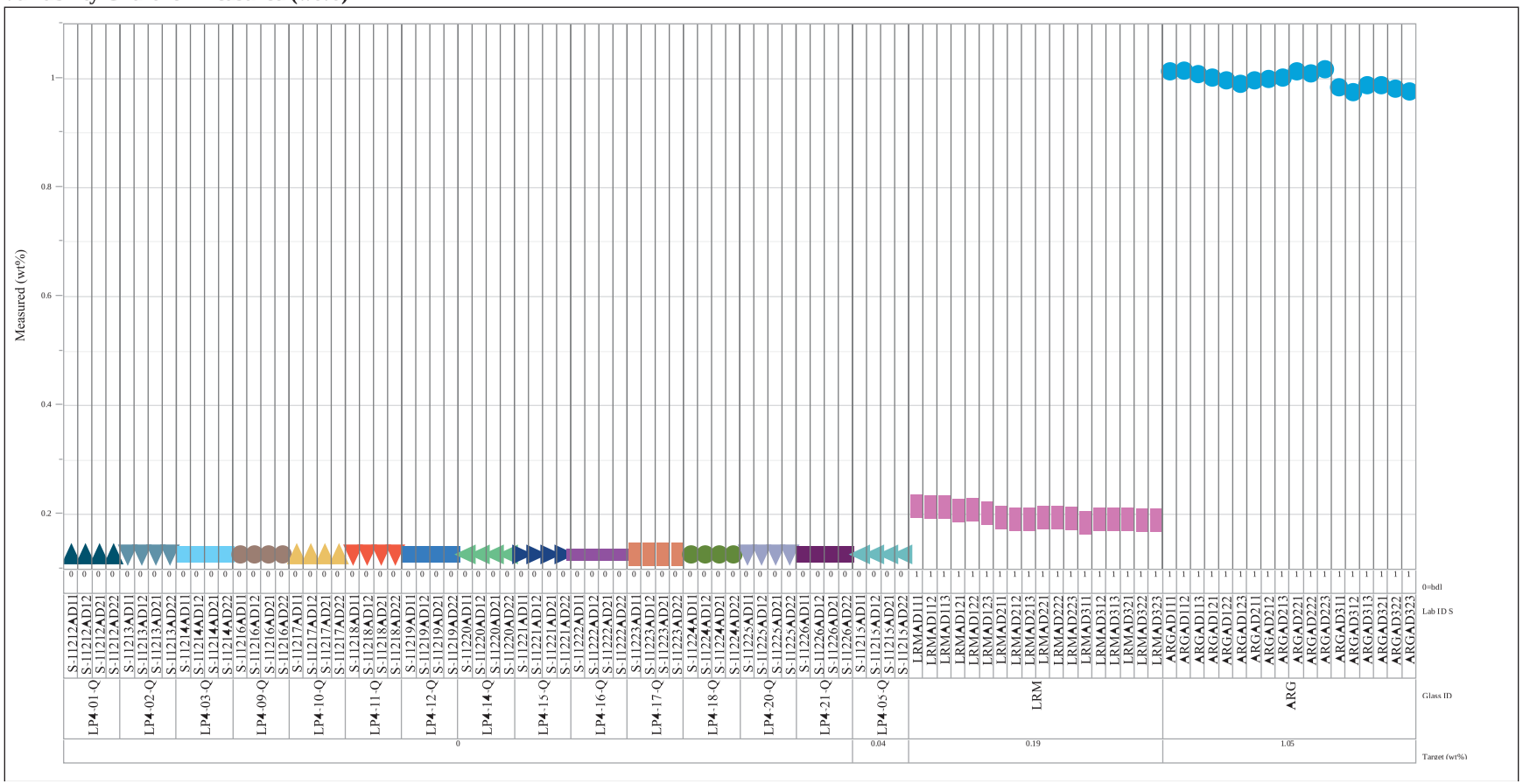


Exhibit A-2. Plots of Oxide Measurements by Set 1 Glass Identifier Grouped by Target Concentrations (continued)

Oxide=P_2O_5, Prep Method=AD
Variability Chart for Measured (wt%)

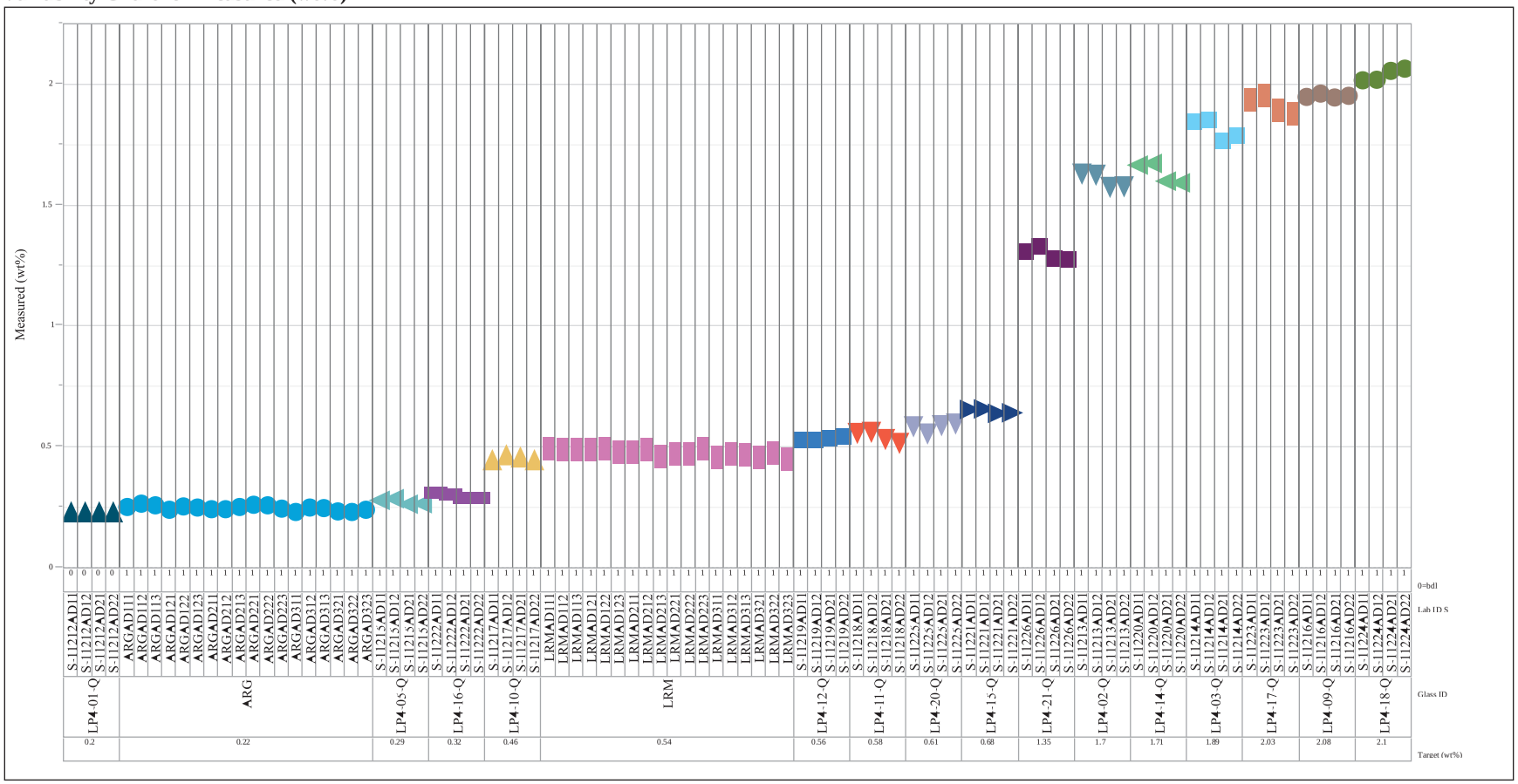


Exhibit A-2. Plots of Oxide Measurements by Set 1 Glass Identifier Grouped by Target Concentrations (continued)

Oxide=PbO, Prep Method=AD
Variability Chart for Measured (wt%)

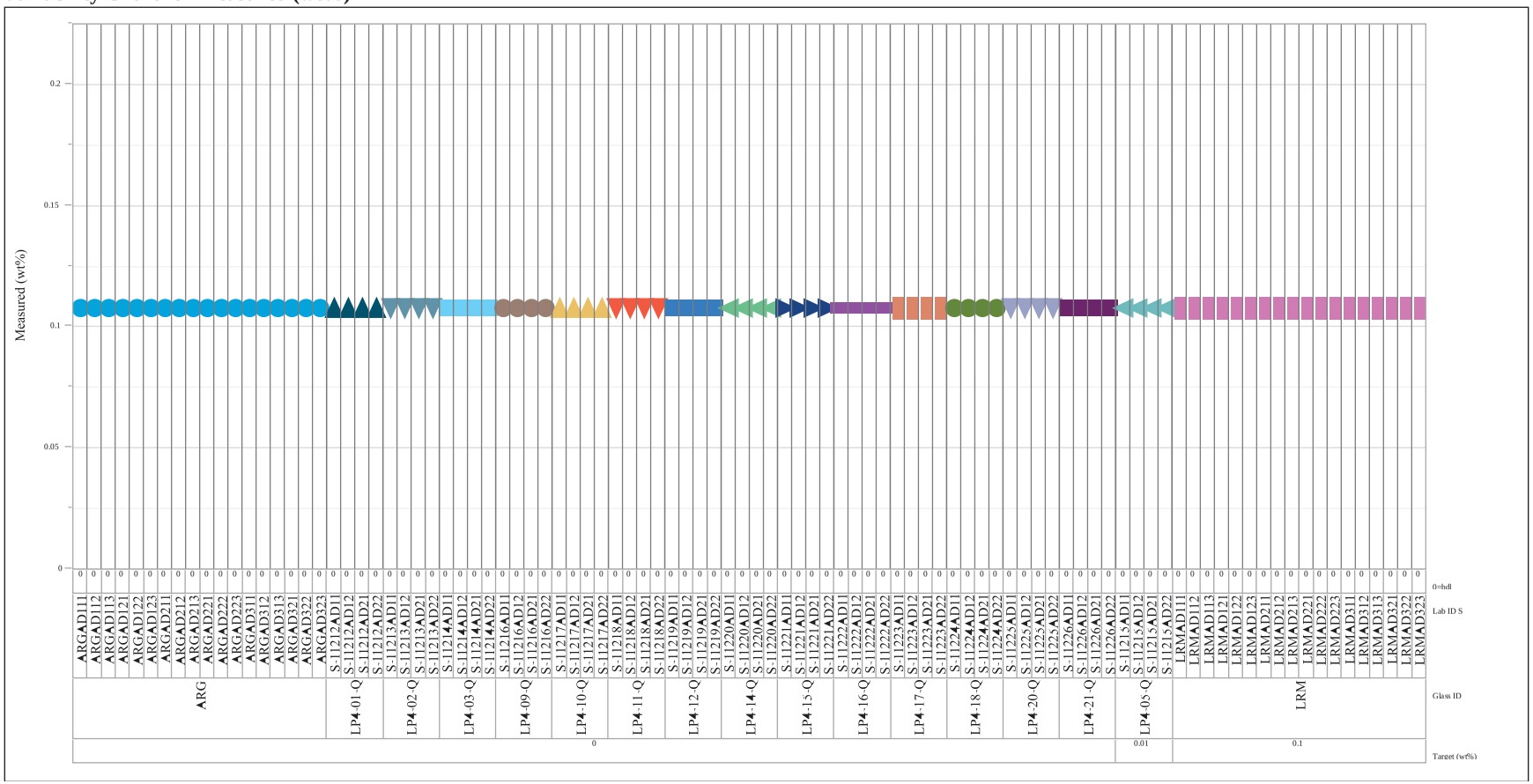


Exhibit A-2. Plots of Oxide Measurements by Set 1 Glass Identifier Grouped by Target Concentrations (continued)

Oxide=SiO_2, Prep Method=PF
Variability Chart for Measured (wt%)

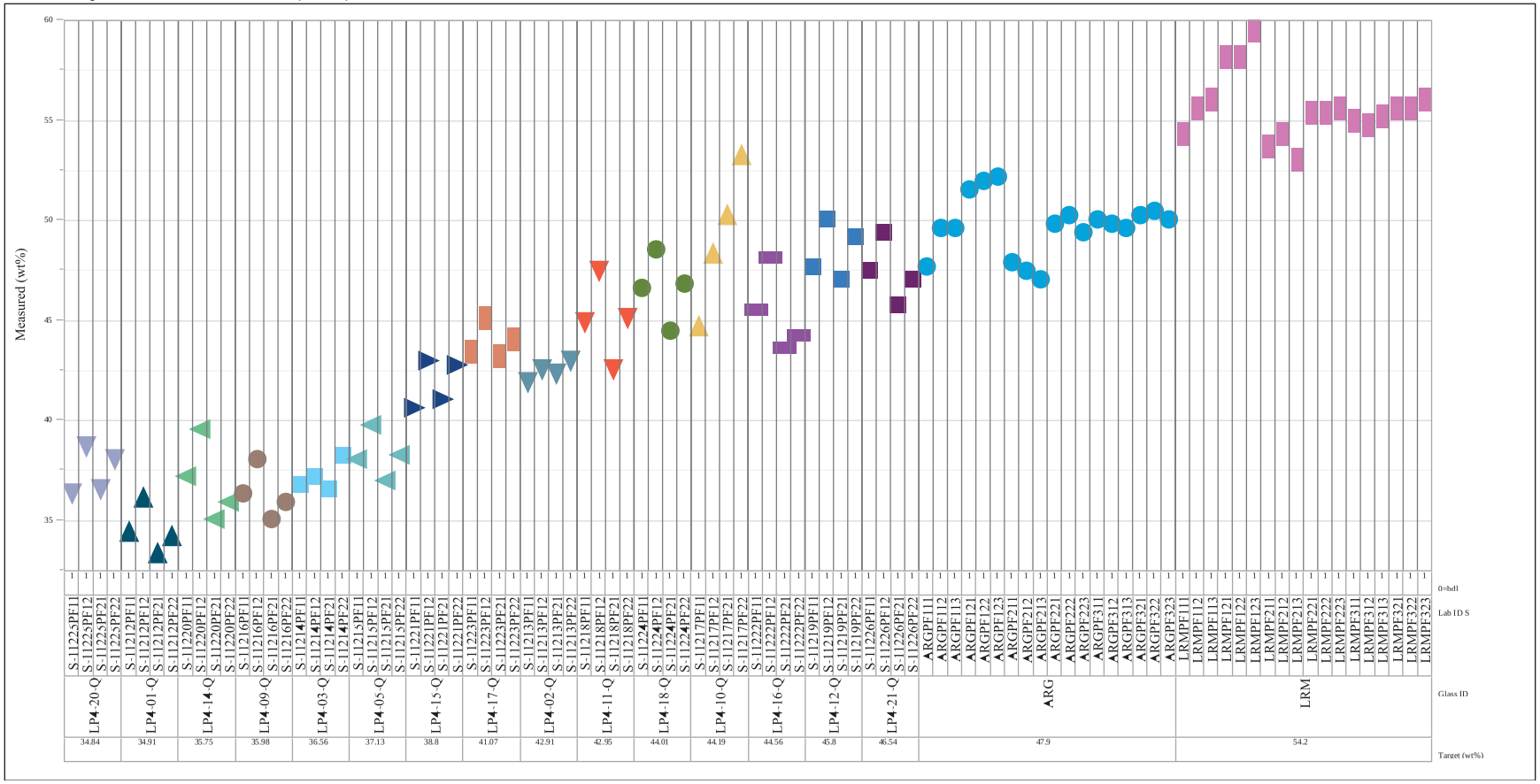


Exhibit A-2. Plots of Oxide Measurements by Set 1 Glass Identifier Grouped by Target Concentrations (continued)

Oxide=SnO_2, Prep Method=PF
Variability Chart for Measured (wt%)

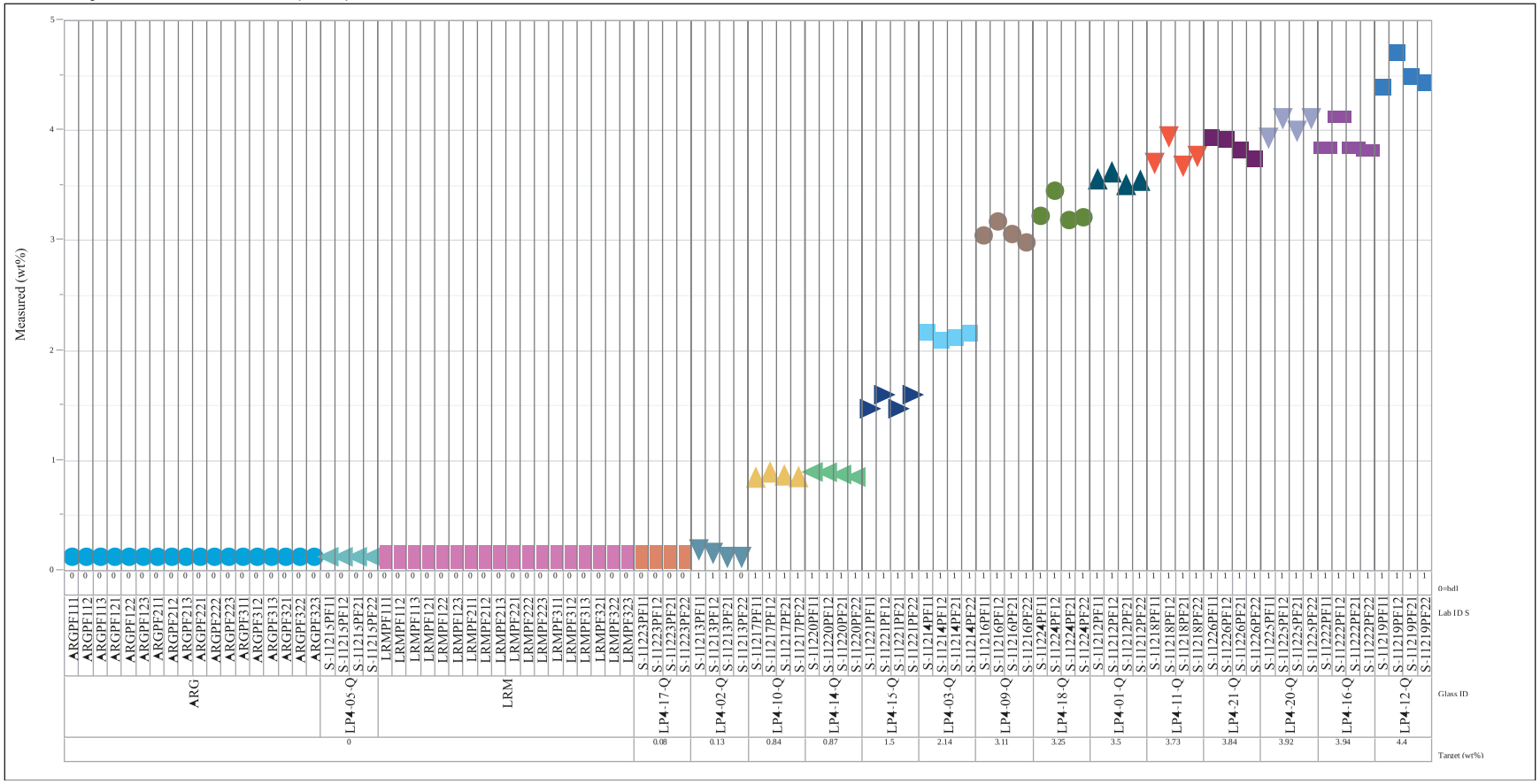


Exhibit A-2. Plots of Oxide Measurements by Set 1 Glass Identifier Grouped by Target Concentrations (continued)

Oxide=SO_3, Prep Method=AD
Variability Chart for Measured (wt%)

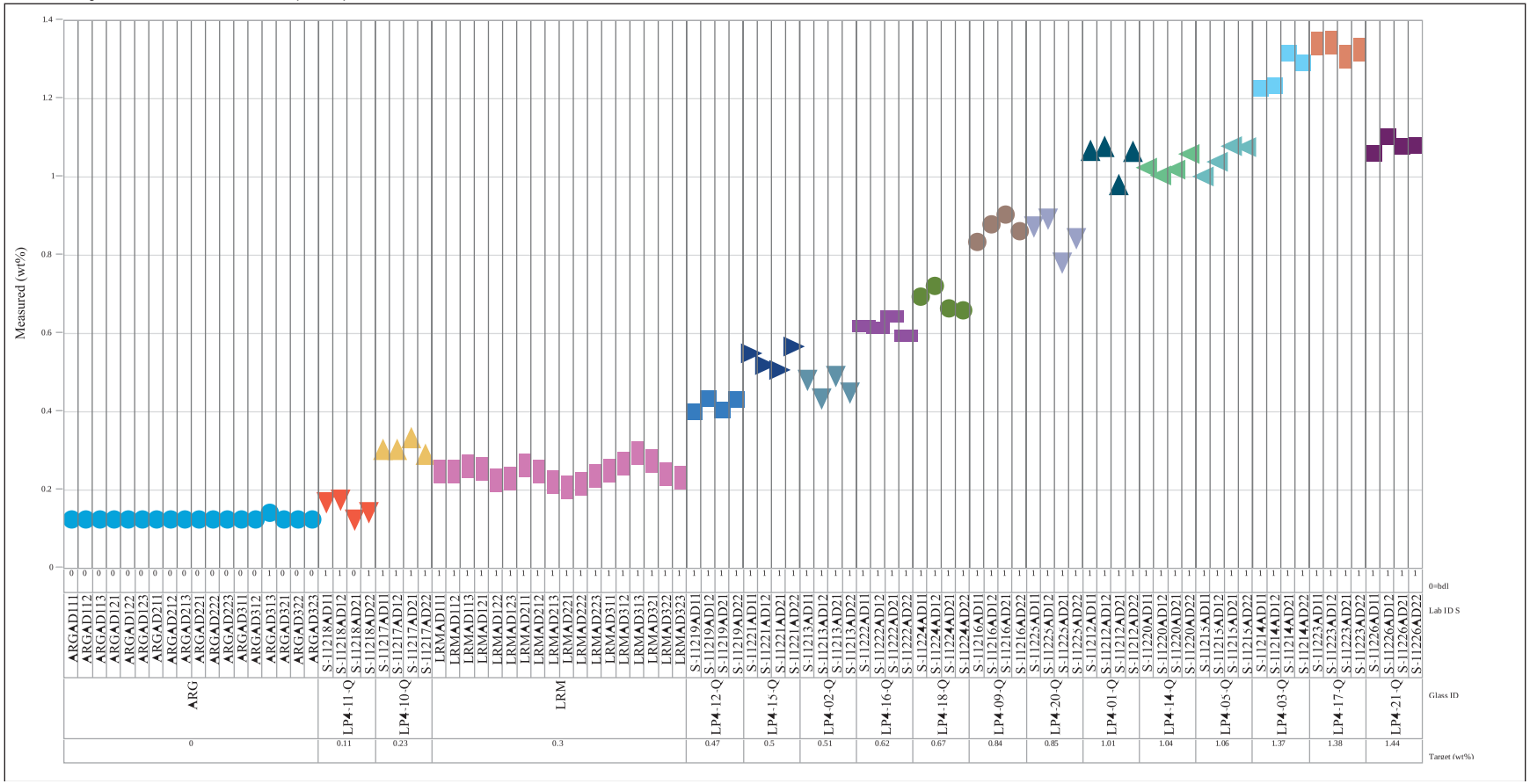


Exhibit A-2. Plots of Oxide Measurements by Set 1 Glass Identifier Grouped by Target Concentrations (continued)

Oxide=TiO_2, Prep Method=AD
Variability Chart for Measured (wt%)

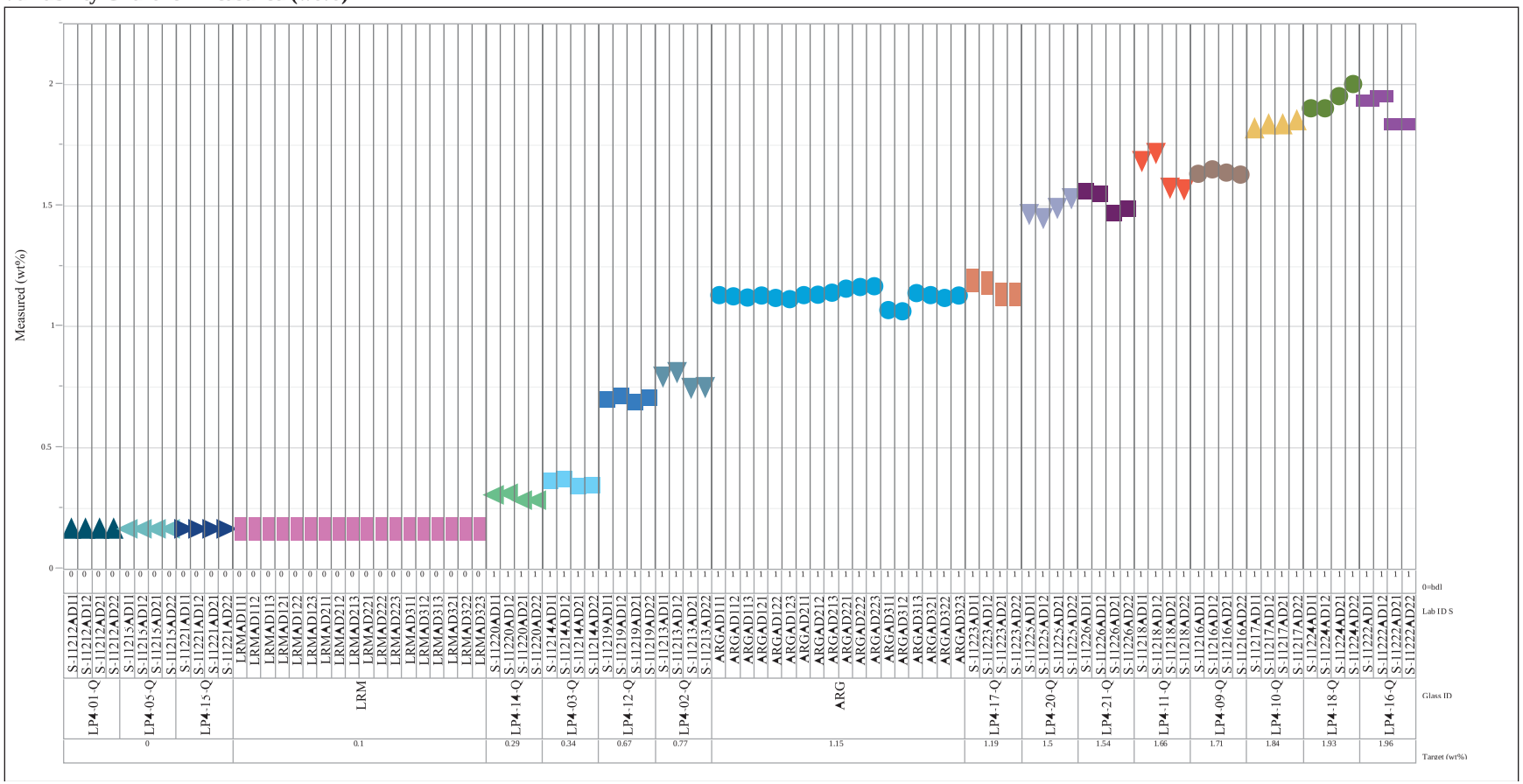


Exhibit A-2. Plots of Oxide Measurements by Set 1 Glass Identifier Grouped by Target Concentrations (continued)

Oxide=V_2O_5, Prep Method=AD
Variability Chart for Measured (wt%)

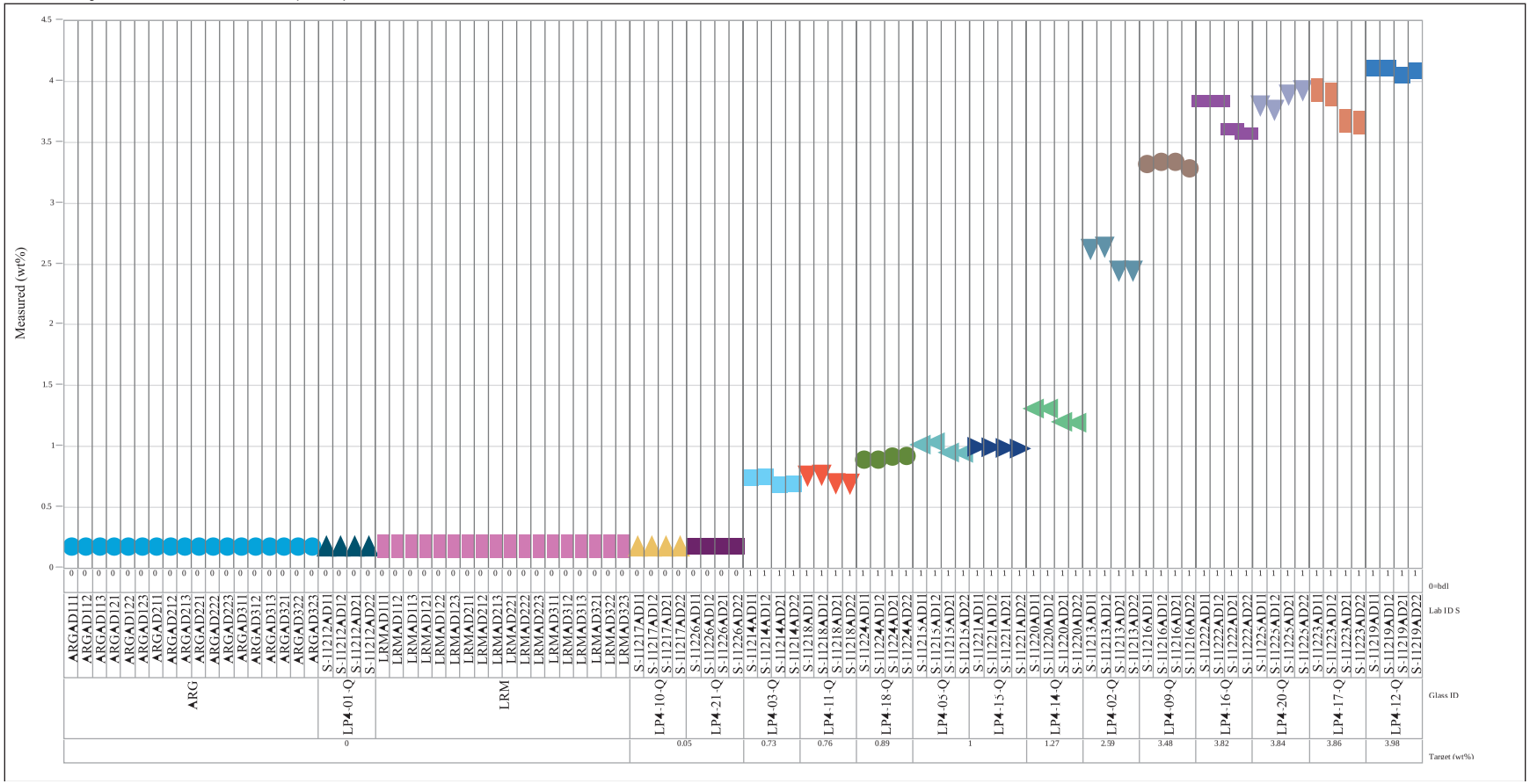


Exhibit A-2. Plots of Oxide Measurements by Set 1 Glass Identifier Grouped by Target Concentrations (continued)

Oxide=ZnO, Prep Method=AD
Variability Chart for Measured (wt%)

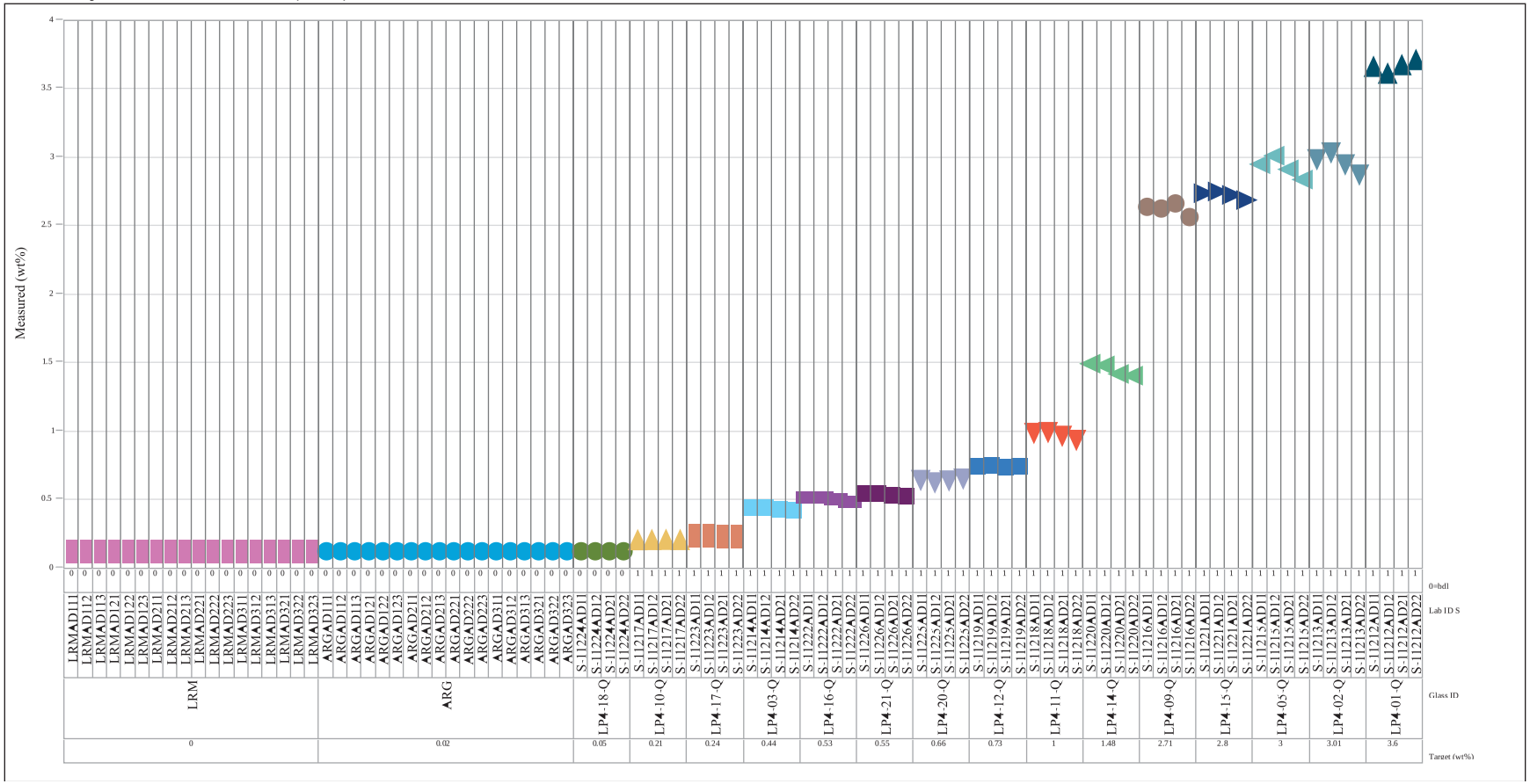


Exhibit A-2. Plots of Oxide Measurements by Set 1 Glass Identifier Grouped by Target Concentrations (continued)

Oxide=ZrO_2, Prep Method=AD
Variability Chart for Measured (wt%)

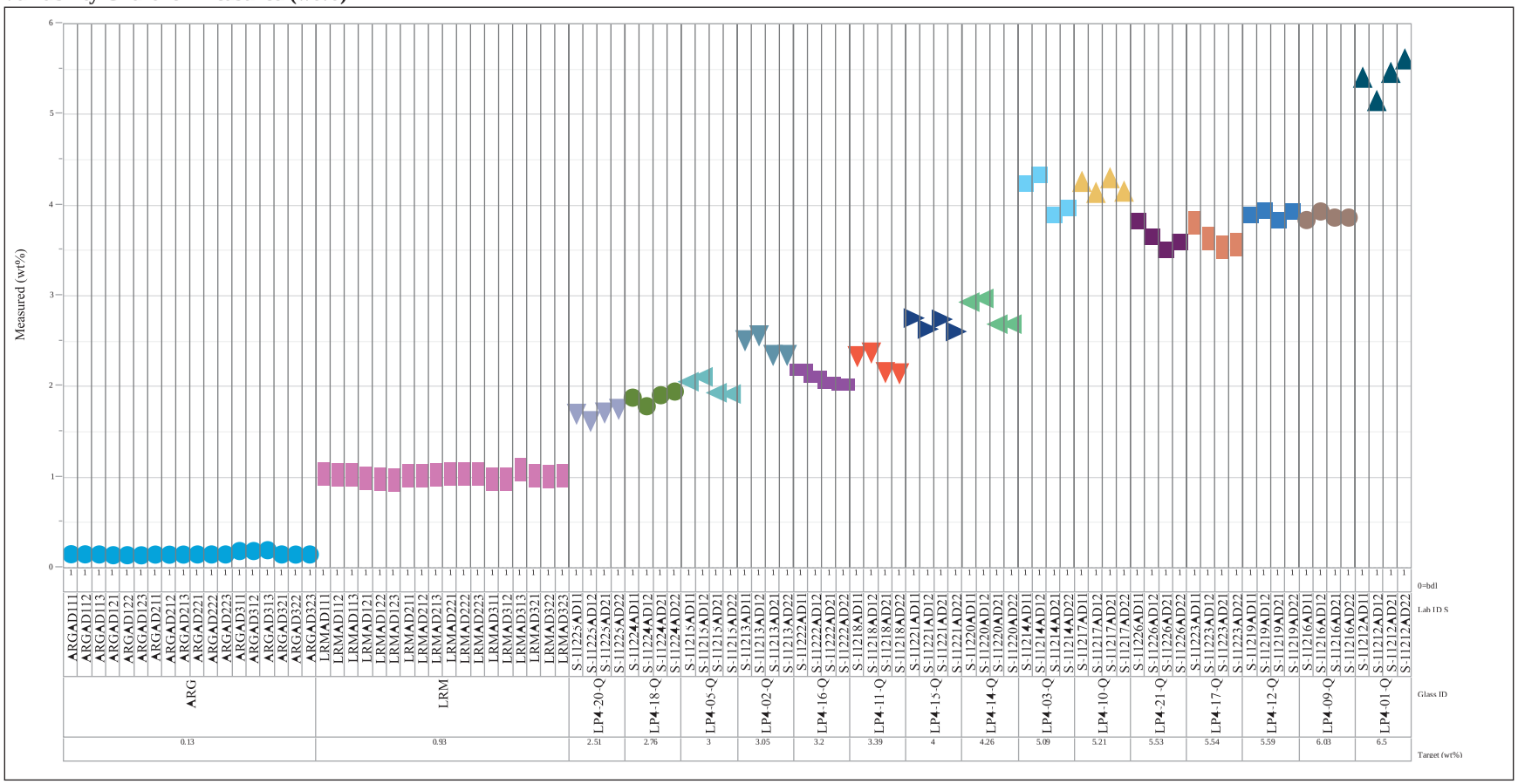
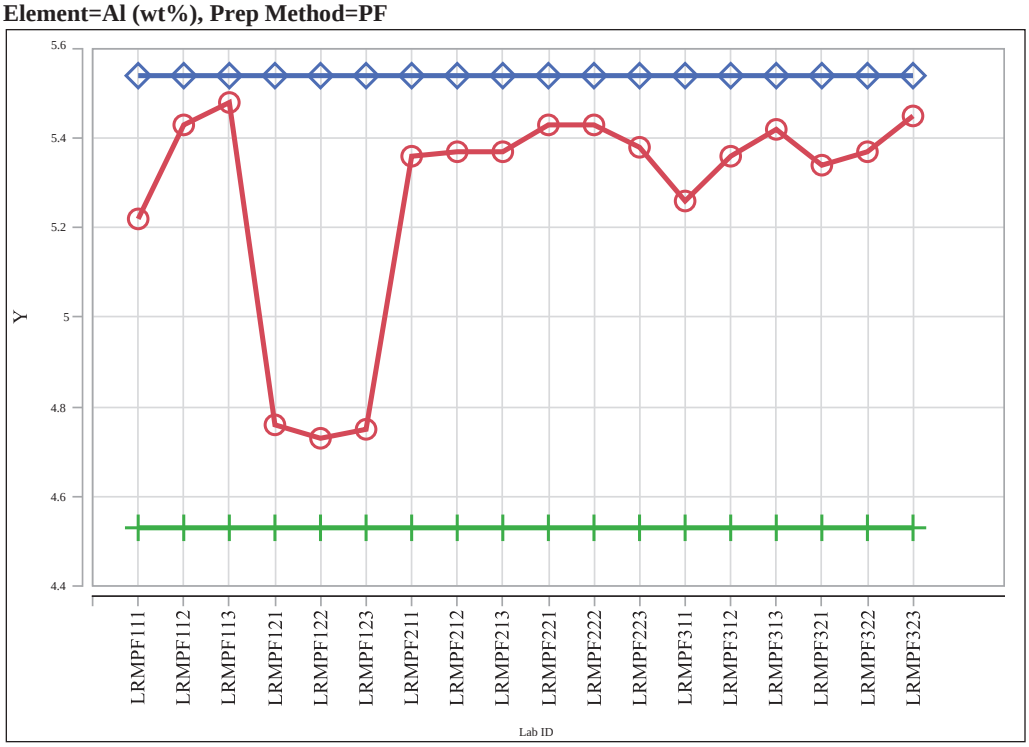
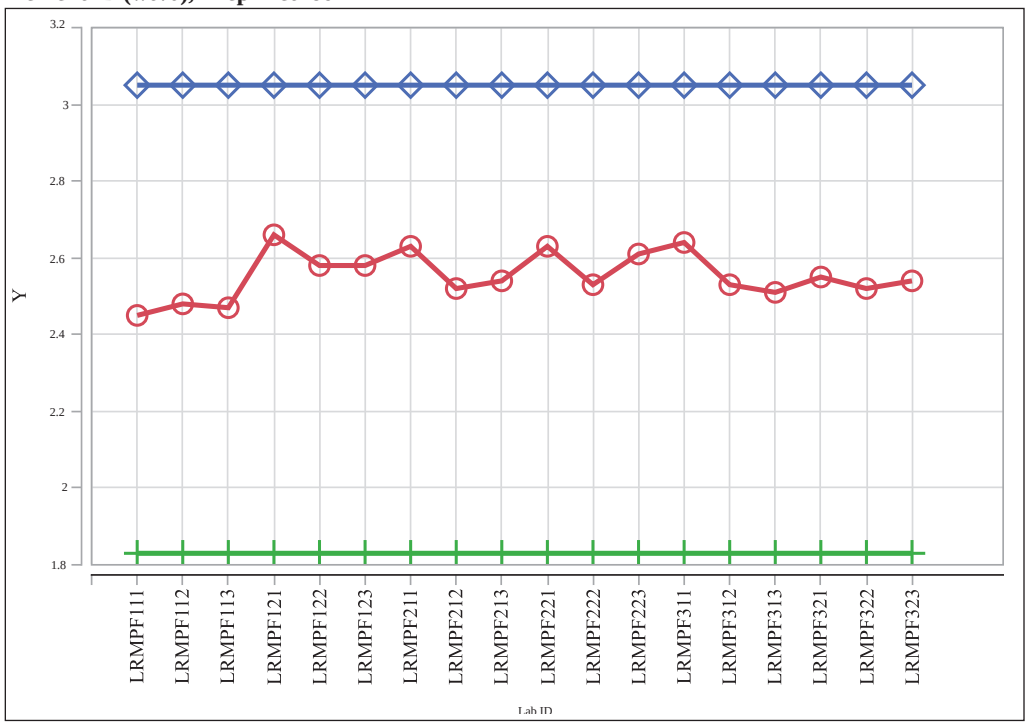


Exhibit A-3. Acceptability Evaluation for Measurements of the LRM Standard

Element=Al (wt%), Prep Method=PF



Element=B (wt%), Prep Method=PF



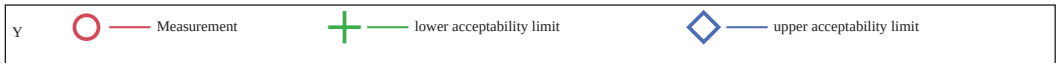
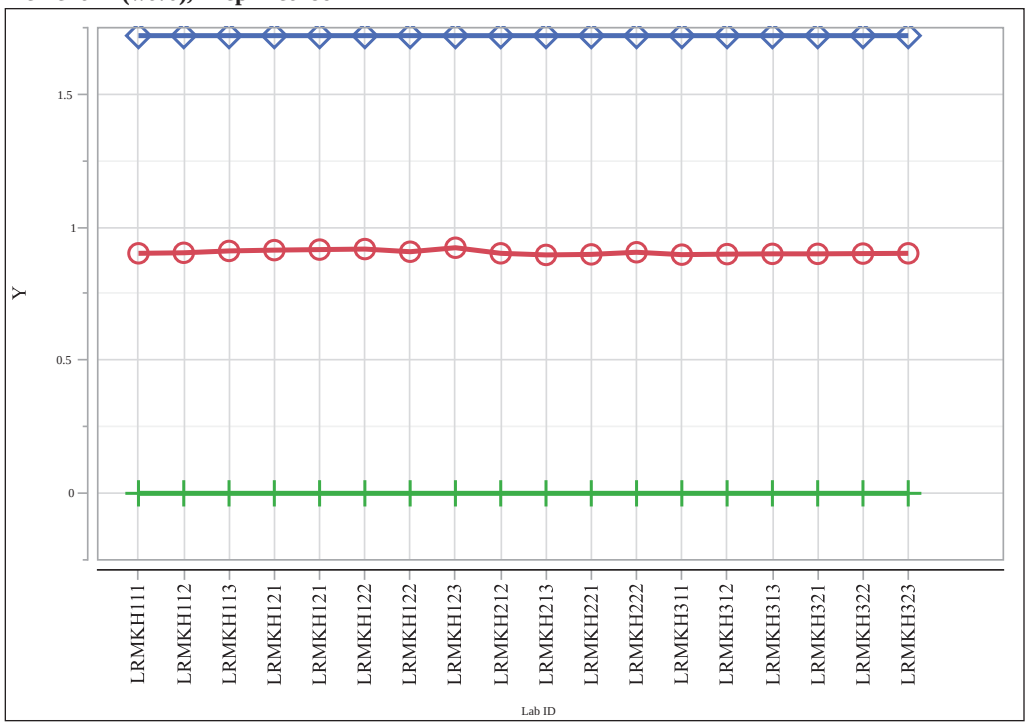
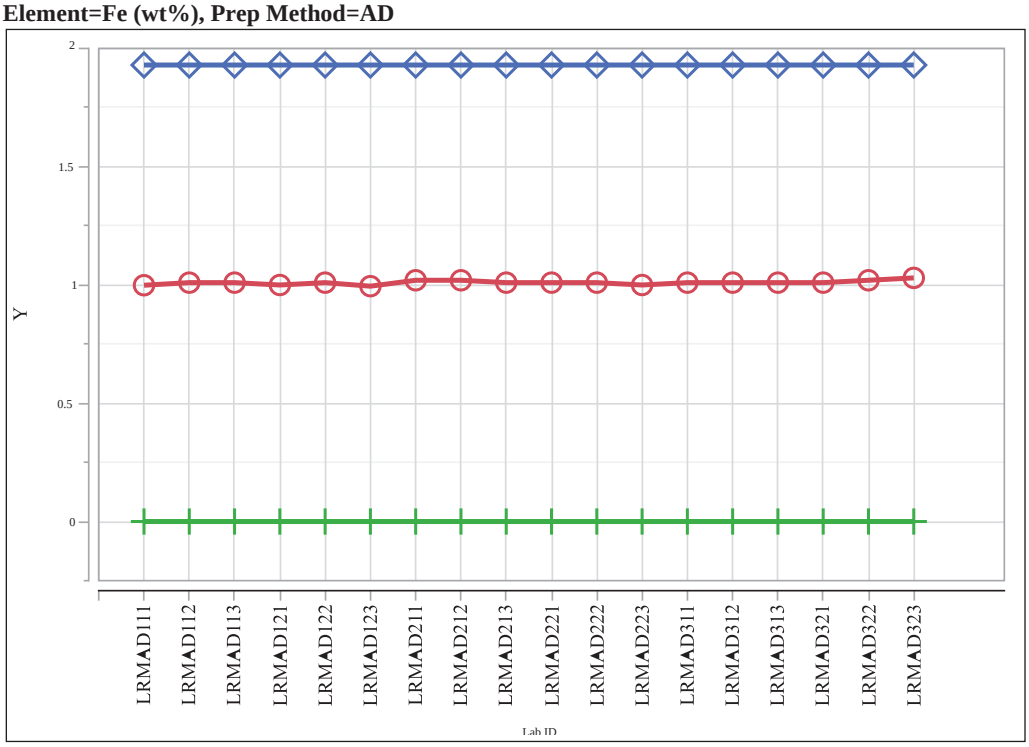


Exhibit A-3. Acceptability Evaluation for Measurements of the LRM Standard (continued)

Element=F (wt%), Prep Method=KH



Element=Fe (wt%), Prep Method=AD



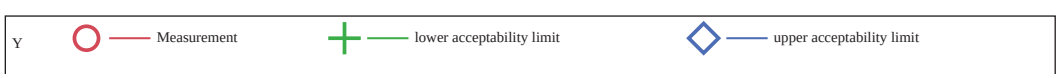
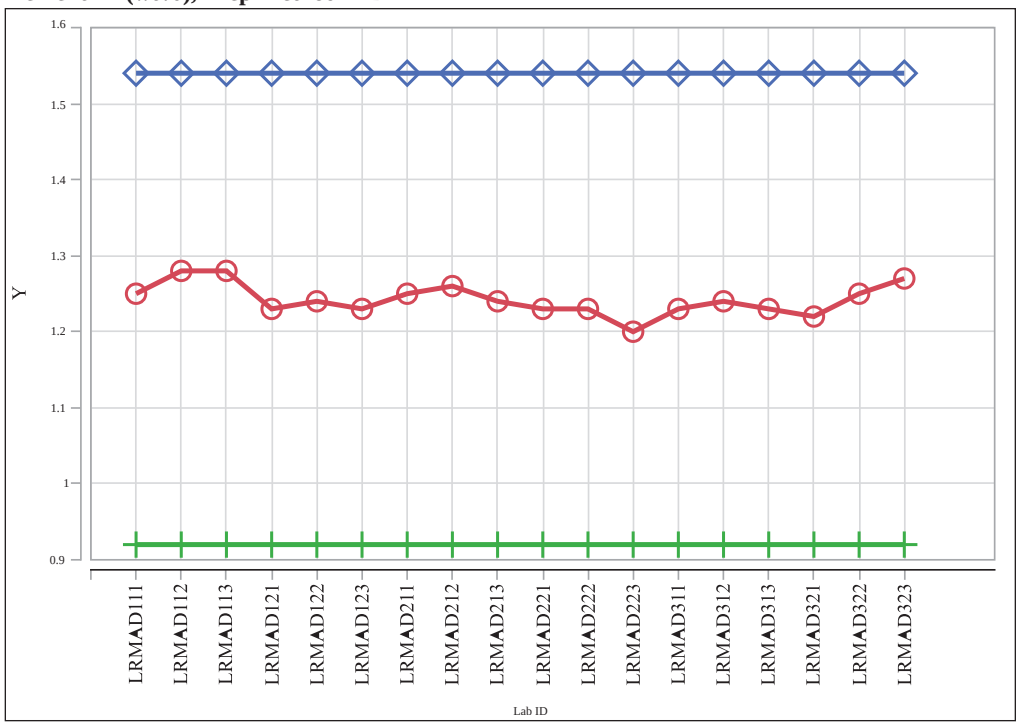
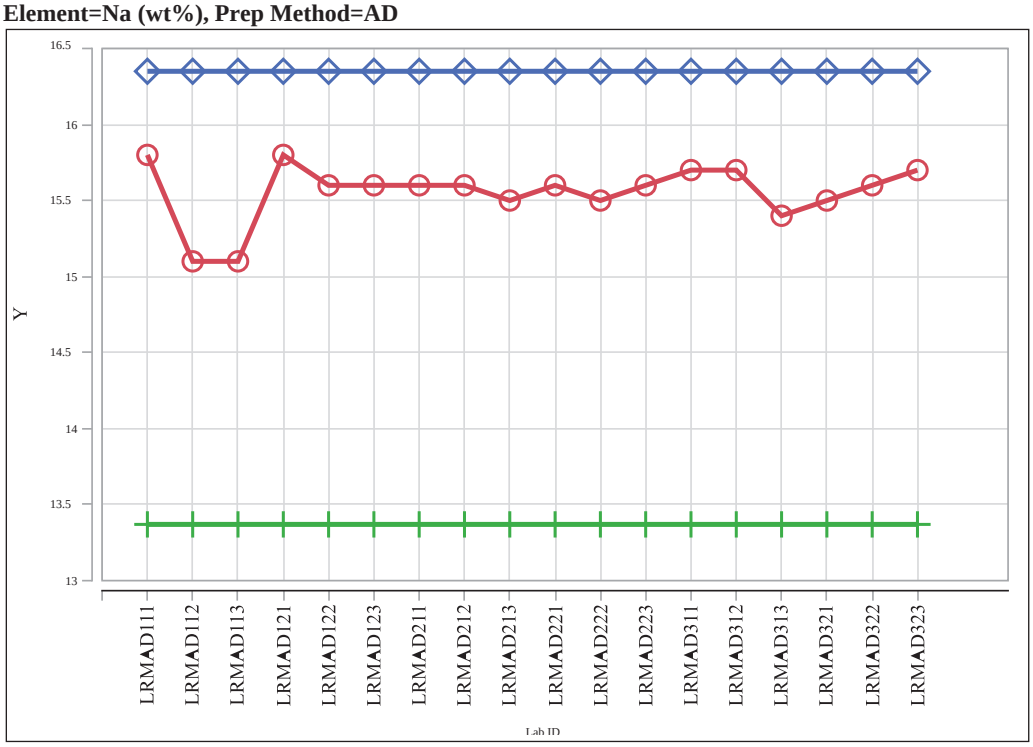


Exhibit A-3. Acceptability Evaluation for Measurements of the LRM Standard (continued)

Element=K (wt%), Prep Method=AD



Element=Na (wt%), Prep Method=AD



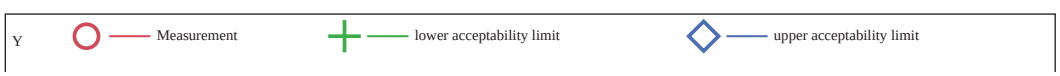
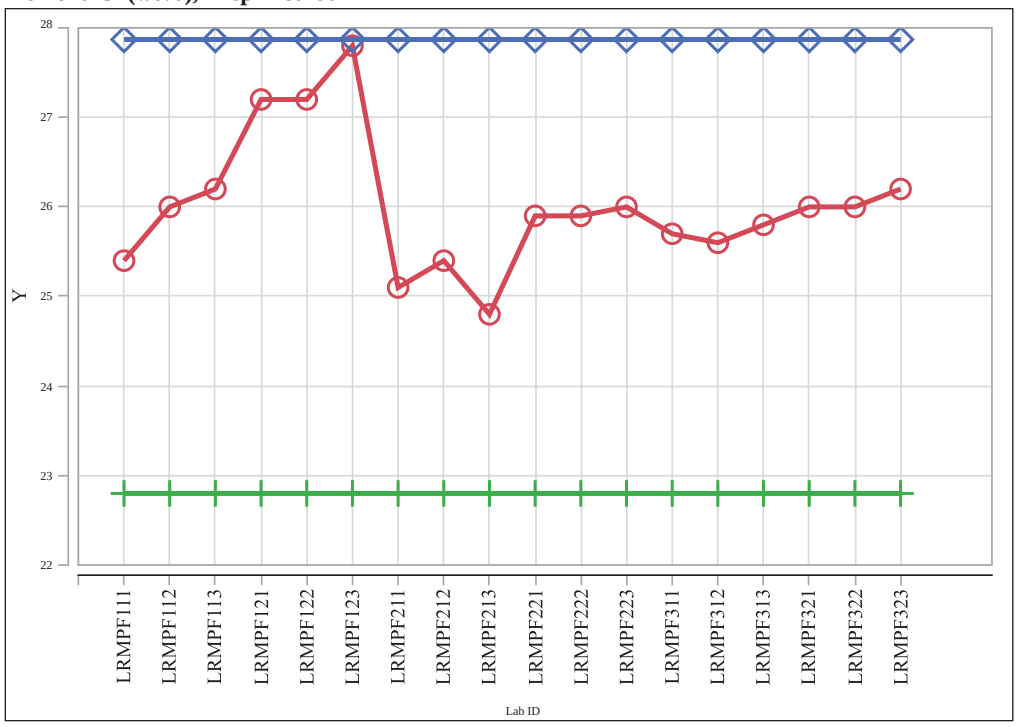
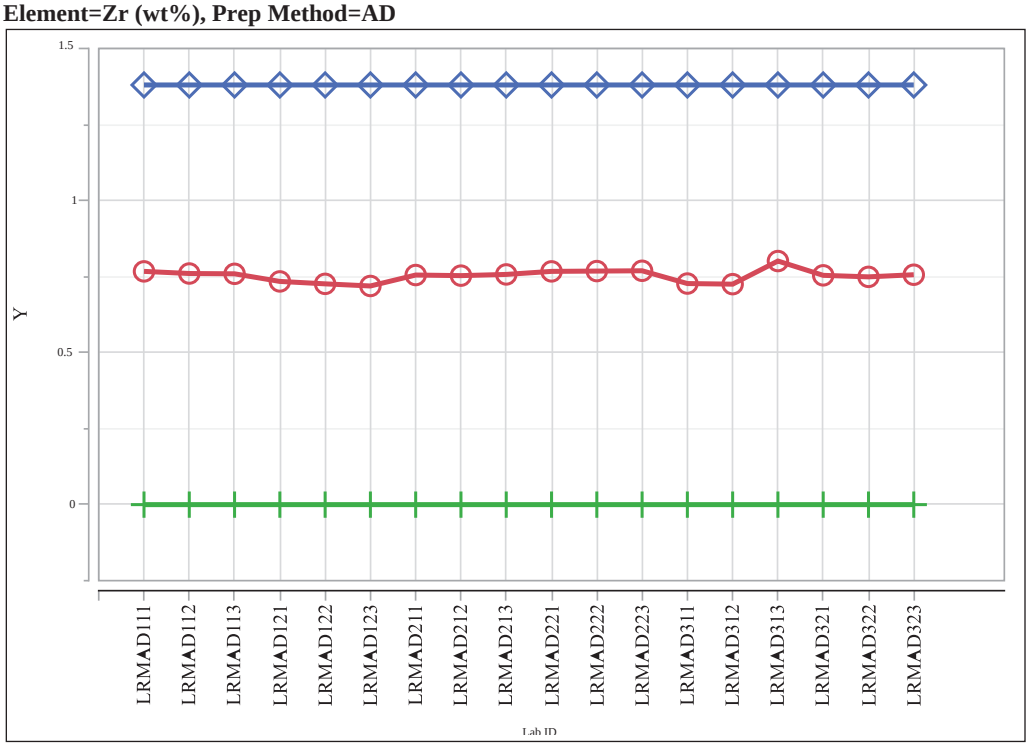


Exhibit A-3. Acceptability Evaluation for Measurements of the LRM Standard (continued)

Element=Si (wt%), Prep Method=PF



Element=Zr (wt%), Prep Method=AD



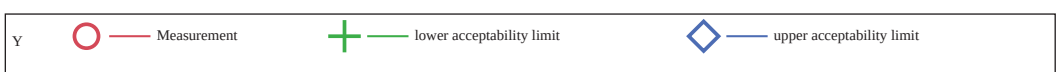
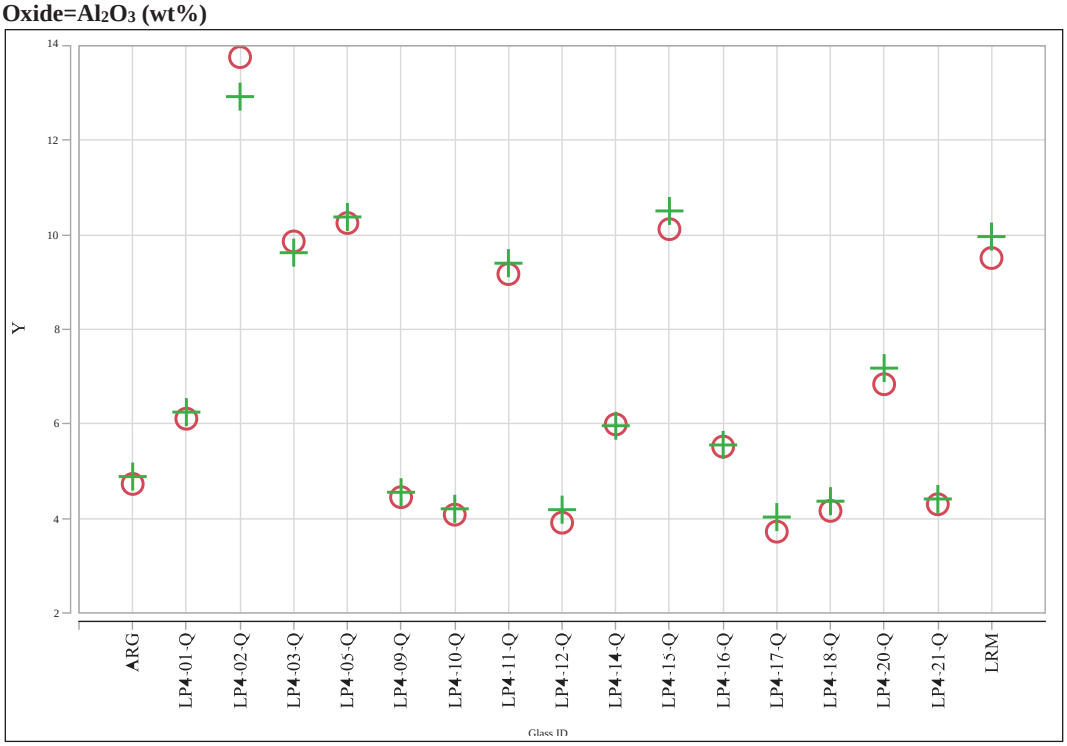


Exhibit A-4. Measured versus Targeted Concentrations by Set 1 Glass ID by Oxide

Oxide=Al_2O_3 (wt%)



Oxide=B_2O_3 (wt%)

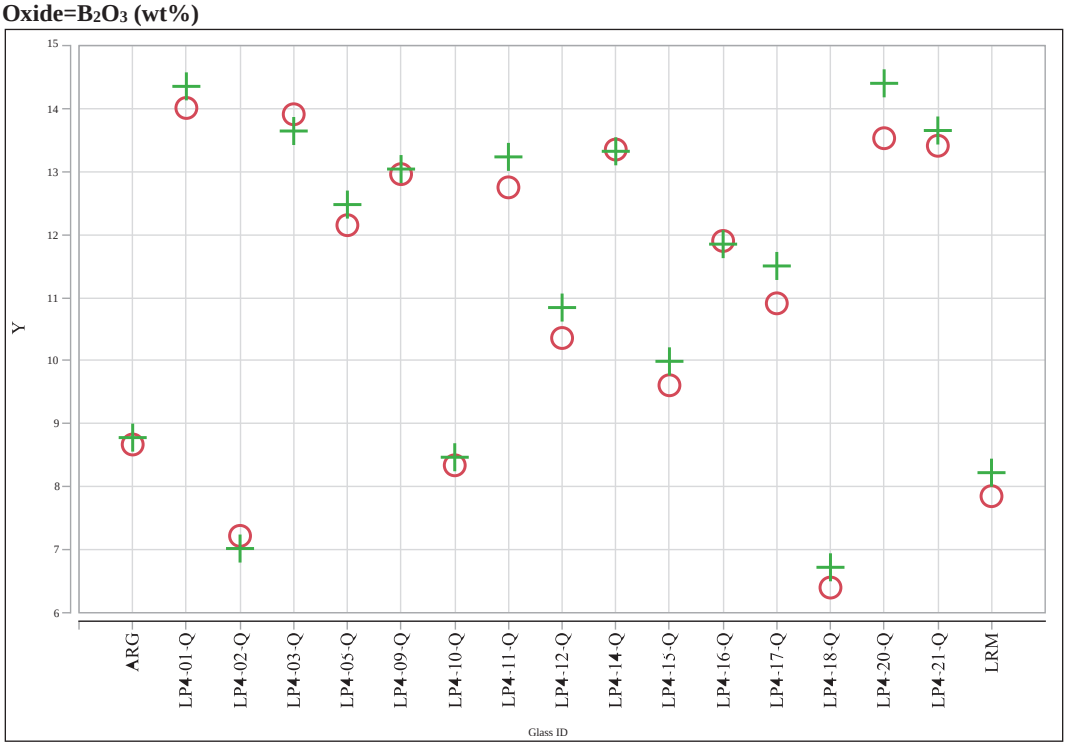
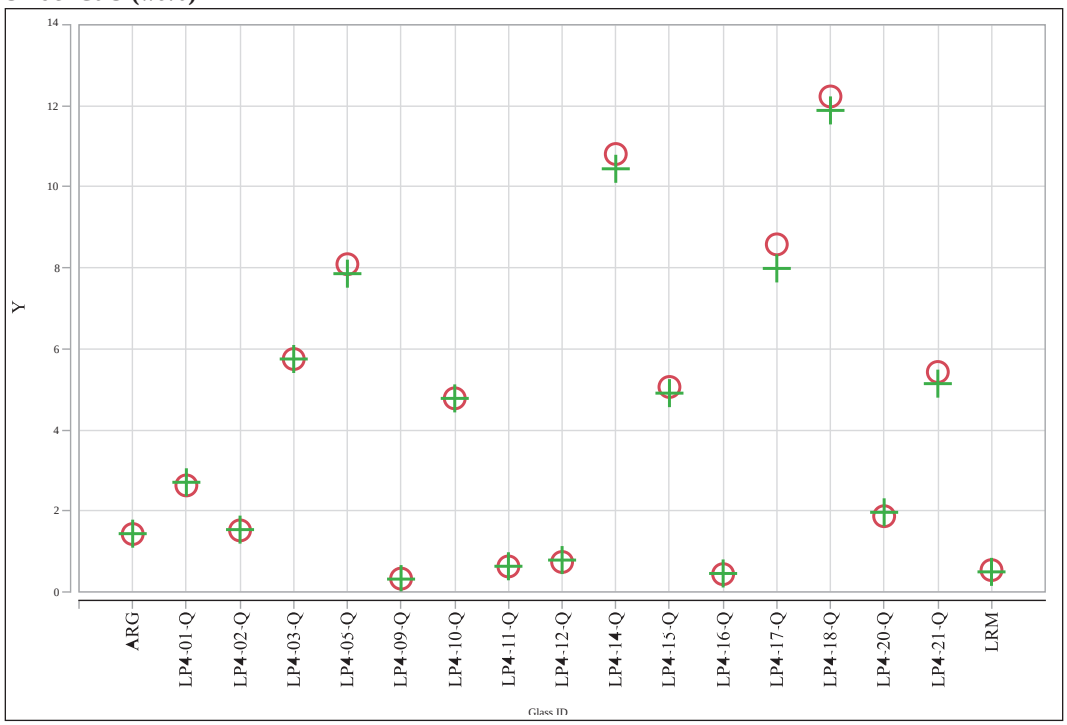
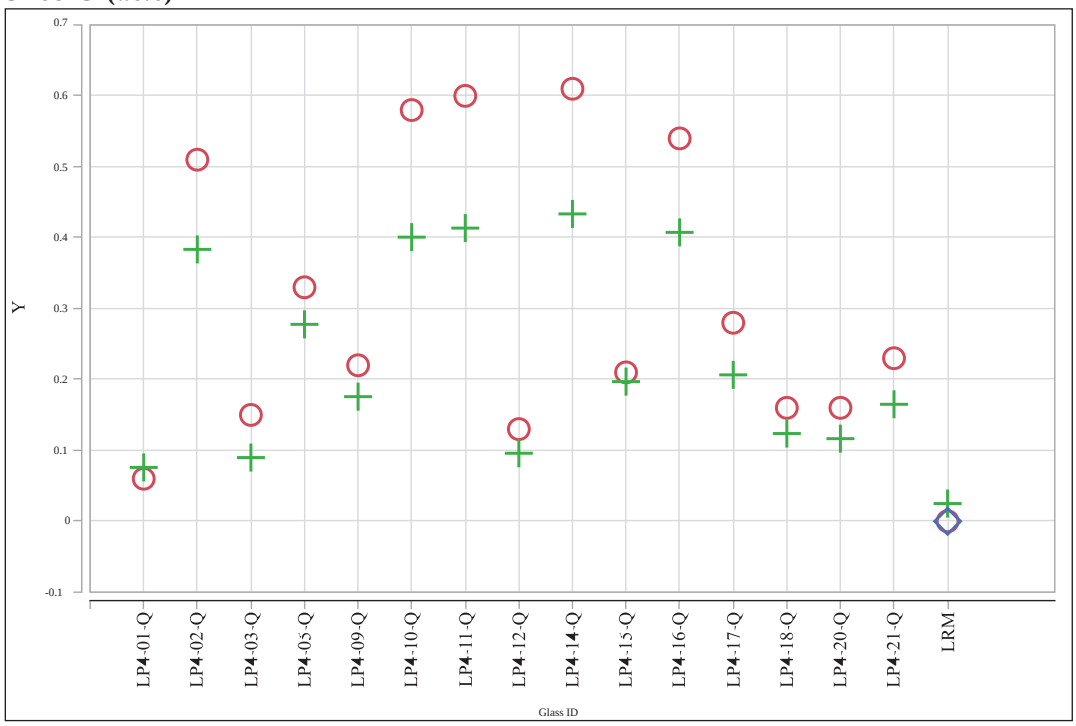


Exhibit A-4. Measured versus Targeted Concentrations by Set 1 Glass ID by Oxide (continued)

Oxide=CaO (wt%)



Oxide=Cl (wt%)



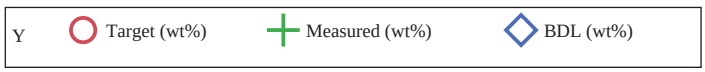
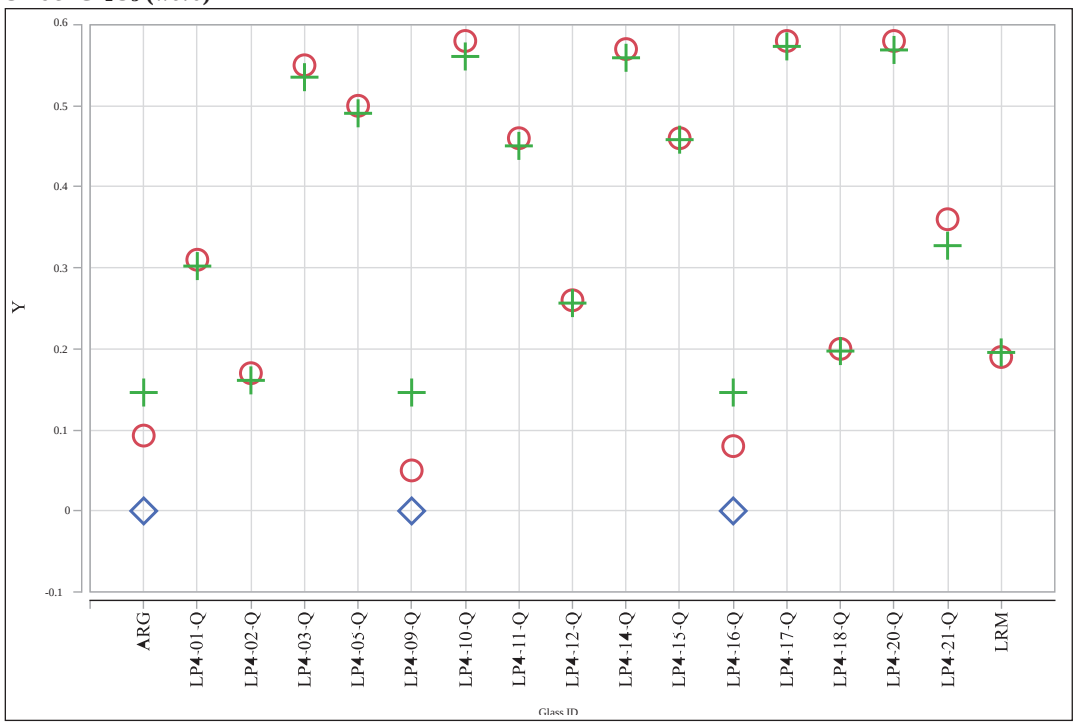
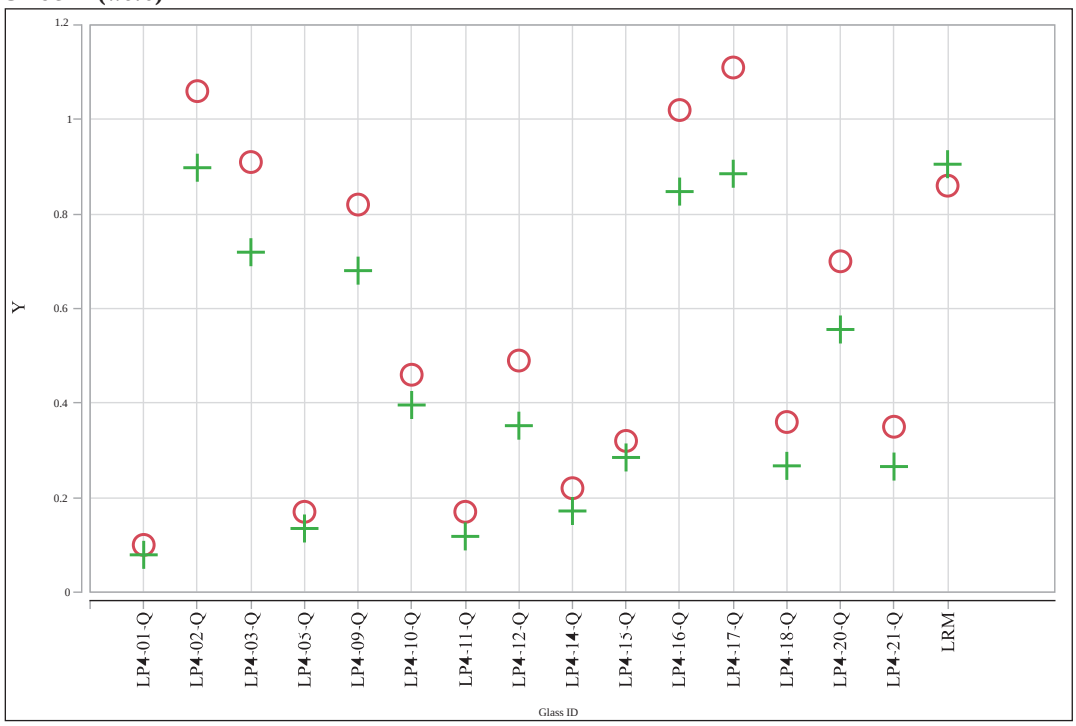


Exhibit A-4. Measured versus Targeted Concentrations by Set 1 Glass ID by Oxide (continued)

Oxide=Cr_2O_3 (wt%)



Oxide=F (wt%)



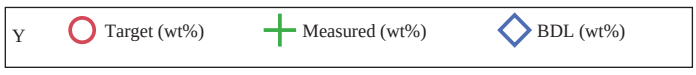
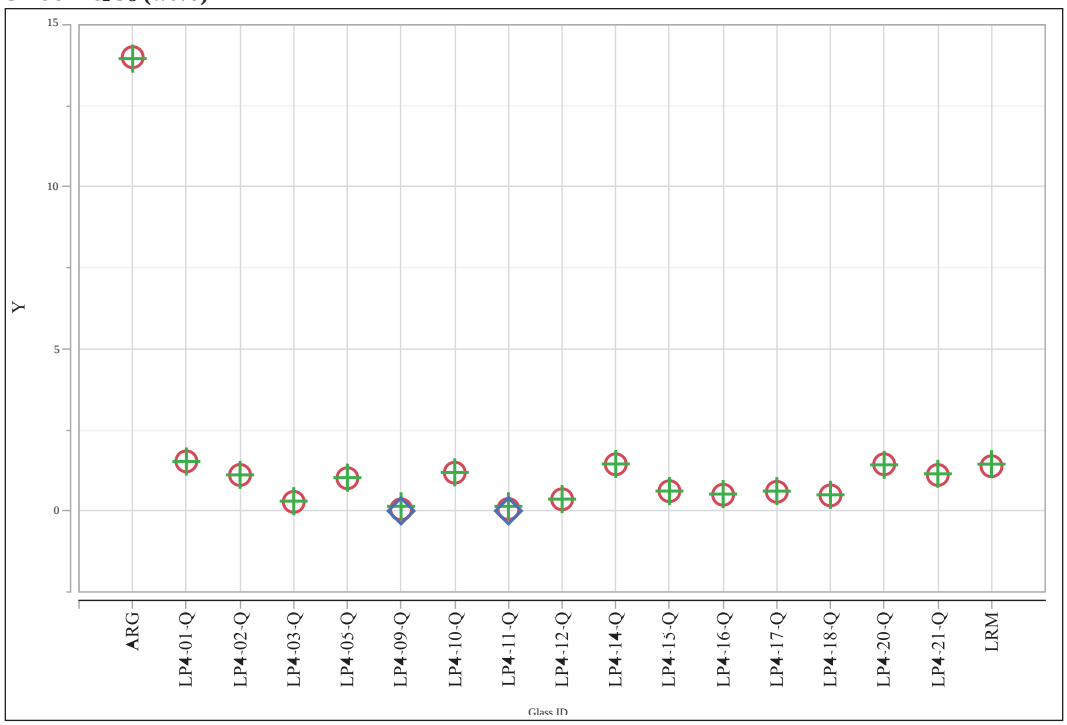


Exhibit A-4. Measured versus Targeted Concentrations by Set 1 Glass ID by Oxide (continued)

Oxide=Fe_2O_3 (wt%)



Oxide=K_2O (wt%)

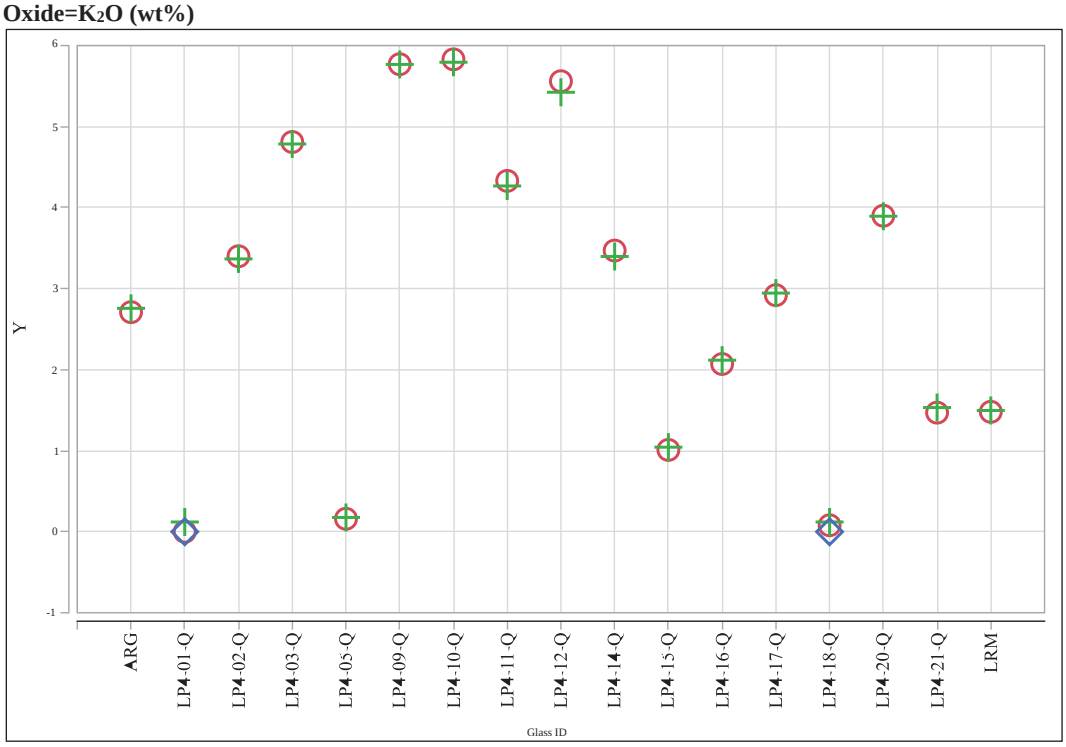
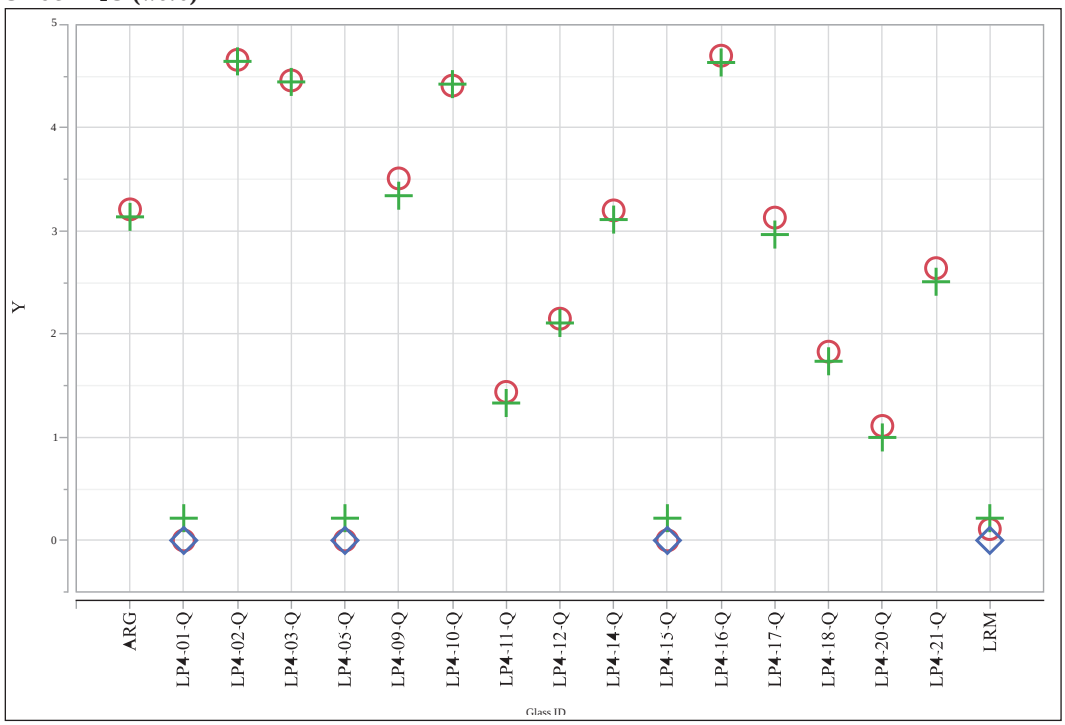
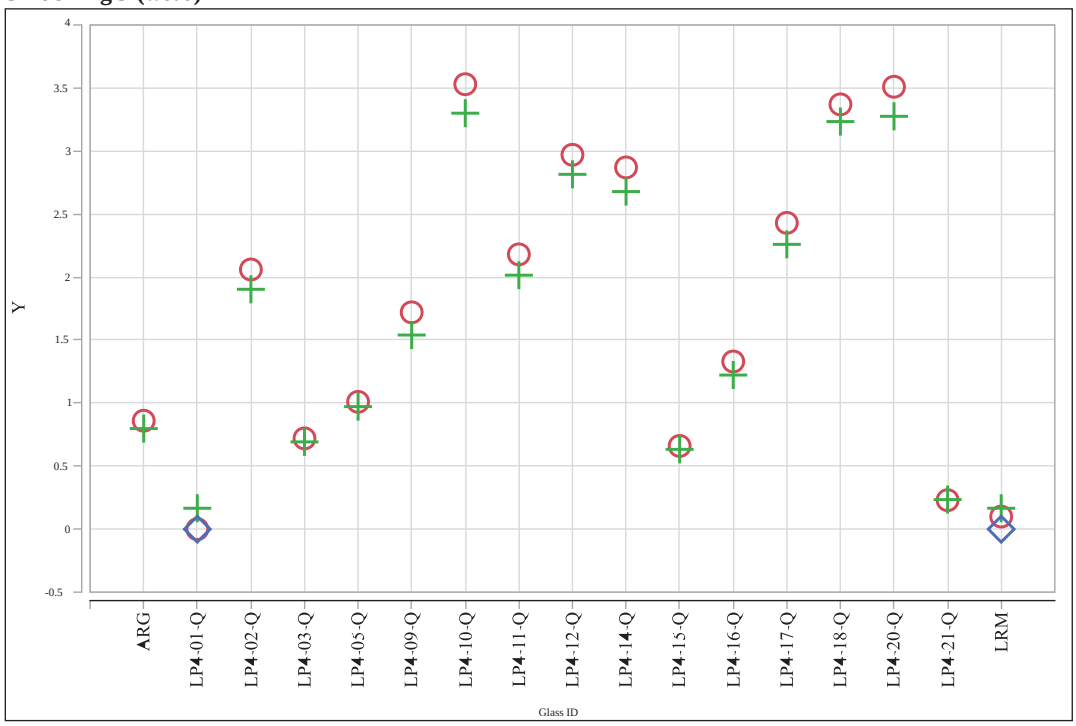


Exhibit A-4. Measured versus Targeted Concentrations by Set 1 Glass ID by Oxide (continued)

Oxide=Li_2O (wt%)



Oxide=MgO (wt%)



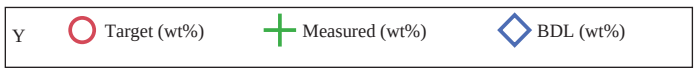
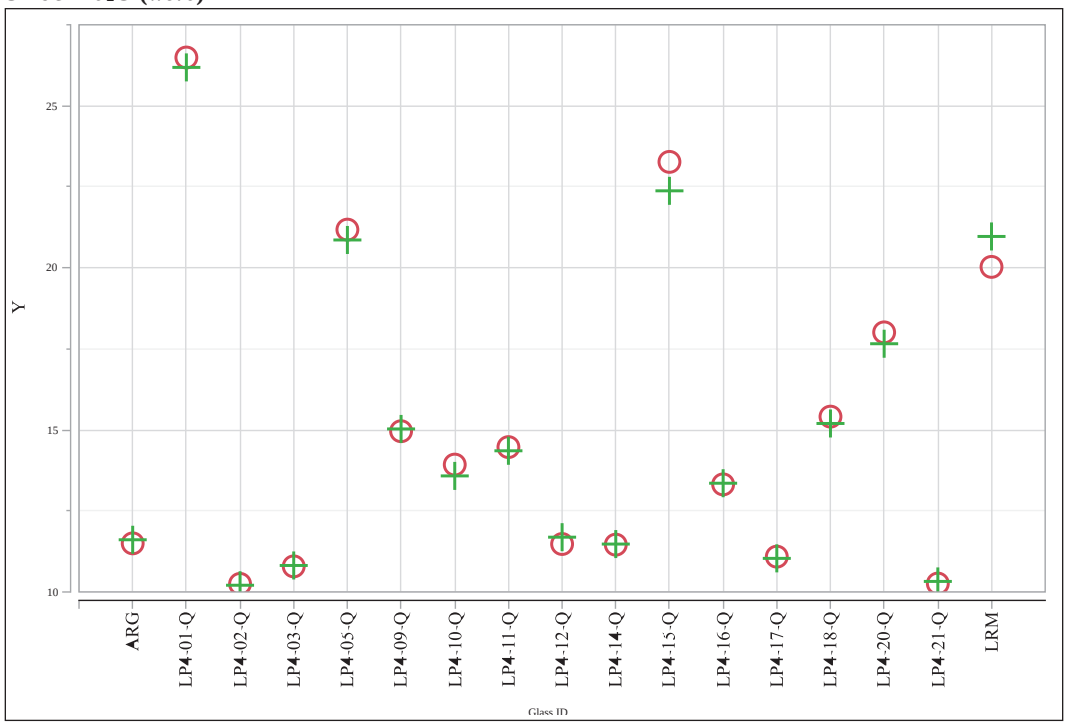
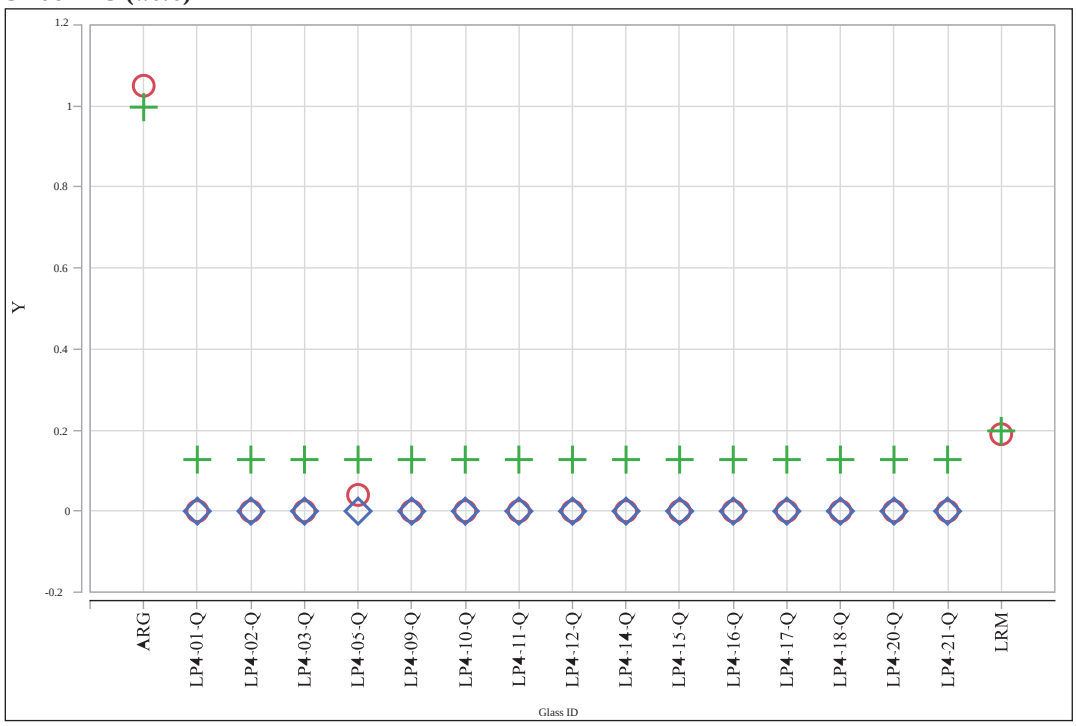


Exhibit A-4. Measured versus Targeted Concentrations by Set 1 Glass ID by Oxide (continued)

Oxide=Na_2O (wt%)



Oxide=NiO (wt%)



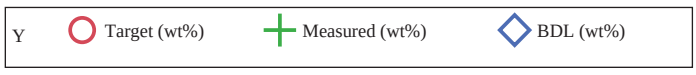
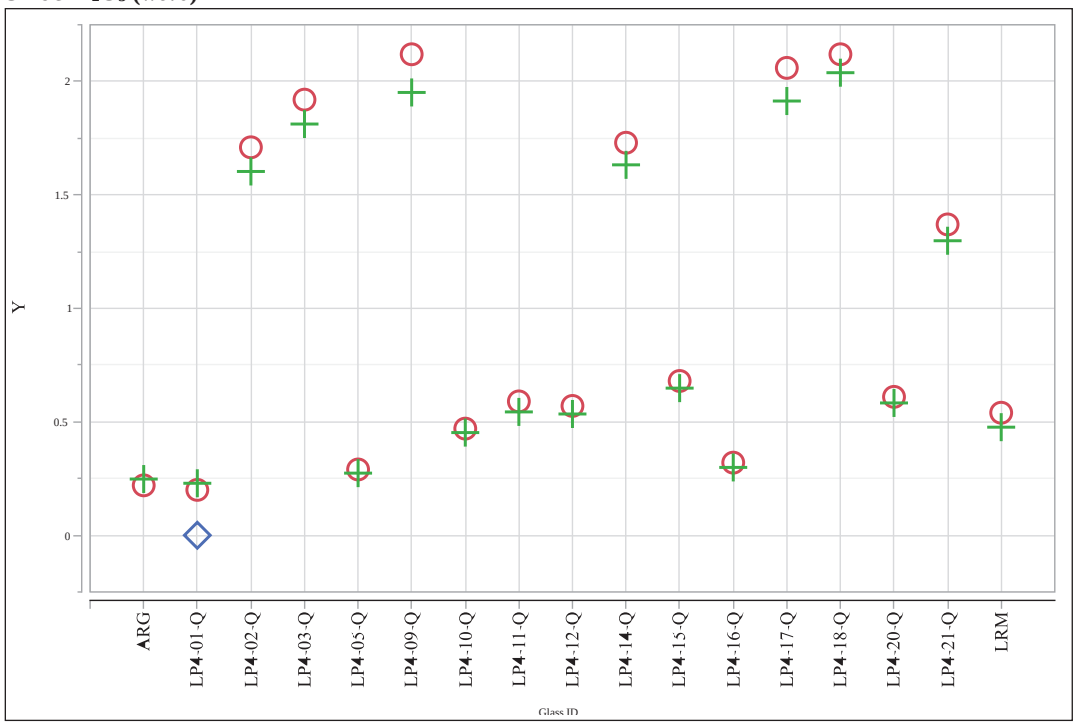
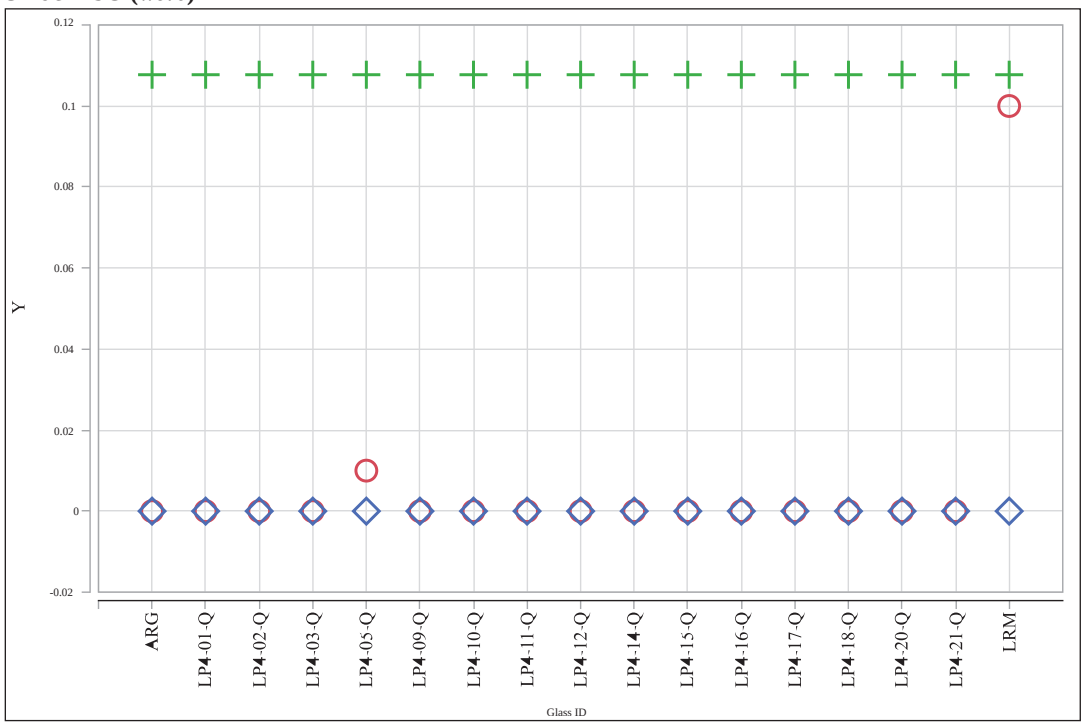


Exhibit A-4. Measured versus Targeted Concentrations by Set 1 Glass ID by Oxide (continued)

Oxide=P_2O_5 (wt%)



Oxide=PbO (wt%)



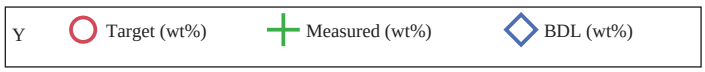
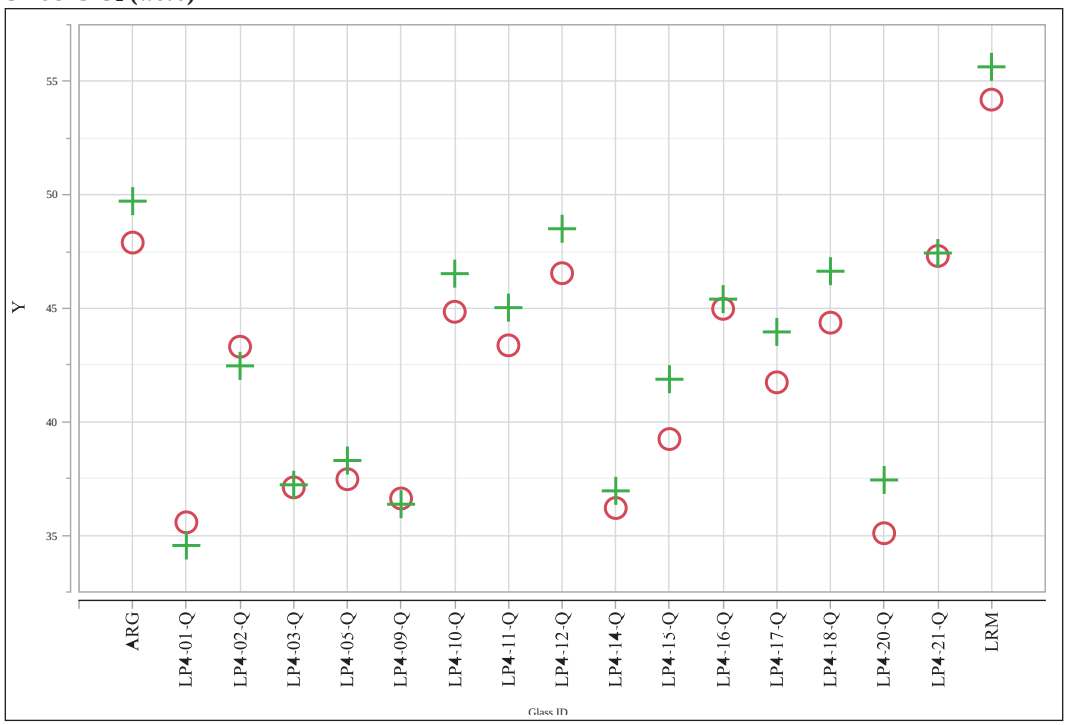
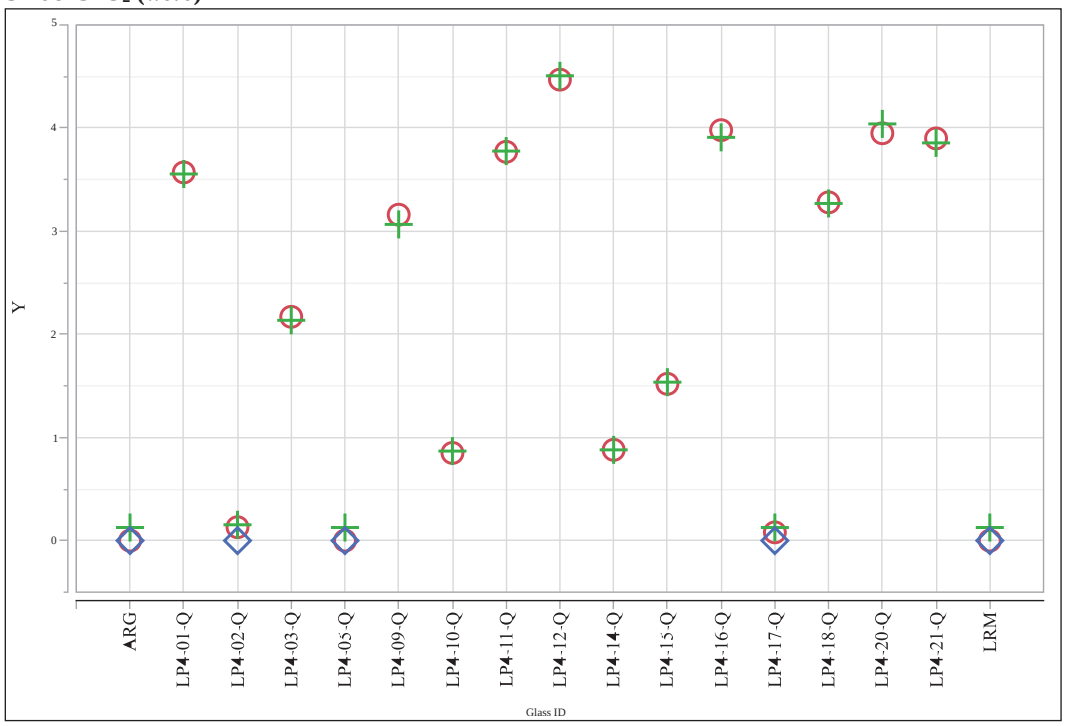


Exhibit A-4. Measured versus Targeted Concentrations by Set 1 Glass ID by Oxide (continued)

Oxide=SiO_2 (wt%)



Oxide=SnO_2 (wt%)



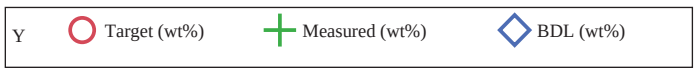
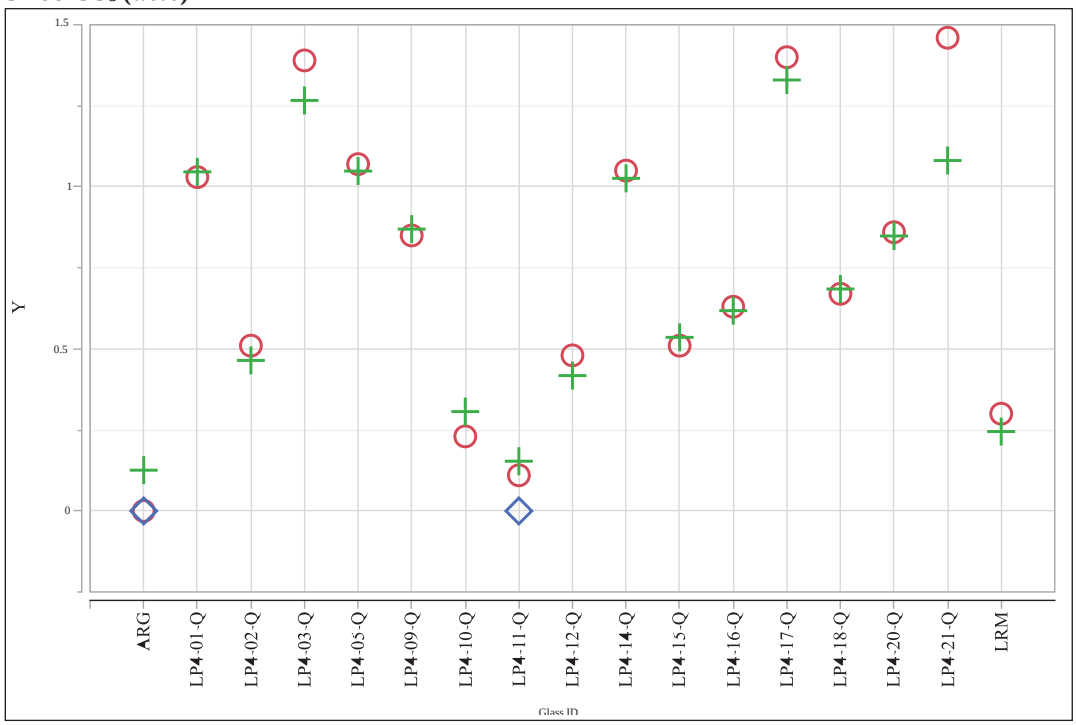
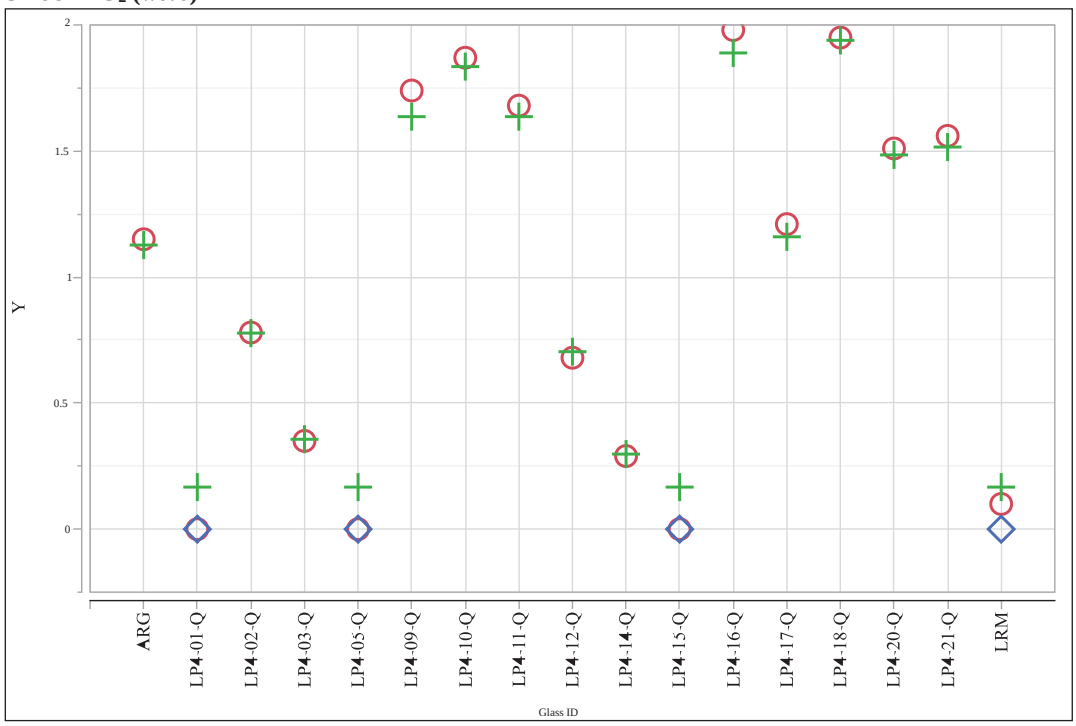


Exhibit A-4. Measured versus Targeted Concentrations by Set 1 Glass ID by Oxide (continued)

Oxide=SO_3 (wt%)



Oxide=TiO_2 (wt%)



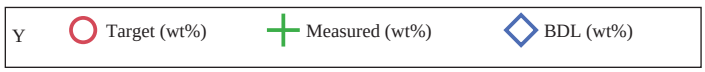
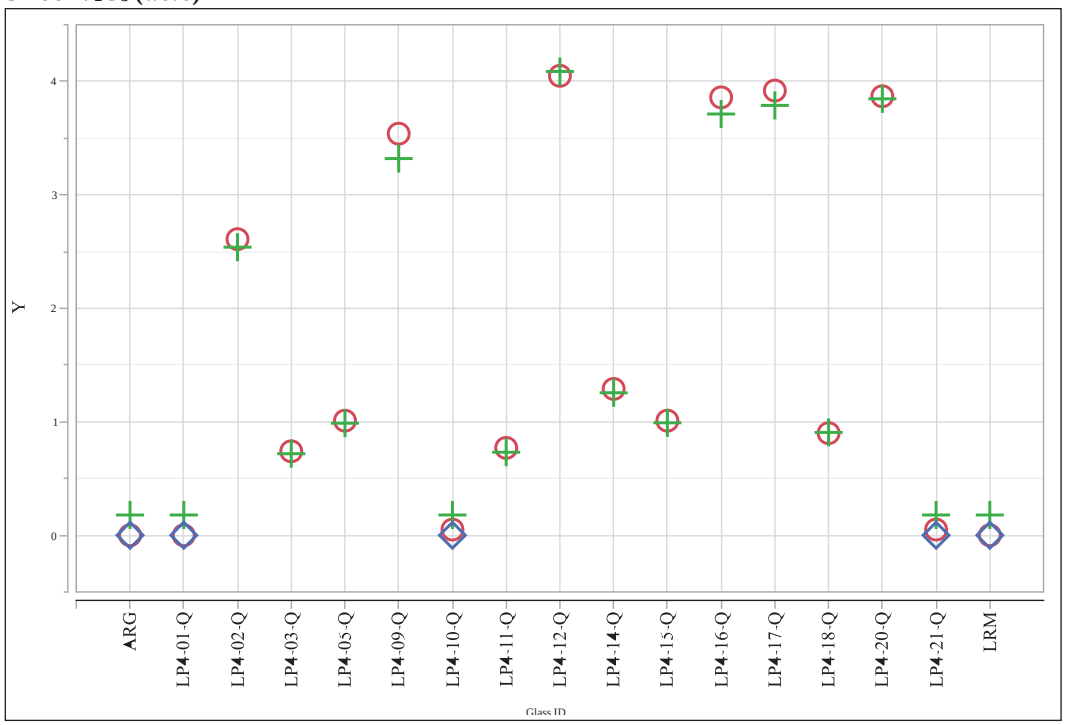
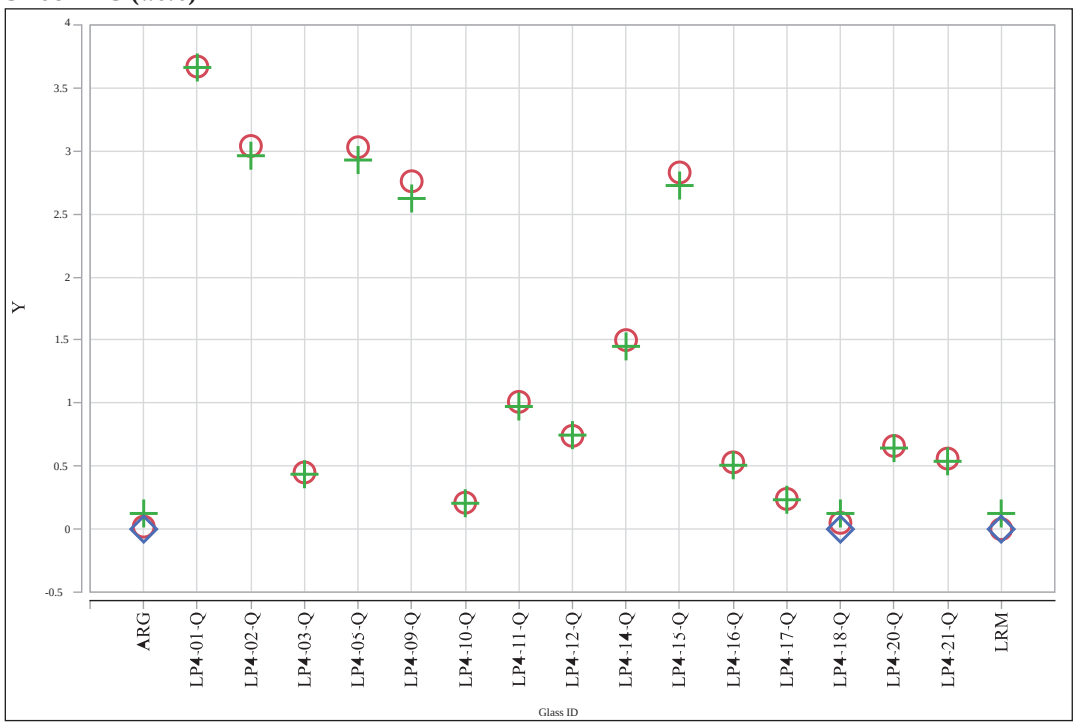


Exhibit A-4. Measured versus Targeted Concentrations by Set 1 Glass ID by Oxide (continued)

Oxide=V_2O_5 (wt%)



Oxide=ZnO (wt%)



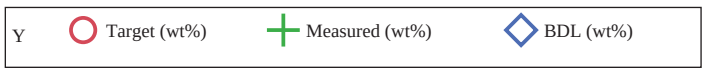
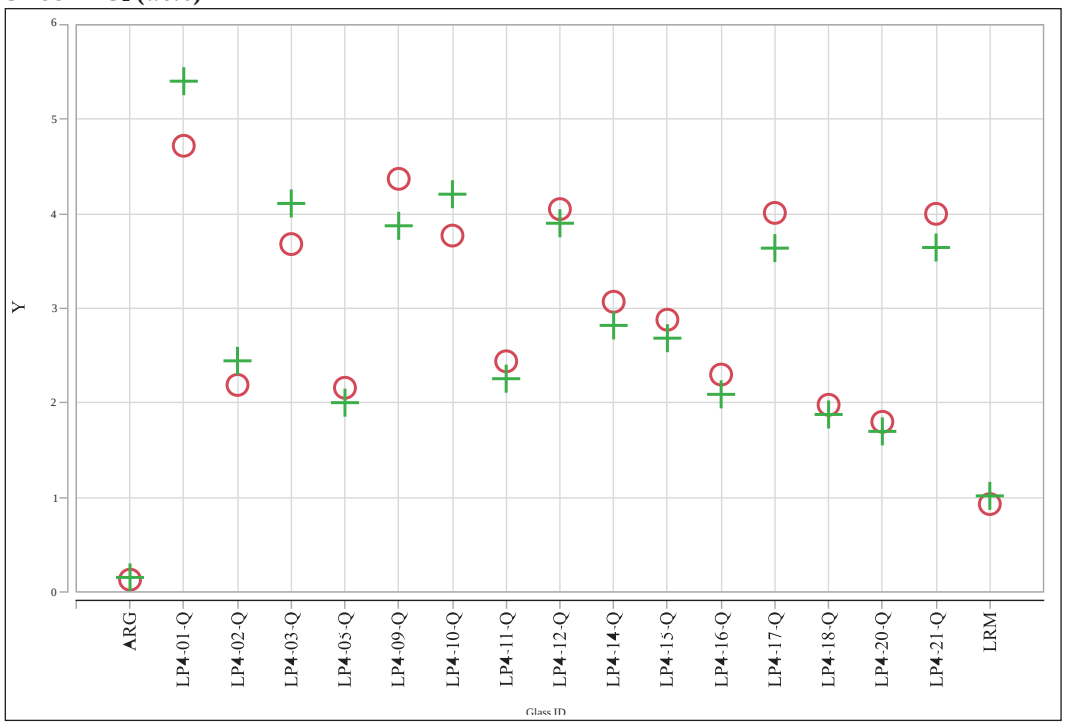
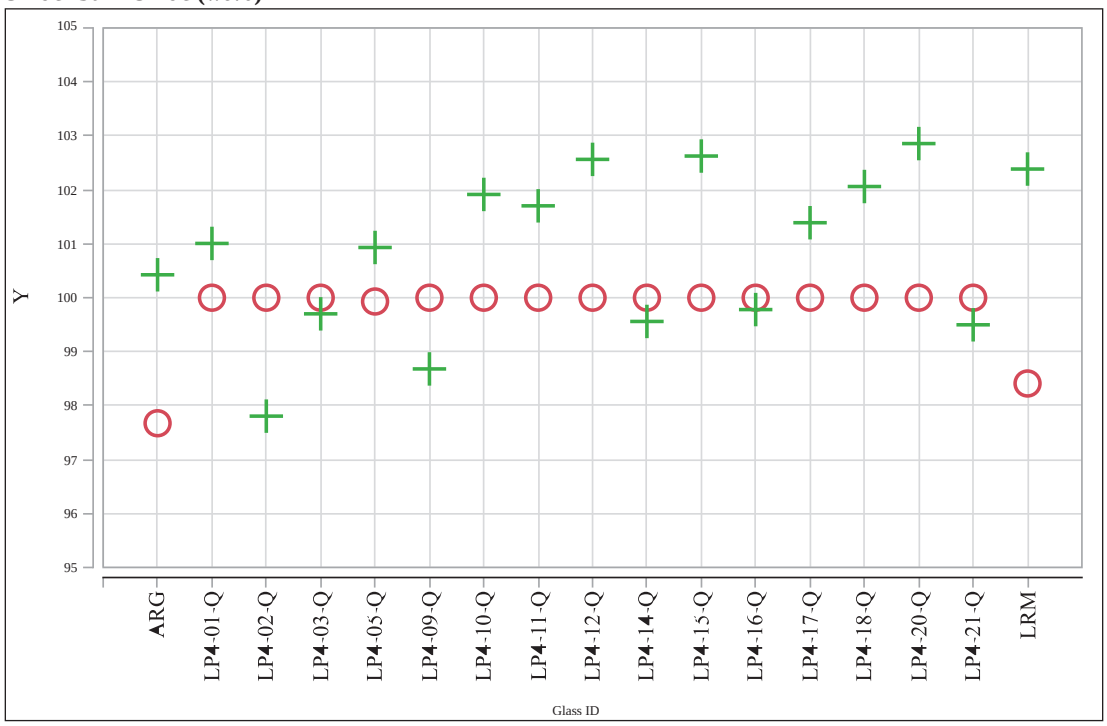


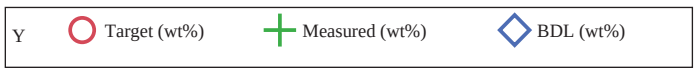
Exhibit A-4. Measured versus Targeted Concentrations by Set 1 Glass ID by Oxide (continued)

Oxide=ZrO_2 (wt%)



Oxide=Sum Oxide (wt%)





Appendix B. Tables and Exhibits Supporting the Set 2 Glass Composition Measurements

Table B-1. PF Measurements of the Set 2 Glasses

Glass ID	Block	Sub-Block	Seq	Lab ID	Al (wt%)	B (wt%)	Li (wt%)	Mg (wt%)	Si (wt%)	Sn (wt%)
LRM	1	1	1	LRMPF111	5.03	2.13	<0.100	<0.100	24.6	<0.100
ARG	1	1	2	ARGPF111	2.38	2.28	1.52	0.501	21.2	<0.100
LP4-23-1-Q	1	1	3	S-11259PF11	3.10	1.65	1.43	1.52	18.8	3.31
LP4-08-1-Q	1	1	4	S-11255PF21	5.61	1.51	1.51	0.444	17.8	1.89
LP4-04-1-Q	1	1	5	S-11252PF11	6.54	1.59	2.38	1.76	17.2	0.258
LP4-08-1-Q	1	1	6	S-11255PF11	5.49	1.51	1.48	0.446	18.1	1.87
LP4-04-1-Q	1	1	7	S-11252PF21	6.57	1.61	2.40	1.77	17.5	0.257
LRM	1	1	8	LRMPF112	5.11	2.07	<0.100	<0.100	24.6	<0.100
ARG	1	1	9	ARGPF112	2.41	2.29	1.52	0.500	21.4	<0.100
LP4-06-2-Q	1	1	10	S-11253PF21	6.62	3.26	0.648	1.86	17.2	2.79
LP4-06-2-Q	1	1	11	S-11253PF11	6.72	3.28	0.660	1.88	17.4	2.82
LP4-13-Q	1	1	12	S-11256PF11	1.96	2.94	1.22	0.505	16.1	1.56
LP4-23-1-Q	1	1	13	S-11259PF21	3.15	1.65	1.45	1.52	18.8	3.33
LP4-13-Q	1	1	14	S-11256PF21	2.02	3.02	1.26	0.513	16.3	1.61
LRM	1	1	15	LRMPF113	5.12	2.08	<0.100	<0.100	24.9	<0.100
ARG	1	1	16	ARGPF113	2.45	2.32	1.54	0.505	21.5	<0.100
LRM	1	2	1	LRMPF121	5.06	2.32	<0.100	<0.100	24.6	<0.100
ARG	1	2	2	ARGPF121	2.38	2.48	1.45	0.506	21.4	<0.100
LP4-08-1-Q	1	2	3	S-11255PF22	5.63	1.78	1.48	0.454	18.1	1.89
LP4-23-1-Q	1	2	4	S-11259PF22	3.07	1.86	1.37	1.52	18.7	3.28
LP4-06-2-Q	1	2	5	S-11253PF12	6.57	3.46	0.626	1.89	17.2	2.81
LP4-13-Q	1	2	6	S-11256PF22	1.94	3.10	1.17	0.508	15.9	1.58
LP4-08-1-Q	1	2	7	S-11255PF12	5.51	1.76	1.44	0.453	18.1	1.85
LRM	1	2	8	LRMPF122	5.10	2.30	<0.100	<0.100	24.8	<0.100
ARG	1	2	9	ARGPF122	2.41	2.52	1.47	0.510	21.4	<0.100
LP4-04-1-Q	1	2	10	S-11252PF12	6.64	1.88	2.36	1.80	17.7	0.260
LP4-23-1-Q	1	2	11	S-11259PF12	3.19	1.94	1.42	1.57	19.4	3.31
LP4-04-1-Q	1	2	12	S-11252PF22	6.67	1.88	2.37	1.82	17.8	0.251
LP4-13-Q	1	2	13	S-11256PF12	1.95	3.13	1.17	0.510	16.0	1.57
LP4-06-2-Q	1	2	14	S-11253PF22	6.59	3.40	0.623	1.88	17.1	2.79
LRM	1	2	15	LRMPF123	5.10	2.30	<0.100	<0.100	24.8	<0.100
ARG	1	2	16	ARGPF123	2.41	2.50	1.49	0.508	21.5	<0.100
LRM	2	1	1	LRMPF211	5.09	2.33	<0.100	<0.100	25.4	<0.100
ARG	2	1	2	ARGPF211	2.42	2.55	1.49	0.515	21.9	<0.100
LP4-19-Q	2	1	3	S-11257PF11	6.78	2.32	0.233	2.05	18.0	0.106
LP4-24-Q	2	1	4	S-11260PF11	7.01	2.94	1.41	1.45	16.3	0.206
LP4-25-1-Q	2	1	5	S-11261PF11	3.90	2.70	2.01	1.98	18.9	2.82
LP4-07-1-Q	2	1	6	S-11254PF21	4.76	2.18	0.582	1.87	16.3	3.14
LP4-24-Q	2	1	7	S-11260PF21	6.88	2.93	1.36	1.45	16.5	0.206
LRM	2	1	8	LRMPF212	5.18	2.34	<0.100	<0.100	25.5	<0.100
ARG	2	1	9	ARGPF212	2.44	2.54	1.49	0.515	22.3	<0.100
LP4-19-Q	2	1	10	S-11257PF21	6.65	2.28	0.227	2.02	17.7	0.124
LP4-07-1-Q	2	1	11	S-11254PF11	4.91	2.21	0.607	1.88	16.3	3.11
LP4-25-1-Q	2	1	12	S-11261PF21	3.91	2.63	2.05	1.92	18.7	2.76
LP4-22-Q	2	1	13	S-11258PF11	4.92	3.88	0.487	0.241	18.9	0.813
LP4-22-Q	2	1	14	S-11258PF21	4.92	3.86	0.488	0.237	18.7	0.806
LRM	2	1	15	LRMPF213	5.17	2.35	<0.100	<0.100	25.5	<0.100
ARG	2	1	16	ARGPF213	2.47	2.56	1.50	0.516	22.5	<0.100
LRM	2	2	1	LRMPF221	5.06	2.33	<0.100	<0.100	24.8	<0.100
ARG	2	2	2	ARGPF221	2.40	2.52	1.50	0.508	21.7	<0.100
LP4-07-1-Q	2	2	3	S-11254PF12	4.76	2.19	0.602	1.88	16.0	3.14
LP4-19-Q	2	2	4	S-11257PF22	6.43	2.24	0.231	2.02	17.3	0.102
LP4-19-Q	2	2	5	S-11257PF12	6.56	2.26	0.235	2.03	17.3	0.113
LP4-24-Q	2	2	6	S-11260PF12	6.82	2.87	1.41	1.44	16.1	0.191
LP4-25-1-Q	2	2	7	S-11261PF22	3.85	2.60	2.07	1.93	18.2	2.79

Table B-1. PF Measurements of the Set 2 Glasses (continued)

ID	Block	Sub-Blk	Seq	Lab ID	Al (wt%)	B (wt%)	Li (wt%)	Mg (wt%)	Si (wt%)	Sn (wt%)
LRM	2	2	8	LRMPF222	5.09	2.31	<0.100	<0.100	24.9	<0.100
ARG	2	2	9	ARGPF222	2.39	2.51	1.49	0.505	21.7	<0.100
LP4-25-1-Q	2	2	10	S-11261PF12	3.77	2.63	2.01	1.96	18.4	2.83
LP4-07-1-Q	2	2	11	S-11254PF22	4.63	2.15	0.577	1.87	15.8	3.05
LP4-22-Q	2	2	12	S-11258PF12	4.86	3.82	0.498	0.232	18.6	0.796
LP4-24-Q	2	2	13	S-11260PF22	6.74	2.89	1.38	1.45	16.2	0.199
LP4-22-Q	2	2	14	S-11258PF22	4.83	3.72	0.504	0.227	18.3	0.819
LRM	2	2	15	LRMPF223	5.10	2.31	<0.100	<0.100	25.1	<0.100
ARG	2	2	16	ARGPF223	2.41	2.52	1.51	0.507	21.8	<0.100

Table B-2. AD Measurements of the Set 2 Glasses

ID	Block	Sub-Blk	Seq	Lab ID	Ca (wt%)	Cr (wt%)	Fe (wt%)	K (wt%)	Na (wt%)	Ni (wt%)	P (wt%)	Pb (wt%)	S (wt%)	Ti (wt%)	V (wt%)	Zn (wt%)	Zr (wt%)
LRM	1	1	1	LRMAD111	0.336	0.128	0.943	1.22	15.1	0.125	0.203	<0.100	0.106	<0.100	<0.100	<0.100	0.714
ARG	1	1	2	ARGAD111	0.950	<0.100	9.02	2.24	9.05	0.769	0.106	<0.100	0.0636	0.659	<0.100	<0.100	0.100
LP4-19-Q	1	1	3	S-11257AD21	1.98	0.276	0.490	2.70	13.6	<0.100	0.576	<0.100	0.233	0.962	0.538	0.351	3.15
LP4-04-1-Q	1	1	4	S-11252AD11	4.71	<0.100	0.119	4.27	7.90	<0.100	0.247	<0.100	0.329	1.08	1.49	<0.100	2.26
LP4-19-Q	1	1	5	S-11257AD11	2.02	0.279	0.498	2.75	13.3	<0.100	0.588	<0.100	0.245	0.978	0.547	0.355	3.20
LP4-08-1-Q	1	1	6	S-11255AD11	0.814	0.282	0.989	4.29	12.6	<0.100	0.769	<0.100	0.258	1.22	1.20	2.25	1.40
LP4-24-Q	1	1	7	S-11260AD11	1.59	0.170	0.623	3.89	12.8	<0.100	0.360	<0.100	0.138	1.09	1.02	2.68	2.13
LRM	1	1	8	LRMAD112	0.344	0.130	0.954	1.23	15.2	0.125	0.210	<0.100	0.0919	<0.100	<0.100	<0.100	0.725
ARG	1	1	9	ARGAD112	0.965	<0.100	9.07	2.29	8.96	0.767	0.106	<0.100	0.0573	0.664	<0.100	<0.100	0.100
LP4-06-2-Q	1	1	10	S-11253AD21	0.188	<0.100	0.480	4.12	10.4	<0.100	0.326	<0.100	0.0719	0.284	1.79	2.44	1.35
LP4-04-1-Q	1	1	11	S-11252AD21	4.65	<0.100	0.117	4.42	8.46	<0.100	0.254	<0.100	0.329	1.06	1.47	<0.100	2.23
LP4-08-1-Q	1	1	12	S-11255AD21	0.798	0.268	0.975	4.26	12.7	<0.100	0.755	<0.100	0.248	1.20	1.19	2.23	1.37
LP4-24-Q	1	1	13	S-11260AD21	1.57	0.165	0.621	3.85	12.8	<0.100	0.364	<0.100	0.134	1.08	1.01	2.69	2.11
LP4-06-2-Q	1	1	14	S-11253AD11	0.190	<0.100	0.483	4.06	10.1	<0.100	0.328	<0.100	0.0880	0.287	1.81	2.48	1.36
LRM	1	1	15	LRMAD113	0.342	0.130	0.951	1.20	15.1	0.125	0.205	<0.100	0.105	<0.100	<0.100	<0.100	0.721
ARG	1	1	16	ARGAD113	0.971	<0.100	9.10	2.20	9.02	0.768	0.102	<0.100	0.0540	0.667	<0.100	<0.100	0.101
LRM	1	2	1	LRMAD121	0.369	0.129	0.971	1.22	15.1	0.129	0.209	<0.100	0.0896	<0.100	<0.100	<0.100	0.714
ARG	1	2	2	ARGAD121	1.06	<0.100	9.29	2.18	8.88	0.773	0.106	<0.100	<0.050	0.673	<0.100	<0.100	<0.100
LP4-08-1-Q	1	2	3	S-11255AD22	0.879	0.270	1.00	4.21	11.2	<0.100	0.769	<0.100	0.243	1.22	1.21	2.22	1.37
LP4-06-2-Q	1	2	4	S-11253AD12	0.205	<0.100	0.496	3.97	9.99	<0.100	0.333	<0.100	0.0759	0.290	1.83	2.50	1.36
LP4-24-Q	1	2	5	S-11260AD12	1.70	0.169	0.630	3.82	12.2	<0.100	0.356	<0.100	0.125	1.09	1.02	2.69	2.09
LP4-04-1-Q	1	2	6	S-11252AD12	5.05	<0.100	0.121	4.22	8.44	<0.100	0.252	<0.100	0.320	1.06	1.49	<0.100	2.21
LP4-24-Q	1	2	7	S-11260AD22	1.68	0.163	0.627	3.85	12.1	<0.100	0.366	<0.100	0.135	1.07	1.01	2.66	2.07
LRM	1	2	8	LRMAD122	0.365	0.128	0.962	1.20	15.1	0.126	0.203	<0.100	0.0856	<0.100	<0.100	<0.100	0.707
ARG	1	2	9	ARGAD122	1.04	<0.100	9.16	2.19	8.78	0.766	0.107	<0.100	0.0515	0.661	<0.100	<0.100	<0.100
LP4-19-Q	1	2	10	S-11257AD12	2.17	0.277	0.502	2.69	14.5	<0.100	0.596	<0.100	0.237	0.967	0.548	0.358	3.13
LP4-04-1-Q	1	2	11	S-11252AD22	5.09	<0.100	0.121	4.24	7.92	<0.100	0.250	<0.100	0.314	1.07	1.50	<0.100	2.22
LP4-08-1-Q	1	2	12	S-11255AD12	0.867	0.278	0.989	4.19	11.3	<0.100	0.761	<0.100	0.248	1.20	1.20	2.21	1.35
LP4-06-2-Q	1	2	13	S-11253AD22	0.202	<0.100	0.493	3.95	9.60	<0.100	0.331	<0.100	0.0710	0.286	1.81	2.48	1.34
LP4-19-Q	1	2	14	S-11257AD22	2.15	0.274	0.496	2.67	14.1	<0.100	0.591	<0.100	0.240	0.960	0.541	0.353	3.10
LRM	1	2	15	LRMAD123	0.369	0.128	0.964	1.18	15.1	0.127	0.216	<0.100	0.0870	<0.100	<0.100	<0.100	0.710
ARG	1	2	16	ARGAD123	1.05	<0.100	9.20	2.15	8.76	0.767	0.106	<0.100	<0.050	0.665	<0.100	<0.100	<0.100
LRM	2	1	1	LRMAD211	0.345	0.133	0.980	1.20	15.5	0.139	0.217	<0.100	0.0704	<0.100	<0.100	<0.100	0.705
ARG	2	1	2	ARGAD211	0.973	<0.100	9.33	2.21	8.76	0.780	0.116	<0.100	<0.050	0.684	<0.100	<0.100	0.106
LP4-23-1-Q	2	1	3	S-11259AD11	2.98	<0.100	0.544	3.33	13.5	<0.100	0.515	<0.100	0.306	1.09	1.37	0.166	1.53
LP4-07-1-Q	2	1	4	S-11254AD11	7.33	<0.100	0.134	0.996	11.5	<0.100	0.650	<0.100	0.254	0.493	1.81	0.426	2.54

Table B-2. AD Measurements of the Set 2 Glasses (continued)

ID	Block	Sub-Blk	Seq	Lab ID	Ca (wt%)	Cr (wt%)	Fe (wt%)	K (wt%)	Na (wt%)	Ni (wt%)	P (wt%)	Pb (wt%)	S (wt%)	Ti (wt%)	V (wt%)	Zn (wt%)	Zr (wt%)
LP4-22-Q	2	1	5	S-11258AD21	<0.100	<0.100	0.865	0.373	14.2	<0.100	0.761	<0.100	0.359	0.583	1.72	0.641	2.07
LP4-13-Q	2	1	6	S-11256AD21	5.30	<0.100	0.636	2.71	13.5	<0.100	0.669	<0.100	0.480	1.01	0.108	2.56	3.15
LP4-13-Q	2	1	7	S-11256AD11	5.28	<0.100	0.631	2.75	14.1	<0.100	0.664	<0.100	0.460	1.01	0.106	2.54	3.13
LRM	2	1	8	LRMAD212	0.340	0.126	0.930	1.23	15.6	0.129	0.205	<0.100	0.0917	<0.100	<0.100	<0.100	0.716
ARG	2	1	9	ARGAD212	0.962	<0.100	8.86	2.30	8.94	0.735	0.107	<0.100	<0.050	0.662	<0.100	<0.100	0.105
LP4-23-1-Q	2	1	10	S-11259AD21	2.92	<0.100	0.533	3.35	13.6	<0.100	0.502	<0.100	0.311	1.07	1.35	0.162	1.53
LP4-25-1-Q	2	1	11	S-11261AD11	6.09	<0.100	0.967	2.10	8.59	<0.100	0.727	<0.100	0.127	0.586	0.576	0.149	1.72
LP4-22-Q	2	1	12	S-11258AD11	<0.100	<0.100	0.849	0.367	14.1	<0.100	0.746	<0.100	0.357	0.576	1.69	0.630	2.04
LP4-25-1-Q	2	1	13	S-11261AD21	6.21	<0.100	0.986	2.17	8.61	<0.100	0.732	<0.100	0.122	0.597	0.581	0.150	1.72
LP4-07-1-Q	2	1	14	S-11254AD21	7.49	<0.100	0.134	1.01	11.0	<0.100	0.652	<0.100	0.246	0.501	1.82	0.429	2.59
LRM	2	1	15	LRMAD213	0.347	0.126	0.935	1.27	15.3	0.129	0.201	<0.100	0.0783	<0.100	<0.100	<0.100	0.712
ARG	2	1	16	ARGAD213	0.977	<0.100	8.89	2.30	8.89	0.737	0.104	<0.100	<0.050	0.666	<0.100	<0.100	0.105
LRM	2	2	1	LRMAD221	0.335	0.130	0.988	1.14	14.5	0.147	0.217	<0.100	0.0830	<0.100	<0.100	<0.100	0.730
ARG	2	2	2	ARGAD221	0.950	<0.100	9.41	2.10	8.43	0.813	0.115	<0.100	<0.050	0.698	<0.100	<0.100	<0.100
LP4-07-1-Q	2	2	3	S-11254AD22	7.36	<0.100	0.144	0.978	10.8	<0.100	0.701	<0.100	0.259	0.522	1.90	0.448	2.63
LP4-07-1-Q	2	2	4	S-11254AD12	7.32	<0.100	0.142	0.955	10.3	<0.100	0.690	<0.100	0.239	0.518	1.89	0.445	2.59
LP4-22-Q	2	2	5	S-11258AD12	<0.100	<0.100	0.899	0.349	14.0	<0.100	0.794	<0.100	0.365	0.602	1.76	0.662	2.08
LP4-25-1-Q	2	2	6	S-11261AD12	6.06	<0.100	1.02	2.04	7.53	<0.100	0.771	<0.100	0.126	0.612	0.589	0.157	1.72
LP4-23-1-Q	2	2	7	S-11259AD12	2.92	<0.100	0.566	3.20	11.3	<0.100	0.533	<0.100	0.305	1.13	1.41	0.173	1.51
LRM	2	2	8	LRMAD222	0.334	0.128	0.975	1.17	14.5	0.146	0.210	<0.100	0.0854	<0.100	<0.100	<0.100	0.705
ARG	2	2	9	ARGAD222	0.952	<0.100	9.24	2.13	8.44	0.790	0.113	<0.100	<0.050	0.681	<0.100	<0.100	<0.100
LP4-22-Q	2	2	10	S-11258AD22	<0.100	<0.100	0.947	0.346	14.2	<0.100	0.841	<0.100	0.370	0.621	1.84	0.694	2.06
LP4-25-1-Q	2	2	11	S-11261AD22	6.10	<0.100	1.08	2.03	7.76	<0.100	0.812	<0.100	0.142	0.630	0.609	0.165	1.73
LP4-13-Q	2	2	12	S-11256AD22	5.26	<0.100	0.703	2.50	12.6	<0.100	0.749	<0.100	0.452	1.09	<0.100	2.77	3.09
LP4-23-1-Q	2	2	13	S-11259AD22	2.91	<0.100	0.584	3.21	11.4	<0.100	0.565	<0.100	0.303	1.15	1.44	0.176	1.53
LP4-13-Q	2	2	14	S-11256AD12	5.29	<0.100	0.704	2.47	12.6	<0.100	0.742	<0.100	0.463	1.09	<0.100	2.79	3.15
LRM	2	2	15	LRMAD223	0.331	0.136	1.03	1.16	14.5	0.154	0.222	<0.100	0.0788	<0.100	<0.100	<0.100	0.715
ARG	2	2	16	ARGAD223	0.938	<0.100	9.88	2.08	8.45	0.850	0.105	<0.100	<0.050	0.721	<0.100	<0.100	<0.100

Table B-3. KH Measurements of the Set 2 Glasses

ID	Block	Sub-Blk	Sequence	Lab ID	Cl (wt%)	F (wt%)
LRM	1	1	1	LRMKH111	<0.0250	0.881
LP4-19-Q	1	1	2	S-11257KH21	0.187	0.730
LP4-07-1-Q	1	1	3	S-11254KH21	0.0504	0.779
LP4-07-1-Q	1	1	4	S-11254KH11	0.0480	0.784
LP4-24-Q	1	1	5	S-11260KH11	0.151	0.507
LP4-04-1-Q	1	1	6	S-11252KH11	0.242	0.118
LRM	1	1	7	LRMKH112	<0.0250	0.883
LP4-06-2-Q	1	1	8	S-11253KH21	0.194	0.257
LP4-06-2-Q	1	1	9	S-11253KH11	0.194	0.259
LP4-24-Q	1	1	10	S-11260KH21	0.148	0.513
LP4-04-1-Q	1	1	11	S-11252KH21	0.242	0.117
LP4-19-Q	1	1	12	S-11257KH11	0.183	0.732
LRM	1	1	13	LRMKH113	<0.0250	0.887
LRM	1	2	1	LRMKH121	<0.0250	0.901
LP4-06-2-Q	1	2	2	S-11253KH22	0.0388	0.052
LP4-04-1-Q	1	2	3	S-11252KH22	0.243	0.118
LP4-24-Q	1	2	4	S-11260KH12	0.151	0.517
LP4-04-1-Q	1	2	5	S-11252KH12	0.242	0.119
LP4-07-1-Q	1	2	6	S-11254KH12	0.0468	0.801
LRM	1	2	7	LRMKH122	<0.0250	0.900
LP4-06-2-Q	1	2	8	S-11253KH12	0.194	0.263
LP4-19-Q	1	2	9	S-11257KH22	0.187	0.748
LP4-24-Q	1	2	10	S-11260KH22	0.147	0.520
LP4-19-Q	1	2	11	S-11257KH12	0.184	0.745
LP4-07-1-Q	1	2	12	S-11254KH22	0.0501	0.802
LRM	1	2	13	LRMKH123	<0.0250	0.899
LRM	2	1	1	LRMKH211	<0.0250	0.881
LP4-22-Q	2	1	2	S-11258KH11	0.313	0.572
LP4-13-Q	2	1	3	S-11256KH11	0.409	0.815
LP4-08-1-Q	2	1	4	S-11255KH11	0.208	0.082
LP4-23-1-Q	2	1	5	S-11259KH11	0.164	0.220
LP4-23-1-Q	2	1	6	S-11259KH21	0.167	0.218
LRM	2	1	7	LRMKH212	<0.0250	0.877
LP4-08-1-Q	2	1	8	S-11255KH21	0.207	0.082
LP4-13-Q	2	1	9	S-11256KH21	0.409	0.813
LP4-25-1-Q	2	1	10	S-11261KH21	0.141	0.749
LP4-22-Q	2	1	11	S-11258KH21	0.313	0.568
LP4-25-1-Q	2	1	12	S-11261KH11	0.142	0.758
LRM	2	1	13	LRMKH213	<0.0250	0.887
LRM	2	2	1	LRMKH221	<0.0250	0.892
LP4-08-1-Q	2	2	2	S-11255KH12	0.209	0.083
LP4-25-1-Q	2	2	3	S-11261KH12	0.142	0.762
LP4-22-Q	2	2	4	S-11258KH12	0.315	0.579
LP4-08-1-Q	2	2	5	S-11255KH22	0.207	0.082
LP4-22-Q	2	2	6	S-11258KH22	0.315	0.574
LRM	2	2	7	LRMKH222	<0.0250	0.889
LP4-23-1-Q	2	2	8	S-11259KH12	0.166	0.224
LP4-23-1-Q	2	2	9	S-11259KH22	0.167	0.222
LP4-25-1-Q	2	2	10	S-11261KH22	0.142	0.756
LP4-13-Q	2	2	11	S-11256KH12	0.414	0.824
LP4-13-Q	2	2	12	S-11256KH22	0.412	0.822
LRM	2	2	13	LRMKH223	<0.0250	0.894

Table B-4. Comparison of Measures and Targeted Compositions of the Set 2 Glasses

Glass ID	Oxide	BDL (<)	Measured (wt %)	Targeted (wt %)	Difference of Measured versus Targeted	% Difference of Measured versus Targeted
LP4-04-1-Q	Al2O3		12.48	13.25	-0.77	-5.8%
LP4-04-1-Q	B2O3		5.603	6.24	-0.637	-10.2%
LP4-04-1-Q	CaO		6.821	7.11	-0.289	-4.1%
LP4-04-1-Q	Cl		0.242	0.47	-0.228	
LP4-04-1-Q	Cr2O3	<	0.146	0.02	0.126	
LP4-04-1-Q	F		0.118	0.14	-0.022	
LP4-04-1-Q	Fe2O3		0.171	0.16	0.011	6.9%
LP4-04-1-Q	K2O		5.165	5.44	-0.275	-5.1%
LP4-04-1-Q	Li2O		5.119	5.05	0.069	1.4%
LP4-04-1-Q	MgO		2.964	3.04	-0.076	-2.5%
LP4-04-1-Q	Na2O		11.027	10.73	0.297	2.8%
LP4-04-1-Q	NiO	<	0.127	0	0.127	
LP4-04-1-Q	P2O5		0.575	0.62	-0.045	-7.3%
LP4-04-1-Q	PbO	<	0.108	0	0.108	
LP4-04-1-Q	SiO2		37.545	38.09	-0.545	-1.4%
LP4-04-1-Q	SnO2		0.326	0.34	-0.014	
LP4-04-1-Q	SO3		0.806	1.4	-0.594	-42.4%
LP4-04-1-Q	TiO2		1.781	1.8	-0.019	
LP4-04-1-Q	V2O5		2.655	2.77	-0.115	
LP4-04-1-Q	ZnO	<	0.124	0.02	0.104	
LP4-04-1-Q	ZrO2		3.012	3.31	-0.298	-9.0%
LP4-04-1-Q	Sum Oxide		96.915	100	-3.085	-3.1%
LP4-06-2-Q	Al2O3		12.518	12.9	-0.382	-3.0%
LP4-06-2-Q	B2O3		10.787	11.57	-0.783	-6.8%
LP4-06-2-Q	CaO		0.275	0.24	0.035	14.6%
LP4-06-2-Q	Cl		0.194	0.51	-0.316	
LP4-06-2-Q	Cr2O3	<	0.146	0.06	0.086	
LP4-06-2-Q	F		0.26	0.4	-0.14	
LP4-06-2-Q	Fe2O3		0.698	0.73	-0.032	
LP4-06-2-Q	K2O		4.849	5.09	-0.241	-4.7%
LP4-06-2-Q	Li2O		1.376	1.32	0.056	
LP4-06-2-Q	MgO		3.113	3.23	-0.117	
LP4-06-2-Q	Na2O		13.51	12.72	0.79	6.2%
LP4-06-2-Q	NiO	<	0.127	0	0.127	
LP4-06-2-Q	P2O5		0.755	0.82	-0.065	-7.9%
LP4-06-2-Q	PbO	<	0.108	0	0.108	
LP4-06-2-Q	SiO2		36.849	37.4	-0.551	-1.5%
LP4-06-2-Q	SnO2		3.558	3.68	-0.122	
LP4-06-2-Q	SO3		0.192	0.29	-0.098	-33.8%
LP4-06-2-Q	TiO2		0.478	0.46	0.018	
LP4-06-2-Q	V2O5		3.231	3.33	-0.099	
LP4-06-2-Q	ZnO		3.081	3.27	-0.189	-5.8%
LP4-06-2-Q	ZrO2		1.827	1.98	-0.153	-7.7%
LP4-06-2-Q	Sum Oxide		97.932	100	-2.068	-2.1%
LP4-07-1-Q	Al2O3		9.003	9.45	-0.447	-4.7%
LP4-07-1-Q	B2O3		7.027	7.31	-0.283	-3.9%
LP4-07-1-Q	CaO		10.319	11.65	-1.331	-11.4%
LP4-07-1-Q	Cl		0.049	0.11	-0.061	
LP4-07-1-Q	Cr2O3	<	0.146	0.13	0.016	
LP4-07-1-Q	F		0.792	1.04	-0.249	
LP4-07-1-Q	Fe2O3		0.198	0.17	0.028	16.5%
LP4-07-1-Q	K2O		1.186	1.16	0.026	
LP4-07-1-Q	Li2O		1.275	1.26	0.015	

Table B-4. Comparison of Measures and Targeted Compositions of the Set 2 Glasses (continued)

Glass ID	Oxide	BDL (<)	Measured (wt %)	Targeted (wt %)	Difference of Measured versus Targeted	% Difference of Measured versus Targeted
LP4-07-1-Q	MgO		3.109	3.12	-0.011	
LP4-07-1-Q	Na2O		14.693	14.47	0.223	1.5%
LP4-07-1-Q	NiO	<	0.127	0	0.127	
LP4-07-1-Q	P2O5		1.543	1.69	-0.147	-8.7%
LP4-07-1-Q	PbO	<	0.108	0	0.108	
LP4-07-1-Q	SiO2		34.443	34.63	-0.187	-0.5%
LP4-07-1-Q	SnO2		3.948	4.08	-0.132	
LP4-07-1-Q	SO3		0.623	1.13	-0.507	-44.9%
LP4-07-1-Q	TiO2		0.848	0.83	0.018	
LP4-07-1-Q	V2O5		3.312	3.34	-0.028	
LP4-07-1-Q	ZnO		0.544	0.57	-0.026	-4.6%
LP4-07-1-Q	ZrO2		3.495	3.86	-0.365	-9.5%
LP4-07-1-Q	Sum Oxide		96.788	100	-3.212	-3.2%
LP4-08-1-Q	Al2O3		10.506	10.86	-0.354	-3.3%
LP4-08-1-Q	B2O3		5.281	6.1	-0.819	-13.4%
LP4-08-1-Q	CaO		1.175	1.15	0.025	
LP4-08-1-Q	Cl		0.208	0.53	-0.322	
LP4-08-1-Q	Cr2O3		0.401	0.44	-0.039	-8.9%
LP4-08-1-Q	F		0.082	0.11	-0.028	
LP4-08-1-Q	Fe2O3		1.413	1.47	-0.057	
LP4-08-1-Q	K2O		5.104	5.38	-0.276	-5.1%
LP4-08-1-Q	Li2O		3.181	3.15	0.031	
LP4-08-1-Q	MgO		0.745	0.76	-0.015	
LP4-08-1-Q	Na2O		16.109	15.52	0.589	3.8%
LP4-08-1-Q	NiO	<	0.127	0	0.127	
LP4-08-1-Q	P2O5		1.749	1.91	-0.161	-8.4%
LP4-08-1-Q	PbO	<	0.108	0	0.108	
LP4-08-1-Q	SiO2		38.561	39.79	-1.229	-3.1%
LP4-08-1-Q	SnO2		2.381	2.5	-0.119	-4.8%
LP4-08-1-Q	SO3		0.622	1.21	-0.588	-48.6%
LP4-08-1-Q	TiO2		2.018	2.02	-0.002	
LP4-08-1-Q	V2O5		2.142	2.21	-0.068	
LP4-08-1-Q	ZnO		2.773	2.89	-0.117	
LP4-08-1-Q	ZrO2		1.854	2	-0.146	-7.3%
LP4-08-1-Q	Sum Oxide		96.54	100	-3.46	-3.5%
LP4-13-Q	Al2O3		3.718	3.88	-0.162	-4.2%
LP4-13-Q	B2O3		9.813	10.67	-0.857	-8.0%
LP4-13-Q	CaO		7.391	8.3	-0.909	-11.0%
LP4-13-Q	Cl		0.411	0.57	-0.159	-27.9%
LP4-13-Q	Cr2O3	<	0.146	0.11	0.036	
LP4-13-Q	F		0.819	0.94	-0.121	
LP4-13-Q	Fe2O3		0.956	0.99	-0.034	
LP4-13-Q	K2O		3.141	3.19	-0.049	
LP4-13-Q	Li2O		2.594	2.59	0.004	
LP4-13-Q	MgO		0.844	0.83	0.014	
LP4-13-Q	Na2O		17.794	17.67	0.124	0.7%
LP4-13-Q	NiO	<	0.127	0	0.127	
LP4-13-Q	P2O5		1.618	1.75	-0.132	-7.5%
LP4-13-Q	PbO	<	0.108	0	0.108	
LP4-13-Q	SiO2		34.389	35.76	-1.371	-3.8%
LP4-13-Q	SnO2		2.006	2.12	-0.114	-5.4%
LP4-13-Q	SO3		1.158	1.21	-0.052	
LP4-13-Q	TiO2		1.751	1.75	0.001	

Table B-4. Comparison of Measures and Targeted Compositions of the Set 2 Glasses (continued)

Glass ID	Oxide	BDL (<)	Measured (wt %)	Targeted (wt %)	Difference of Measured versus Targeted	% Difference of Measured versus Targeted
LP4-13-Q	V2O5	<	0.185	0.16	0.025	
LP4-13-Q	ZnO		3.317	3.38	-0.063	
LP4-13-Q	ZrO2		4.228	4.13	0.098	
LP4-13-Q	Sum Oxide		96.514	100	-3.486	-3.5%
LP4-19-Q	Al2O3		12.48	12.49	-0.01	-0.1%
LP4-19-Q	B2O3		7.325	7.4	-0.075	-1.0%
LP4-19-Q	CaO		2.91	2.95	-0.04	-1.4%
LP4-19-Q	Cl		0.185	0.32	-0.135	
LP4-19-Q	Cr2O3		0.404	0.6	-0.196	-32.7%
LP4-19-Q	F		0.739	0.86	-0.121	
LP4-19-Q	Fe2O3		0.71	0.73	-0.02	
LP4-19-Q	K2O		3.255	3.39	-0.135	
LP4-19-Q	Li2O		0.498	0.48	0.018	
LP4-19-Q	MgO		3.366	3.29	0.076	
LP4-19-Q	Na2O		18.704	19.93	-1.226	-6.2%
LP4-19-Q	NiO	<	0.127	0	0.127	
LP4-19-Q	P2O5		1.347	1.47	-0.123	-8.4%
LP4-19-Q	PbO	<	0.108	0	0.108	
LP4-19-Q	SiO2		37.598	36.51	1.088	3.0%
LP4-19-Q	SnO2		0.141	0.15	-0.009	-6.0%
LP4-19-Q	SO3		0.596	1.44	-0.844	-58.6%
LP4-19-Q	TiO2		1.613	1.61	0.003	
LP4-19-Q	V2O5		0.97	1.28	-0.31	-24.2%
LP4-19-Q	ZnO		0.441	0.46	-0.019	
LP4-19-Q	ZrO2		4.248	4.64	-0.392	-8.4%
LP4-19-Q	Sum Oxide		97.765	100	-2.235	-2.2%
LP4-22-Q	Al2O3		9.225	9.47	-0.245	-2.6%
LP4-22-Q	B2O3		12.3	12.82	-0.52	-4.1%
LP4-22-Q	CaO	<	0.14	0.11	0.03	
LP4-22-Q	Cl		0.314	0.43	-0.116	
LP4-22-Q	Cr2O3	<	0.146	0.01	0.136	
LP4-22-Q	F		0.573	0.76	-0.187	
LP4-22-Q	Fe2O3		1.272	1.34	-0.068	-5.1%
LP4-22-Q	K2O		0.432	0.4	0.032	8.0%
LP4-22-Q	Li2O		1.064	1.05	0.014	
LP4-22-Q	MgO		0.388	0.41	-0.022	-5.4%
LP4-22-Q	Na2O		19.041	20.51	-1.47	-7.2%
LP4-22-Q	NiO	<	0.127	0	0.127	
LP4-22-Q	P2O5		1.8	2	-0.2	-10.0%
LP4-22-Q	PbO	<	0.108	0	0.108	
LP4-22-Q	SiO2		39.844	40.44	-0.596	
LP4-22-Q	SnO2		1.026	1.1	-0.074	-6.7%
LP4-22-Q	SO3		0.906	1.03	-0.124	-12.0%
LP4-22-Q	TiO2		0.993	1	-0.007	
LP4-22-Q	V2O5		3.129	3.16	-0.031	
LP4-22-Q	ZnO		0.818	0.85	-0.032	
LP4-22-Q	ZrO2		2.786	3.11	-0.324	-10.4%
LP4-22-Q	Sum Oxide		96.432	100	-3.568	-3.6%
LP4-23-1-Q	Al2O3		5.909	6.07	-0.161	
LP4-23-1-Q	B2O3		5.715	6.46	-0.745	-11.5%
LP4-23-1-Q	CaO		4.103	4.4	-0.297	-6.8%
LP4-23-1-Q	Cl		0.166	0.41	-0.244	
LP4-23-1-Q	Cr2O3	<	0.146	0.11	0.036	

Table B-4. Comparison of Measures and Targeted Compositions of the Set 2 Glasses (continued)

Glass ID	Oxide	BDL (<)	Measured (wt %)	Targeted (wt %)	Difference of Measured versus Targeted	% Difference of Measured versus Targeted
LP4-23-1-Q	F		0.221	0.27	-0.049	
LP4-23-1-Q	Fe2O3		0.796	0.83	-0.034	
LP4-23-1-Q	K2O		3.942	4.12	-0.178	
LP4-23-1-Q	Li2O		3.052	2.99	0.062	
LP4-23-1-Q	MgO		2.541	2.63	-0.089	
LP4-23-1-Q	Na2O		16.783	16.57	0.213	
LP4-23-1-Q	NiO	<	0.127	0	0.127	
LP4-23-1-Q	P2O5		1.212	1.32	-0.108	-8.2%
LP4-23-1-Q	PbO	<	0.108	0	0.108	
LP4-23-1-Q	SiO2		40.486	41.64	-1.154	-2.8%
LP4-23-1-Q	SnO2		4.199	4.35	-0.151	
LP4-23-1-Q	SO3		0.765	0.95	-0.185	-19.5%
LP4-23-1-Q	TiO2		1.851	1.85	0.001	
LP4-23-1-Q	V2O5		2.486	2.5	-0.014	
LP4-23-1-Q	ZnO		0.211	0.22	-0.009	
LP4-23-1-Q	ZrO2		2.06	2.31	-0.25	-10.8%
LP4-23-1-Q	Sum Oxide		96.879	100	-3.121	-3.1%
LP4-24-Q	Al2O3		12.967	13.26	-0.293	-2.2%
LP4-24-Q	B2O3		9.362	9.6	-0.238	-2.5%
LP4-24-Q	CaO		2.288	2.34	-0.052	
LP4-24-Q	Cl		0.149	0.2	-0.051	
LP4-24-Q	Cr2O3		0.244	0.25	-0.006	
LP4-24-Q	F		0.514	0.59	-0.076	
LP4-24-Q	Fe2O3		0.894	0.94	-0.046	-4.9%
LP4-24-Q	K2O		4.641	4.66	-0.019	
LP4-24-Q	Li2O		2.993	2.9	0.093	
LP4-24-Q	MgO		2.4	2.42	-0.02	
LP4-24-Q	Na2O		16.816	16.05	0.766	4.8%
LP4-24-Q	NiO	<	0.127	0	0.127	
LP4-24-Q	P2O5		0.828	0.89	-0.062	-7.0%
LP4-24-Q	PbO	<	0.108	0	0.108	
LP4-24-Q	SiO2		34.817	34.94	-0.123	-0.4%
LP4-24-Q	SnO2		0.255	0.28	-0.025	-8.9%
LP4-24-Q	SO3		0.332	0.32	0.012	
LP4-24-Q	TiO2		1.806	1.83	-0.024	
LP4-24-Q	V2O5		1.812	1.88	-0.068	
LP4-24-Q	ZnO		3.336	3.51	-0.174	-5.0%
LP4-24-Q	ZrO2		2.837	3.14	-0.303	-9.6%
LP4-24-Q	Sum Oxide		99.526	100	-0.474	-0.5%
LP4-25-1-Q	Al2O3		7.289	7.42	-0.131	-1.8%
LP4-25-1-Q	B2O3		8.501	8.77	-0.269	-3.1%
LP4-25-1-Q	CaO		8.556	9.38	-0.824	-8.8%
LP4-25-1-Q	Cl		0.142	0.45	-0.308	
LP4-25-1-Q	Cr2O3	<	0.146	0.14	0.006	
LP4-25-1-Q	F		0.756	0.97	-0.214	
LP4-25-1-Q	Fe2O3		1.449	1.5	-0.051	
LP4-25-1-Q	K2O		2.512	2.62	-0.108	
LP4-25-1-Q	Li2O		4.381	4.22	0.161	
LP4-25-1-Q	MgO		3.23	3.22	0.01	
LP4-25-1-Q	Na2O		10.949	10.73	0.219	2.0%
LP4-25-1-Q	NiO	<	0.127	0	0.127	
LP4-25-1-Q	P2O5		1.743	1.86	-0.117	-6.3%
LP4-25-1-Q	PbO	<	0.108	0	0.108	

Table B-4. Comparison of Measures and Targeted Compositions of the Set 2 Glasses (continued)

Glass ID	Oxide	BDL (<)	Measured (wt %)	Targeted (wt %)	Difference of Measured versus Targeted	% Difference of Measured versus Targeted
LP4-25-1-Q	SiO2		39.684	39.5	0.184	0.5%
LP4-25-1-Q	SnO2		3.555	3.75	-0.195	-5.2%
LP4-25-1-Q	SO3		0.323	0.65	-0.327	-50.3%
LP4-25-1-Q	TiO2		1.011	0.99	0.021	
LP4-25-1-Q	V2O5		1.051	1.03	0.021	
LP4-25-1-Q	ZnO		0.193	0.2	-0.007	
LP4-25-1-Q	ZrO2		2.327	2.6	-0.273	-10.5%
LP4-25-1-Q	Sum Oxide		98.033	100	-1.967	-2.0%
LRM	Al2O3		9.638	9.51	0.128	
LRM	B2O3		7.29	7.85	-0.56	-7.0%
LRM	CaO		0.485	0.54	-0.055	-10.0%
LRM	Cl	<	0.025	0	0.025	
LRM	Cr2O3		0.189	0.19	-0.001	
LRM	F		0.889	0.86	0.029	
LRM	Fe2O3		1.38	1.38	0	
LRM	K2O		1.448	1.48	-0.032	
LRM	Li2O	<	0.215	0.11	0.105	
LRM	MgO	<	0.166	0.1	0.066	
LRM	Na2O		20.287	20.03	0.257	
LRM	NiO		0.17	0.19	-0.02	-11.0%
LRM	P2O5		0.481	0.54	-0.059	-11.0%
LRM	PbO	<	0.108	0.1	0.008	8.0%
LRM	SiO2		53.393	54.2	-0.807	
LRM	SnO2	<	0.127	0	0.127	
LRM	SO3		0.219	0.3	-0.081	-27.0%
LRM	TiO2	<	0.167	0.1	0.067	
LRM	V2O5	<	0.179	0	0.179	
LRM	ZnO	<	0.124	0	0.124	
LRM	ZrO2		0.965	0.93	0.035	
LRM	Sum Oxide		97.945	98.41	-0.465	0.0%

Exhibit B-1. Plots of Oxide Measurements in Analytical Sequence for the Set 2 Glasses

Oxide=Al_2O_3, Prep Method=PF
Variability Chart for Measured (wt%)

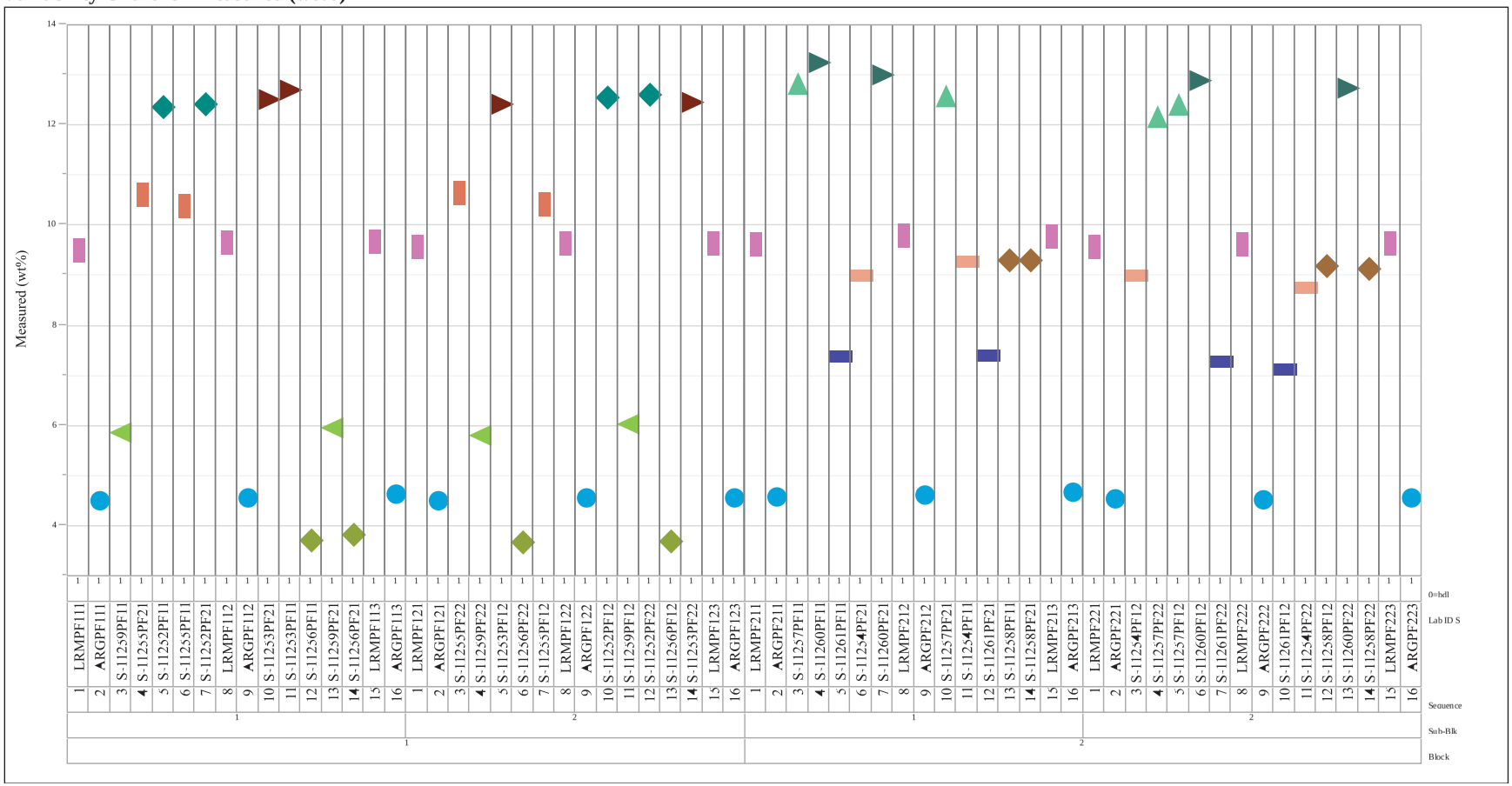


Exhibit B-1. Plots of Oxide Measurements in Analytical Sequence for the Set 2 Glasses (continued)

Oxide=B_2O_3, Prep Method=PF
Variability Chart for Measured (wt%)

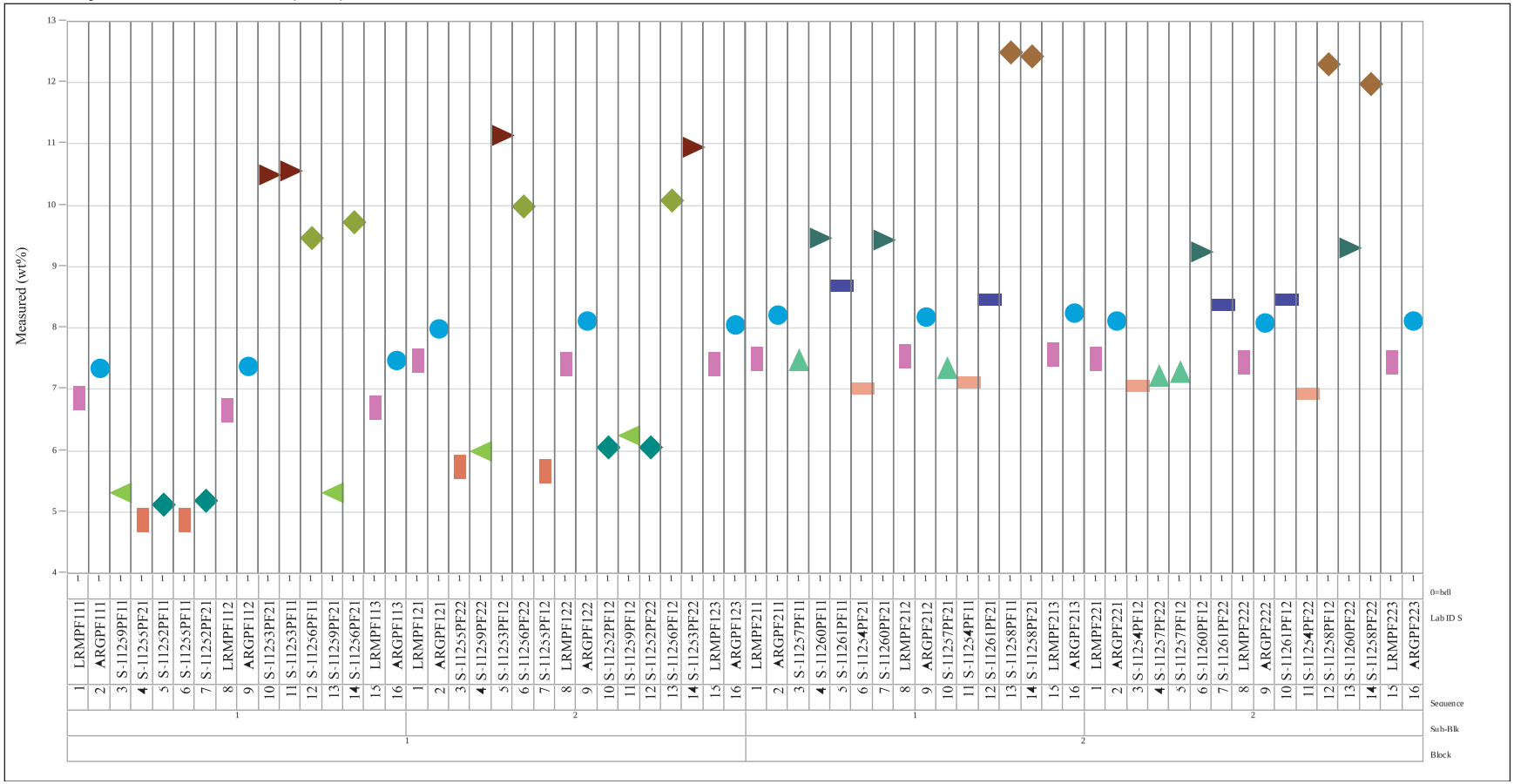


Exhibit B-1. Plots of Oxide Measurements in Analytical Sequence for the Set 2 Glasses (continued)

Oxide=CaO, Prep Method=AD
Variability Chart for Measured (wt%)

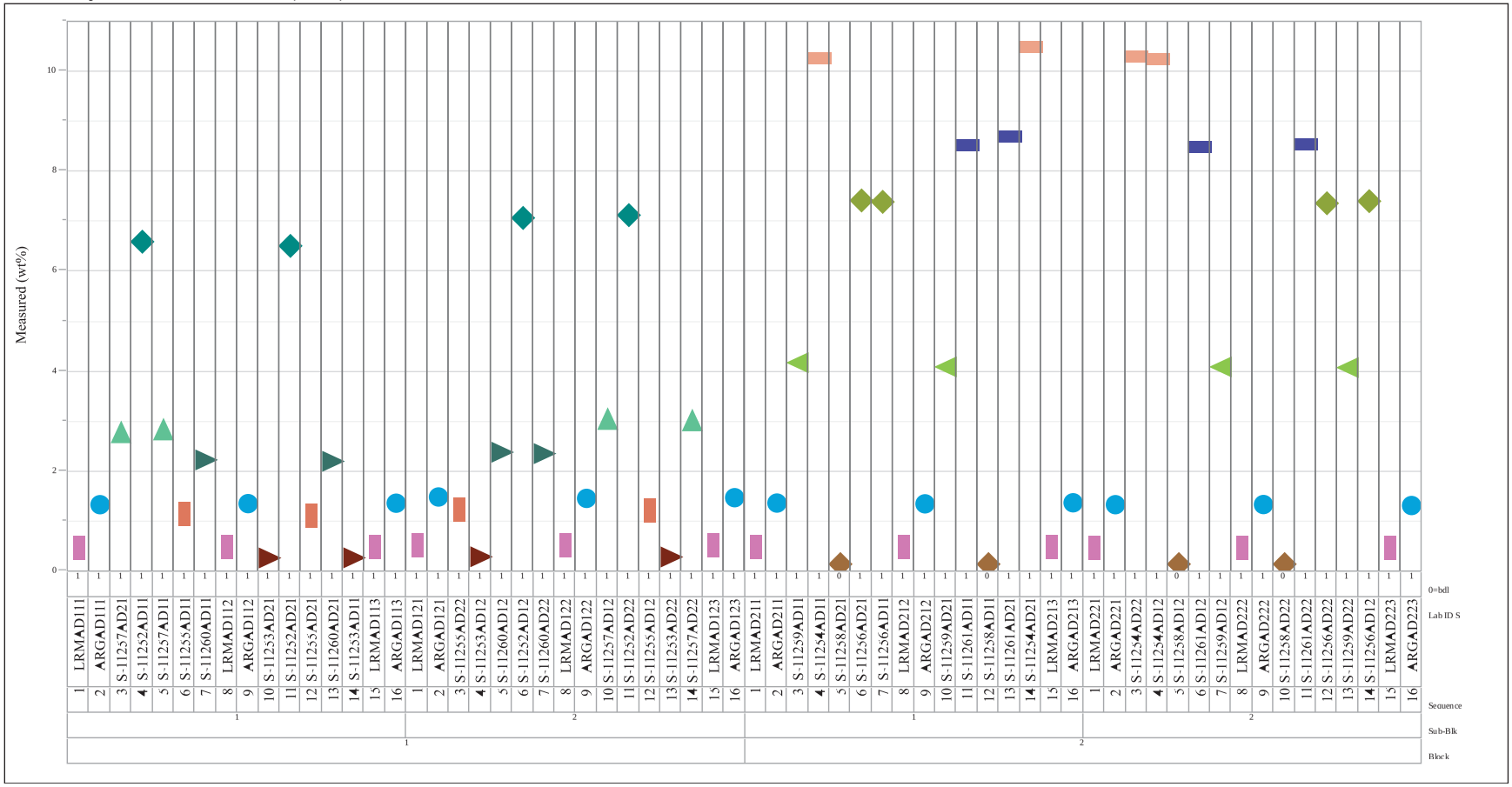


Exhibit B-1. Plots of Oxide Measurements in Analytical Sequence for the Set 2 Glasses (continued)

Oxide=Cl, Prep Method=KH
Variability Chart for Measured (wt%)

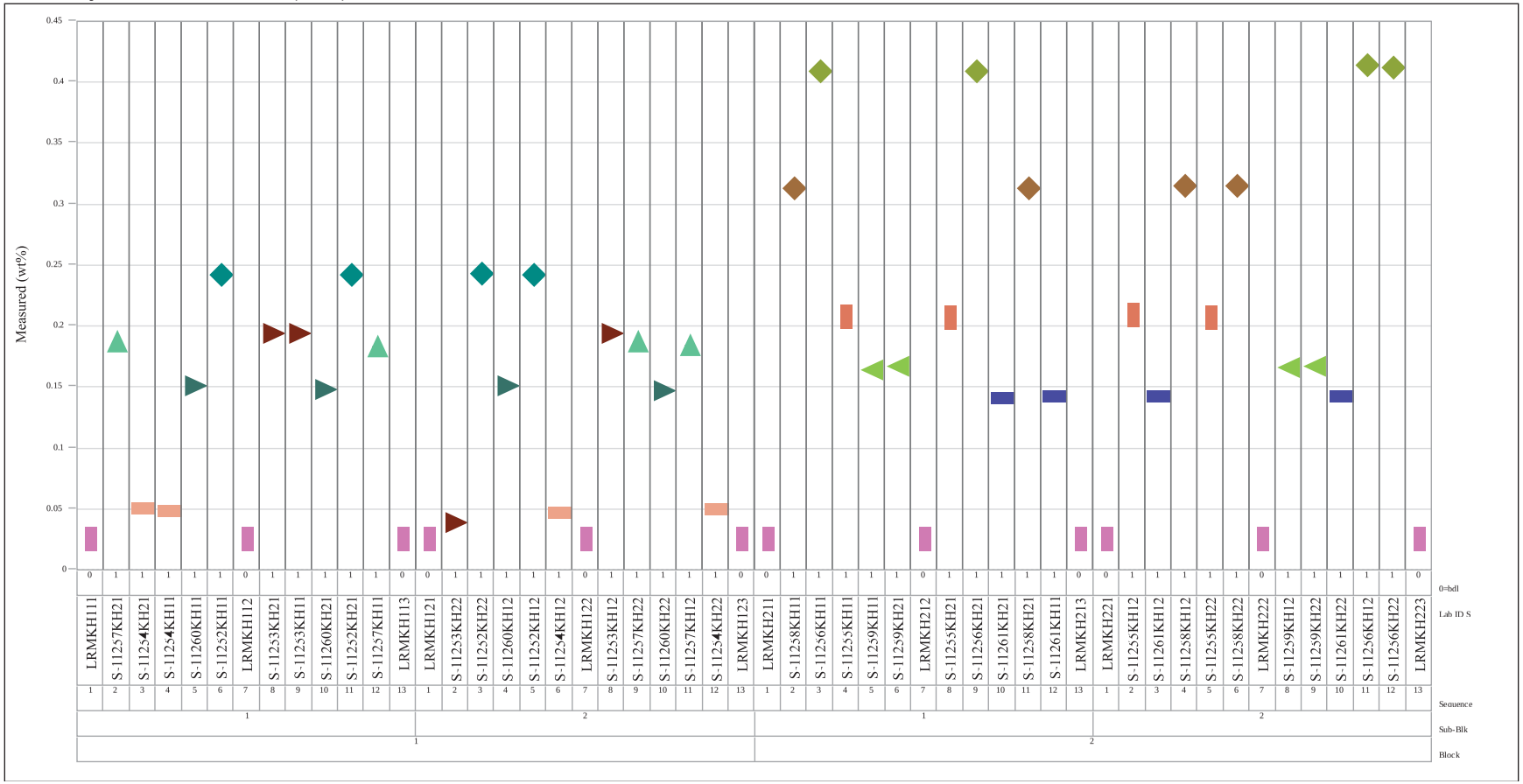


Exhibit B-1. Plots of Oxide Measurements in Analytical Sequence for the Set 2 Glasses (continued)

Oxide=Cr_2O_3, Prep Method=AD
Variability Chart for Measured (wt%)

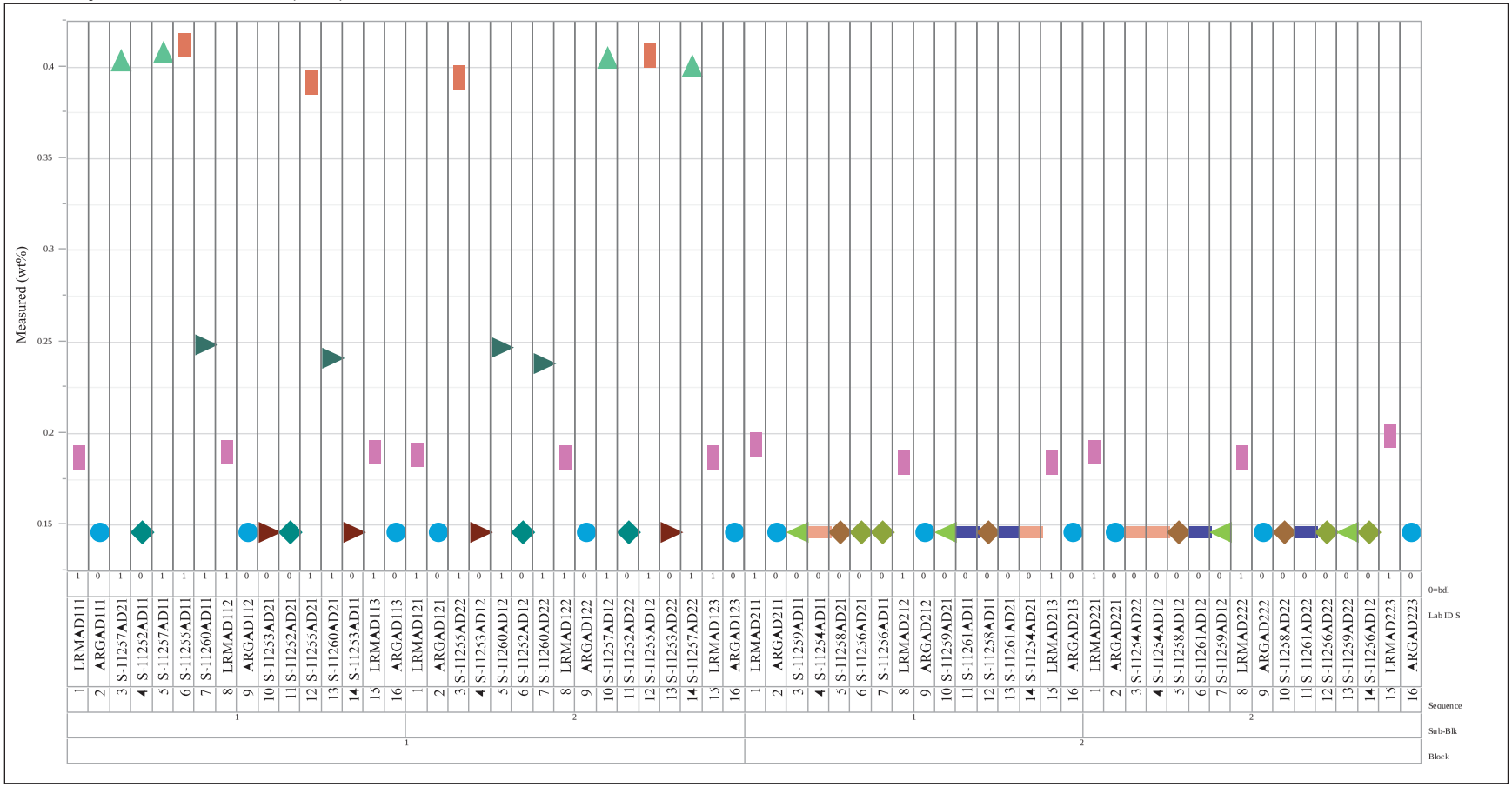


Exhibit B-1. Plots of Oxide Measurements in Analytical Sequence for the Set 2 Glasses (continued)

Oxide=F, Prep Method=KH
Variability Chart for Measured (wt%)

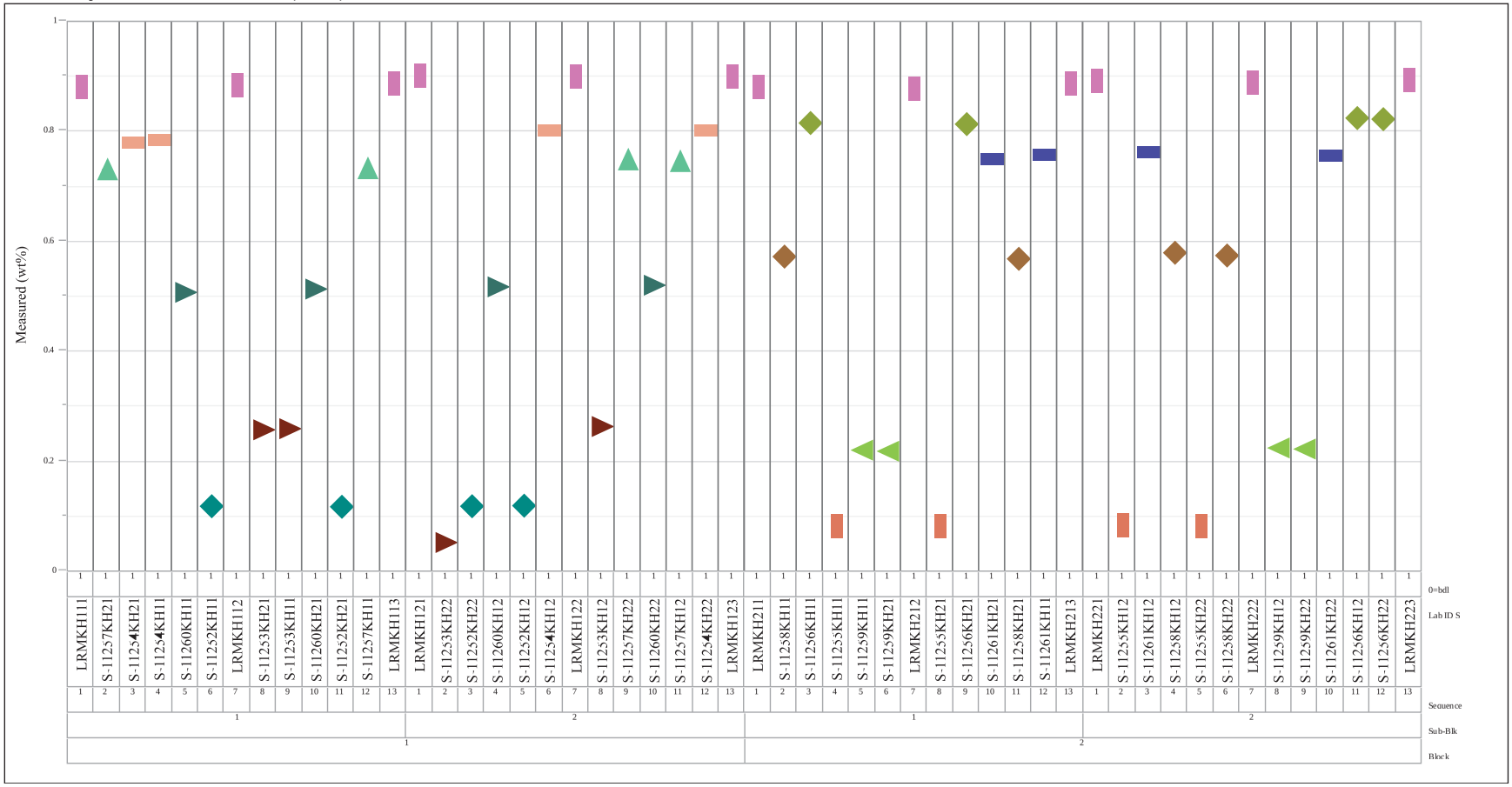


Exhibit B-1. Plots of Oxide Measurements in Analytical Sequence for the Set 2 Glasses (continued)

Oxide=Fe_2O_3, Prep Method=AD
Variability Chart for Measured (wt%)

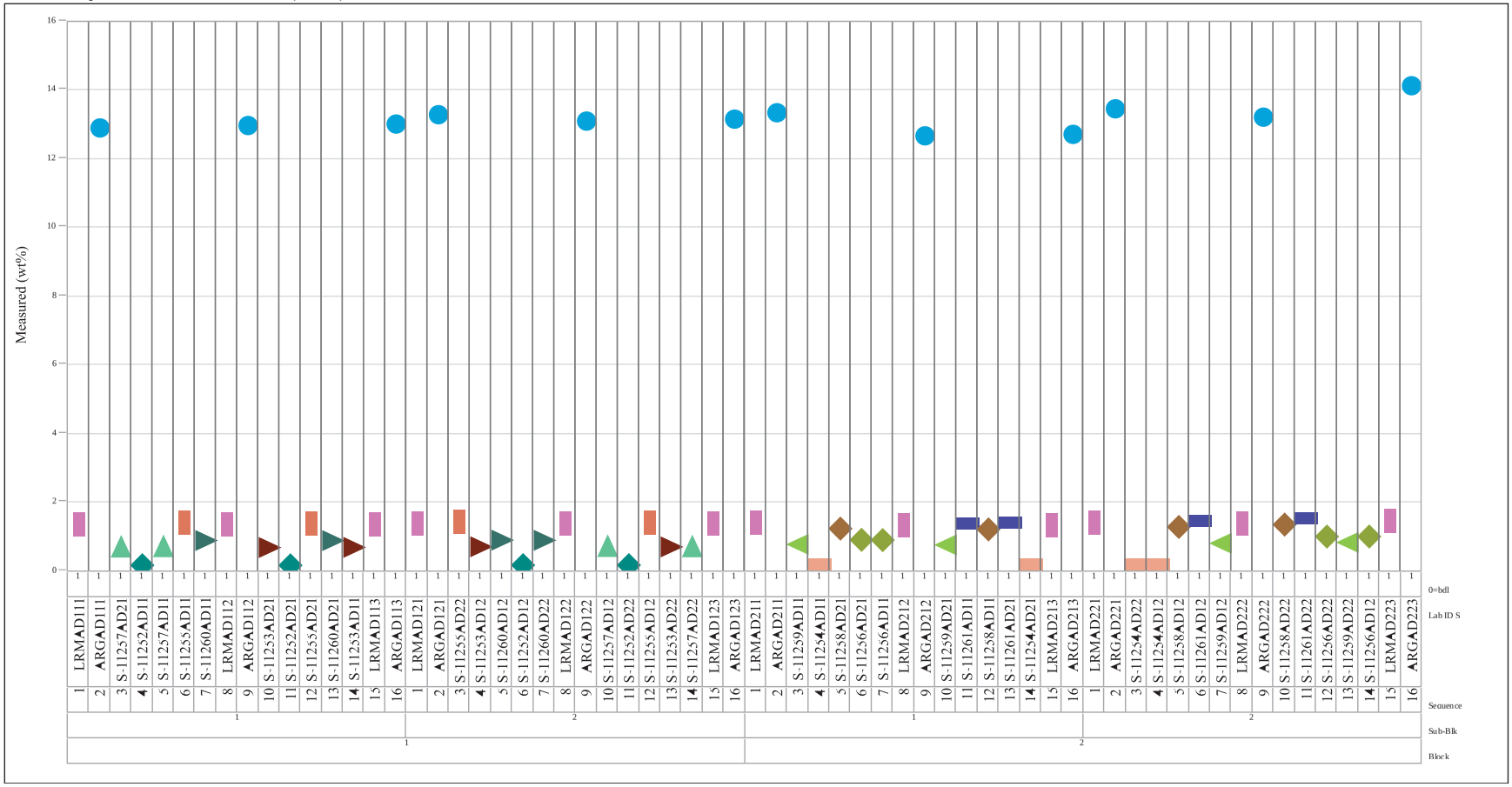


Exhibit B-1. Plots of Oxide Measurements in Analytical Sequence for the Set 2 Glasses (continued)

Oxide=K_2O, Prep Method=AD
Variability Chart for Measured (wt%)

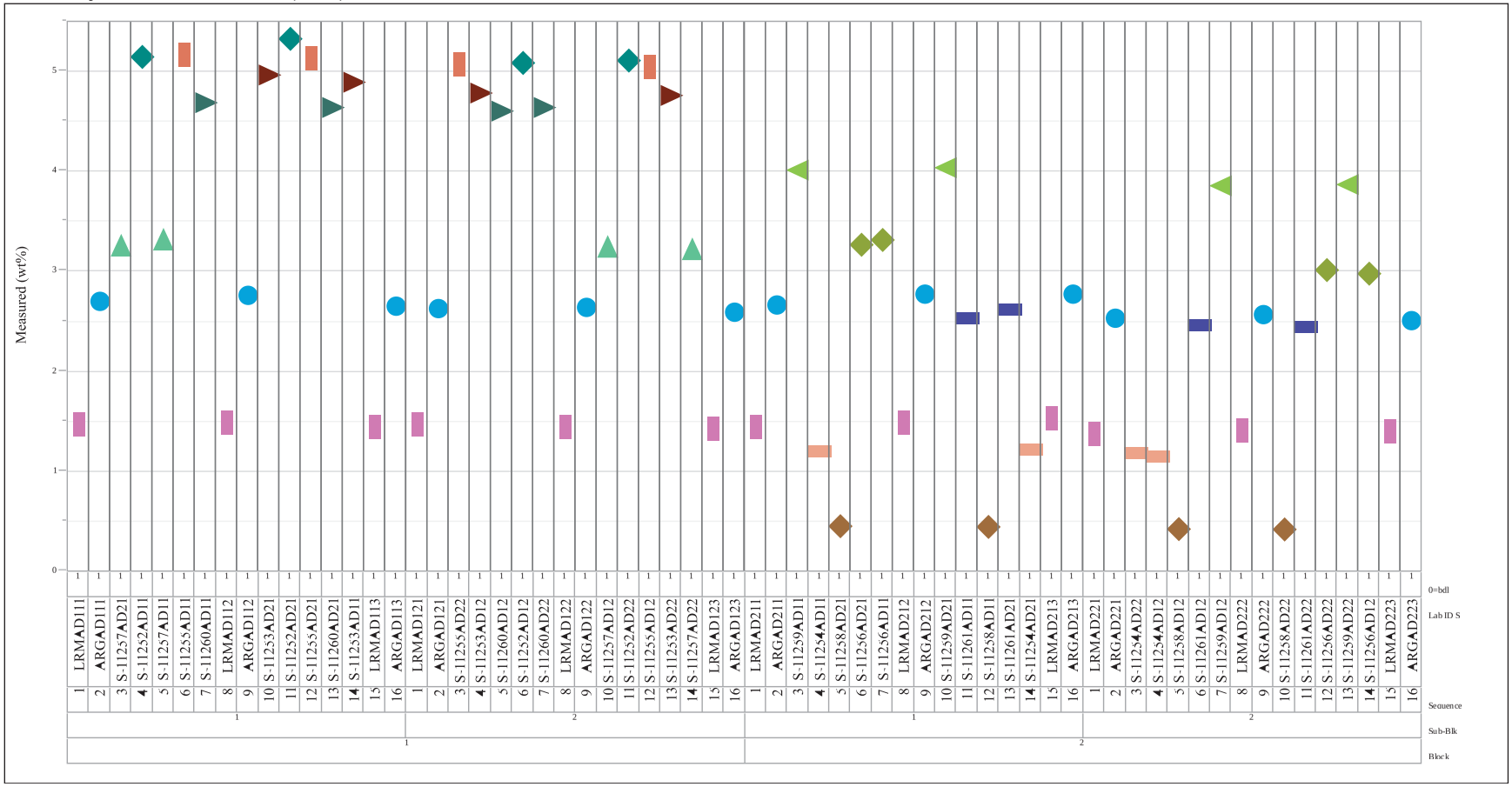


Exhibit B-1. Plots of Oxide Measurements in Analytical Sequence for the Set 2 Glasses (continued)

Oxide=Li_2O, Prep Method=AD
Variability Chart for Measured (wt%)

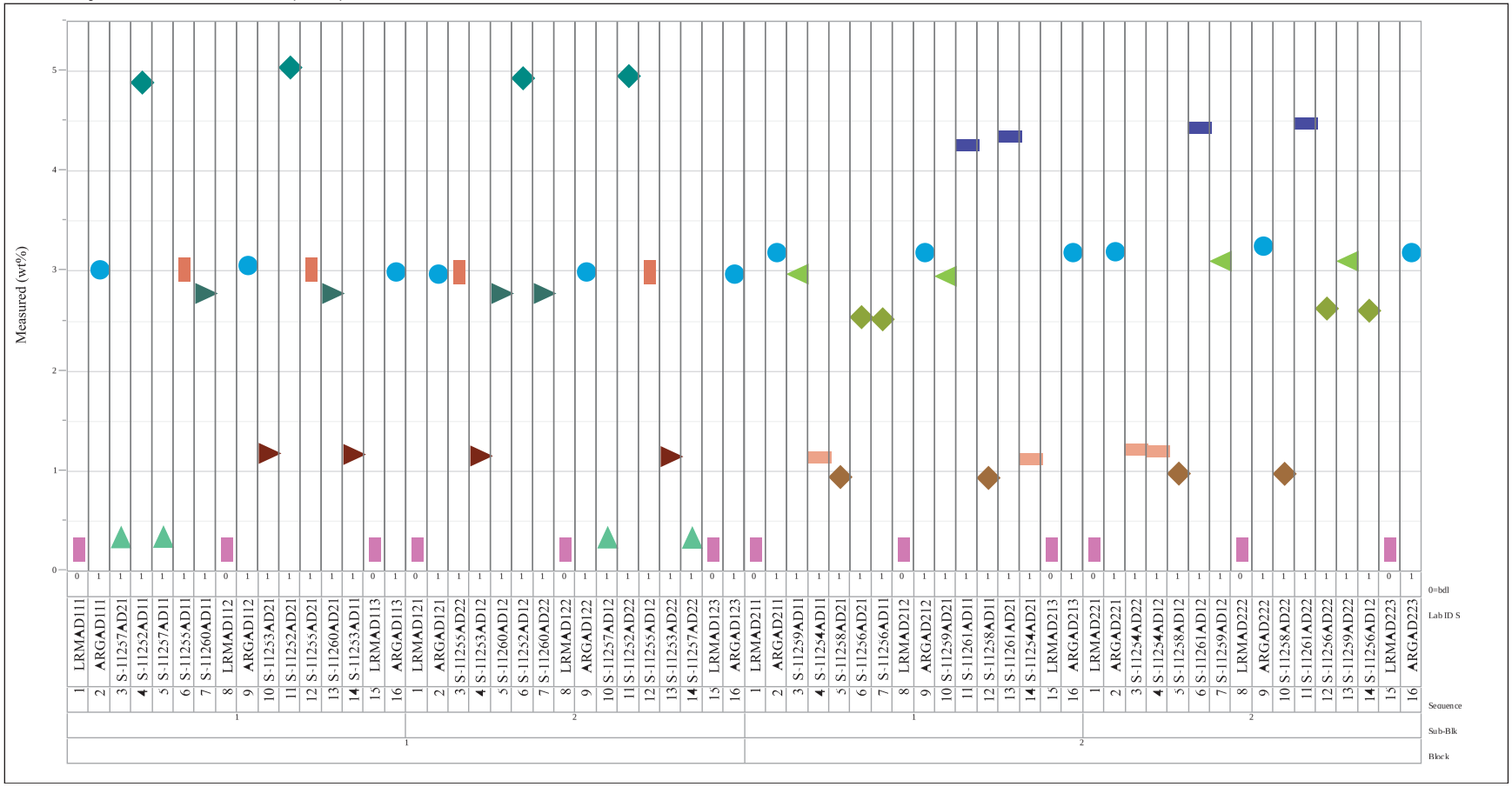


Exhibit B-1. Plots of Oxide Measurements in Analytical Sequence for the Set 2 Glasses (continued)

Oxide=MgO, Prep Method=AD
Variability Chart for Measured (wt%)

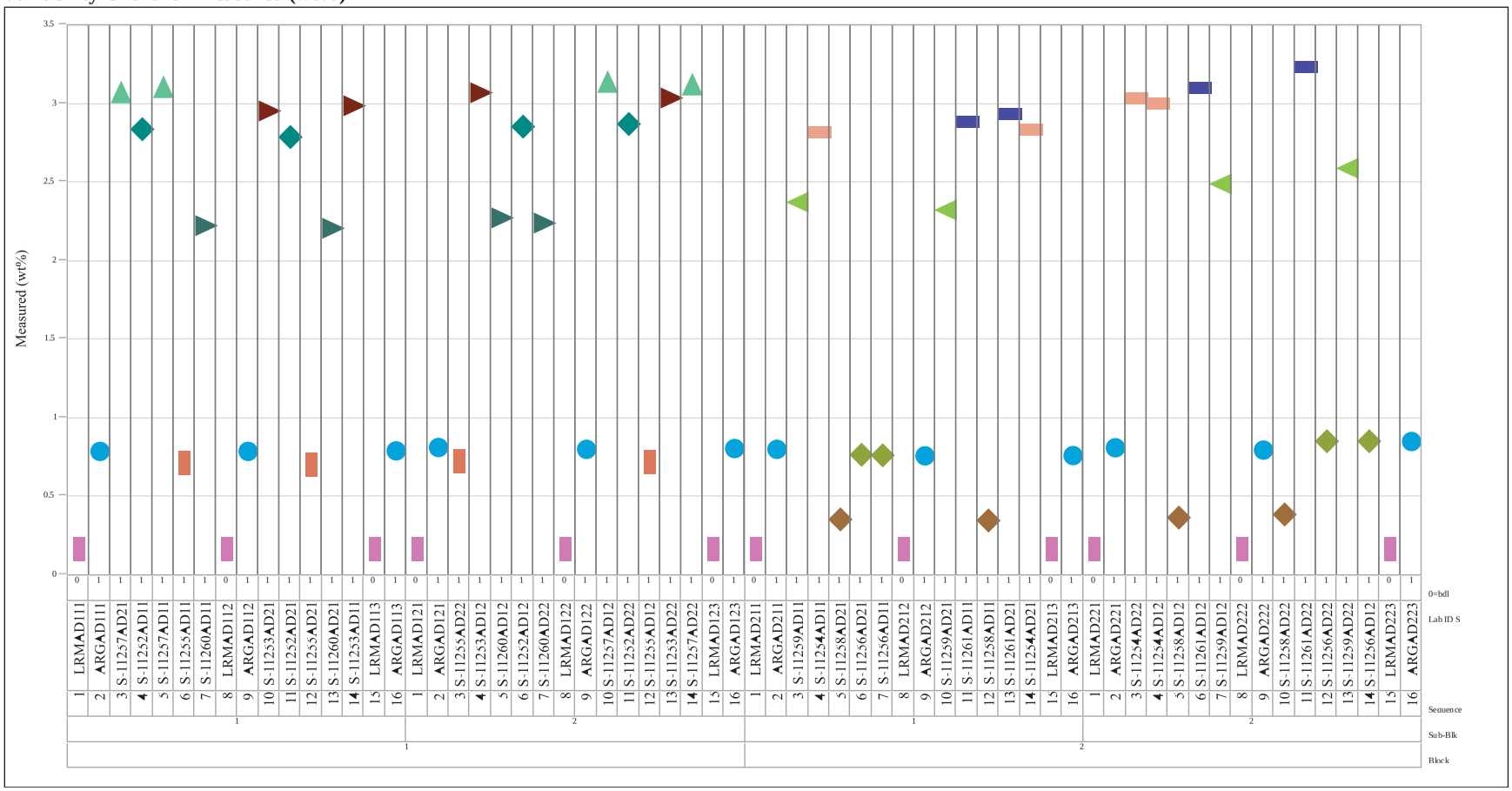


Exhibit B-1. Plots of Oxide Measurements in Analytical Sequence for the Set 2 Glasses (continued)

Oxide=Na_2O, Prep Method=AD
Variability Chart for Measured (wt%)

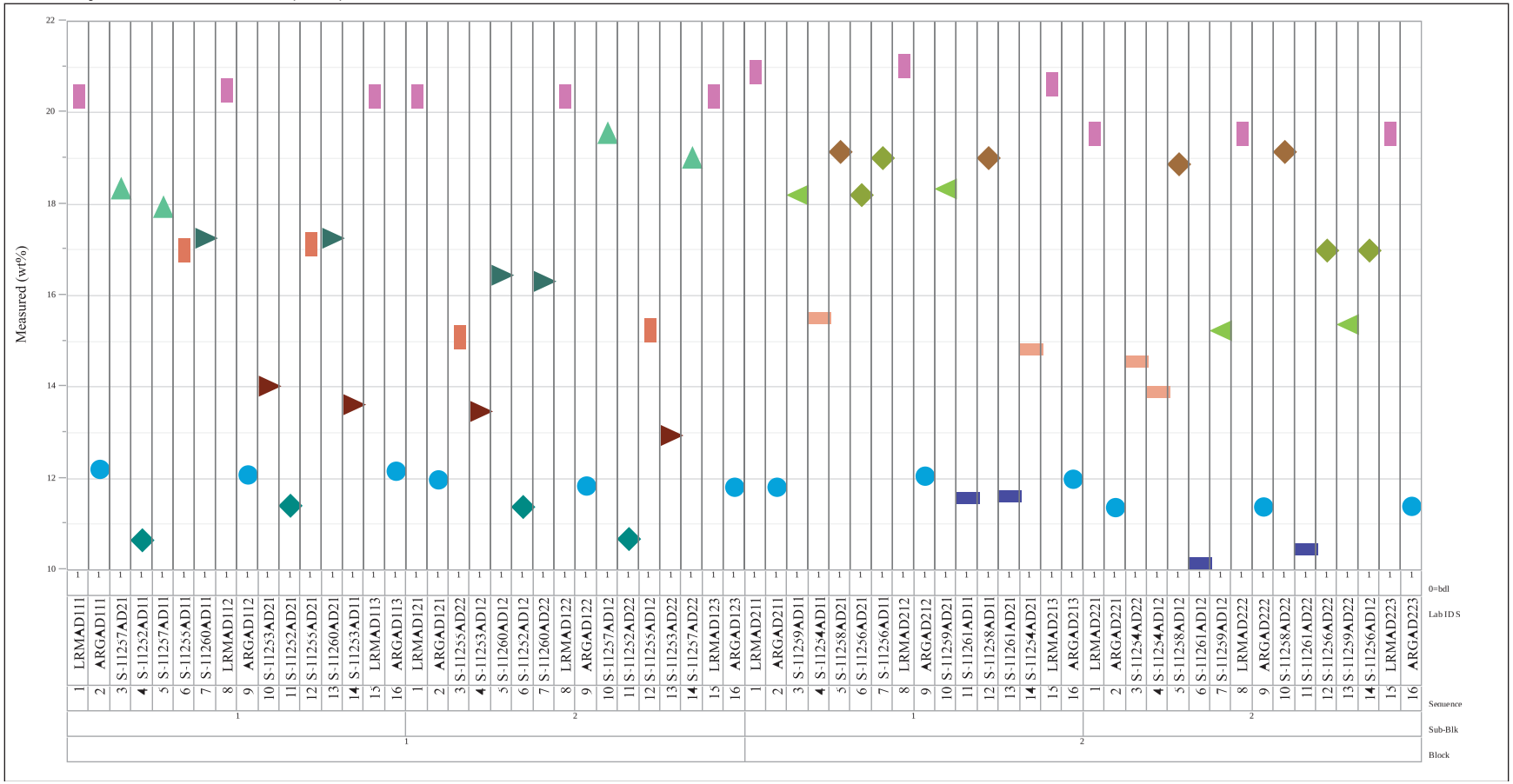


Exhibit B-1. Plots of Oxide Measurements in Analytical Sequence for the Set 2 Glasses (continued)

Oxide=NiO, Prep Method=AD
Variability Chart for Measured (wt%)

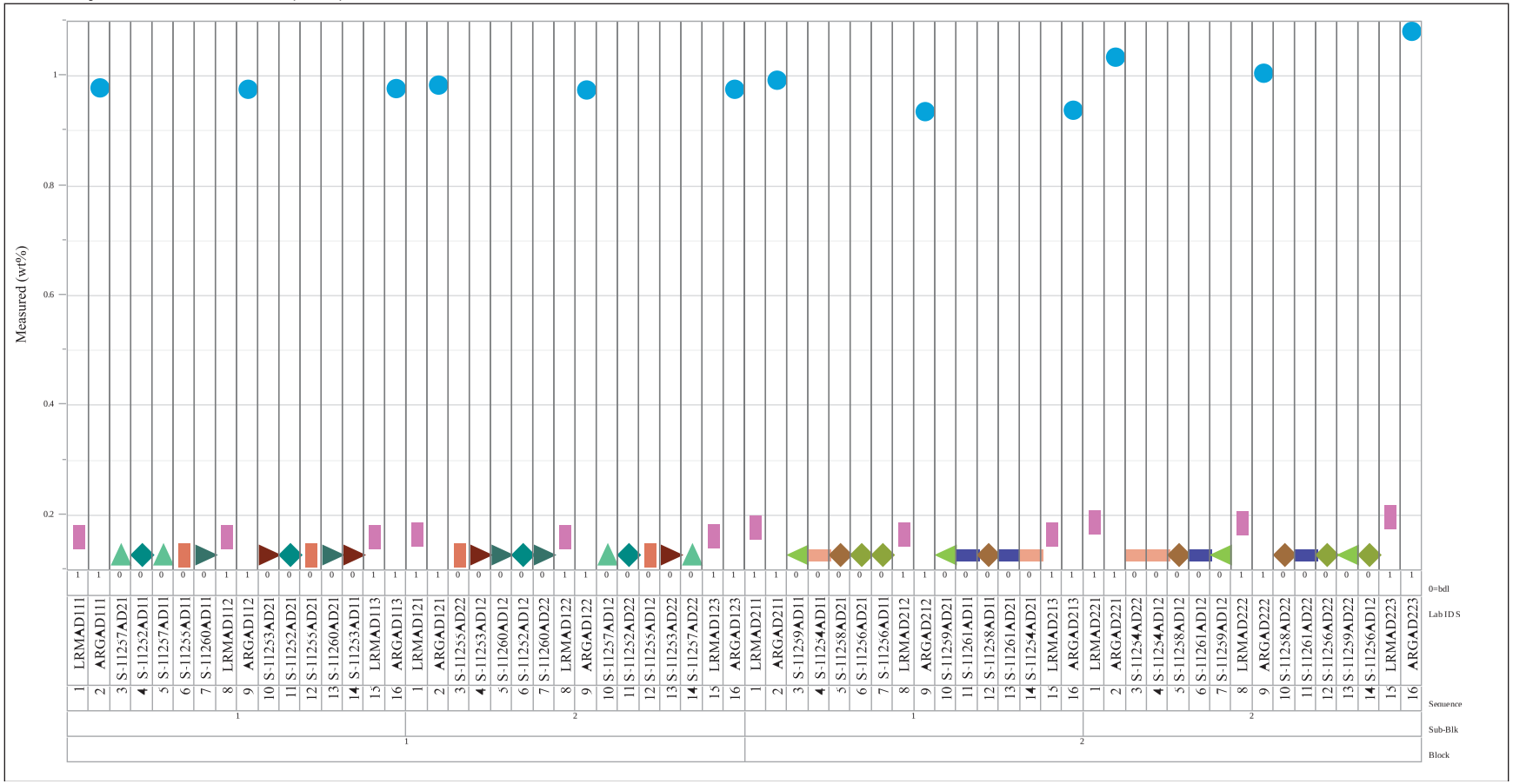


Exhibit B-1. Plots of Oxide Measurements in Analytical Sequence for the Set 2 Glasses (continued)

Oxide=P_2O_5, Prep Method=PF
Variability Chart for Measured (wt%)

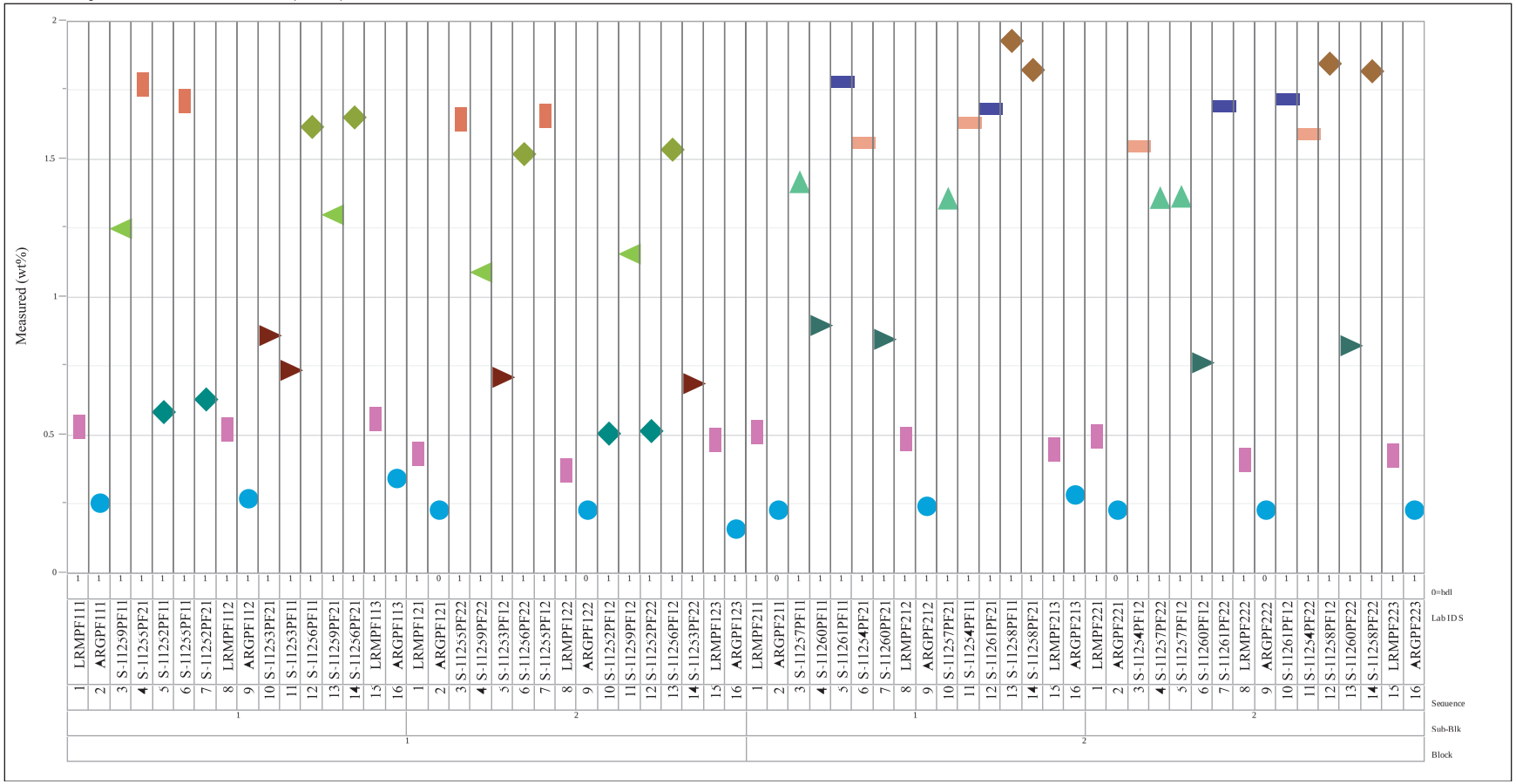


Exhibit B-1. Plots of Oxide Measurements in Analytical Sequence for the Set 2 Glasses (continued)

Oxide=PbO, Prep Method=AD
Variability Chart for Measured (wt%)

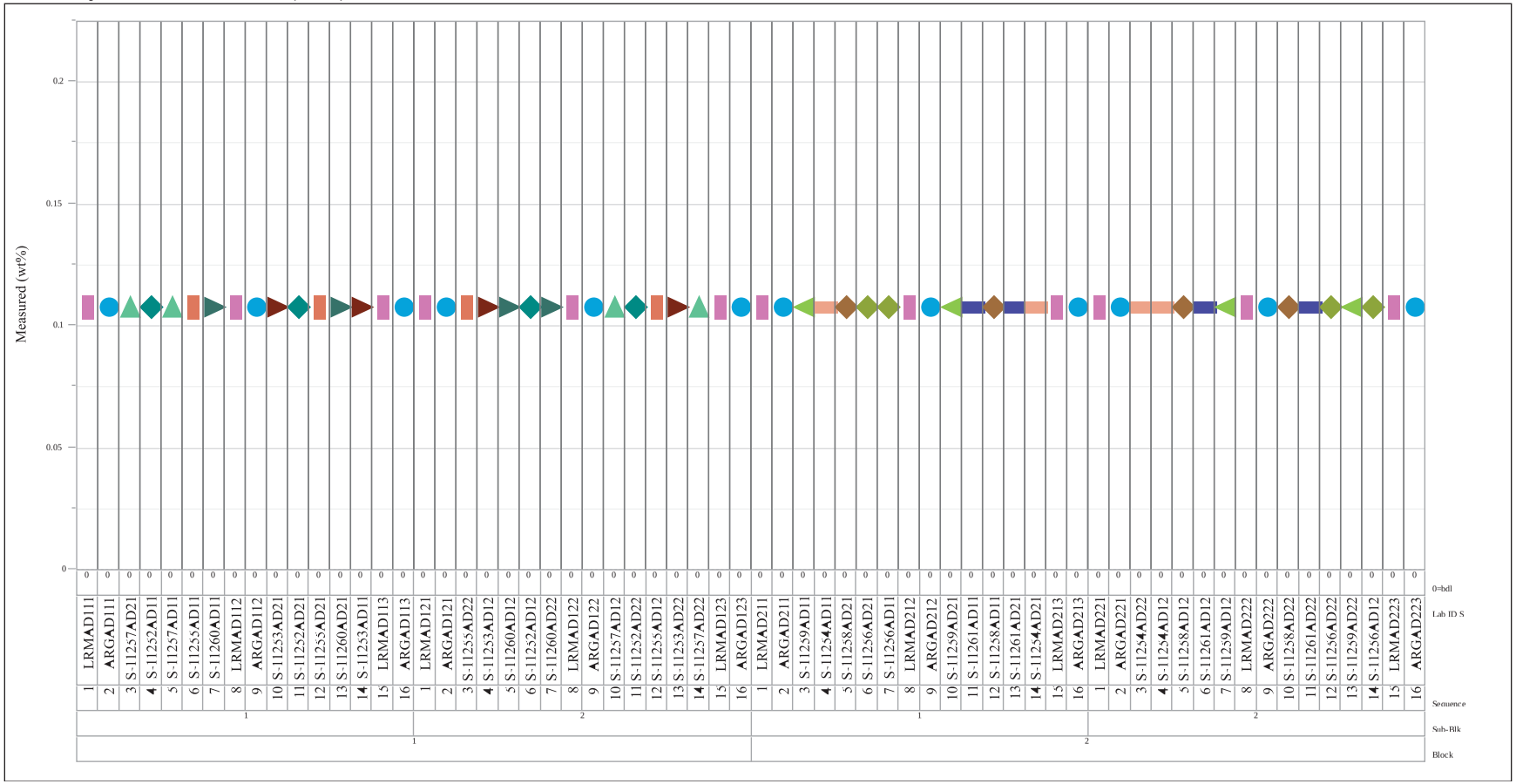


Exhibit B-1. Plots of Oxide Measurements in Analytical Sequence for the Set 2 Glasses (continued)

Oxide=SiO_2, Prep Method=PF
Variability Chart for Measured (wt%)

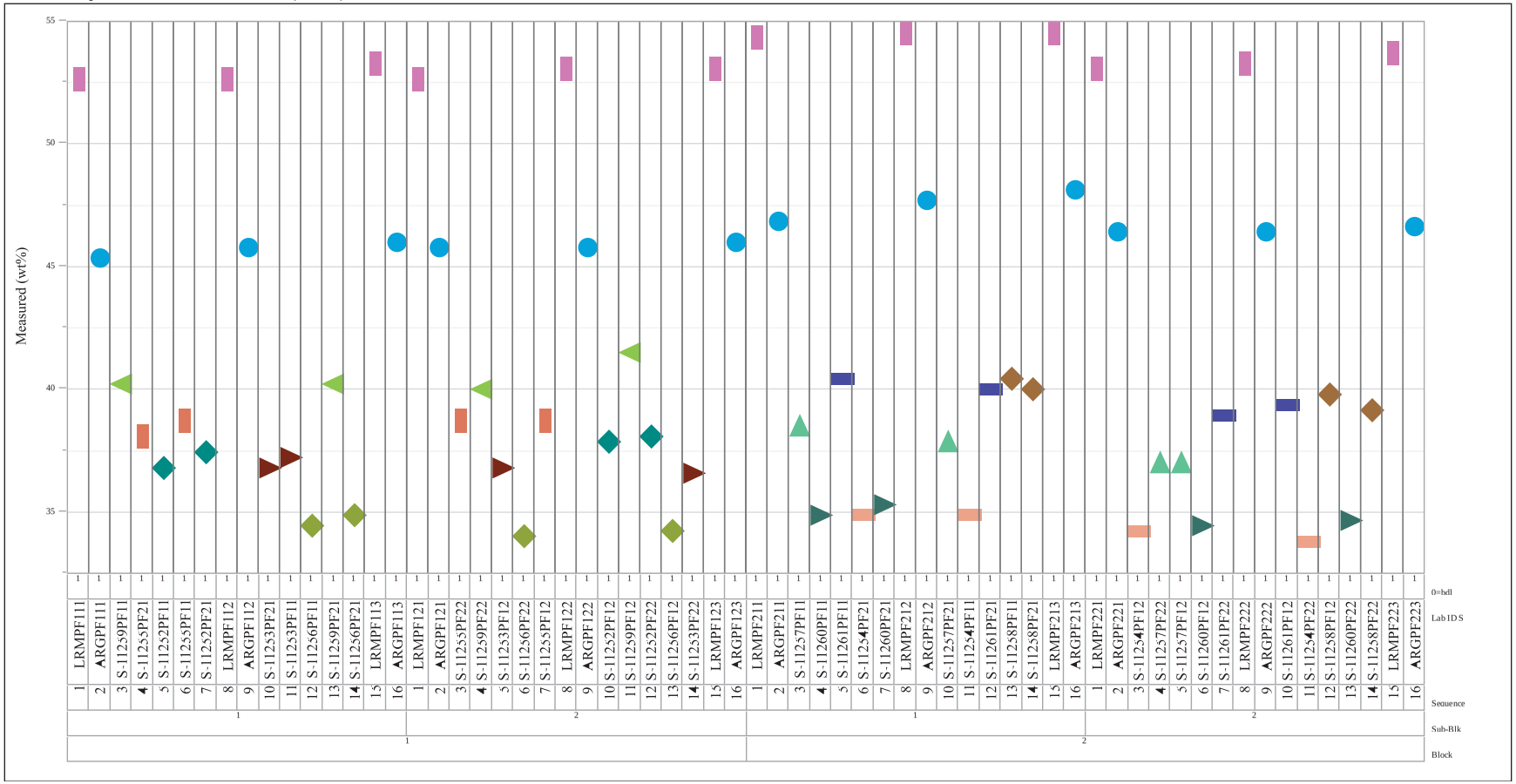


Exhibit B-1. Plots of Oxide Measurements in Analytical Sequence for the Set 2 Glasses (continued)

Oxide=SnO_2, Prep Method=PF
Variability Chart for Measured (wt%)

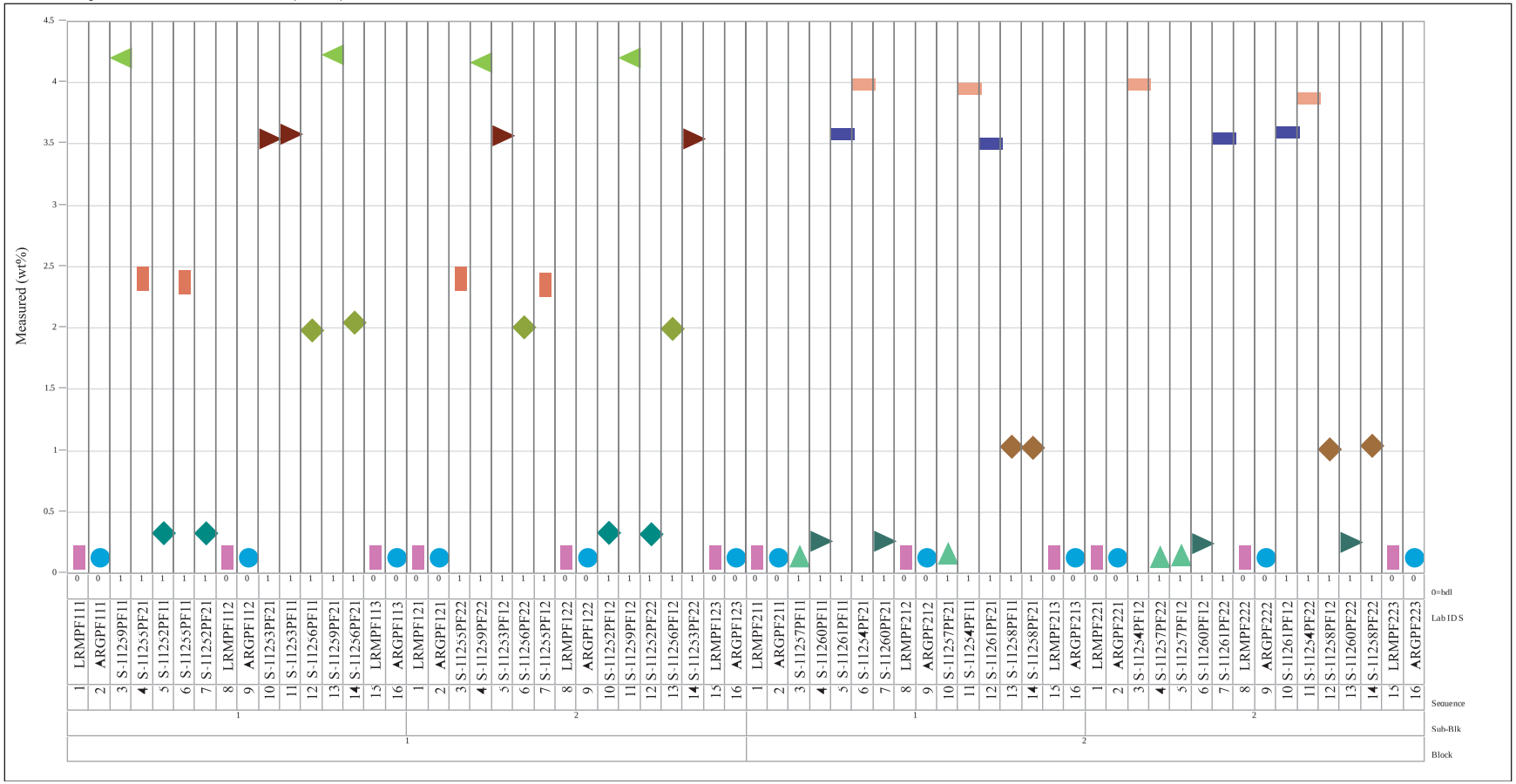


Exhibit B-1. Plots of Oxide Measurements in Analytical Sequence for the Set 2 Glasses (continued)

Oxide=SO_3, Prep Method=AD
Variability Chart for Measured (wt%)

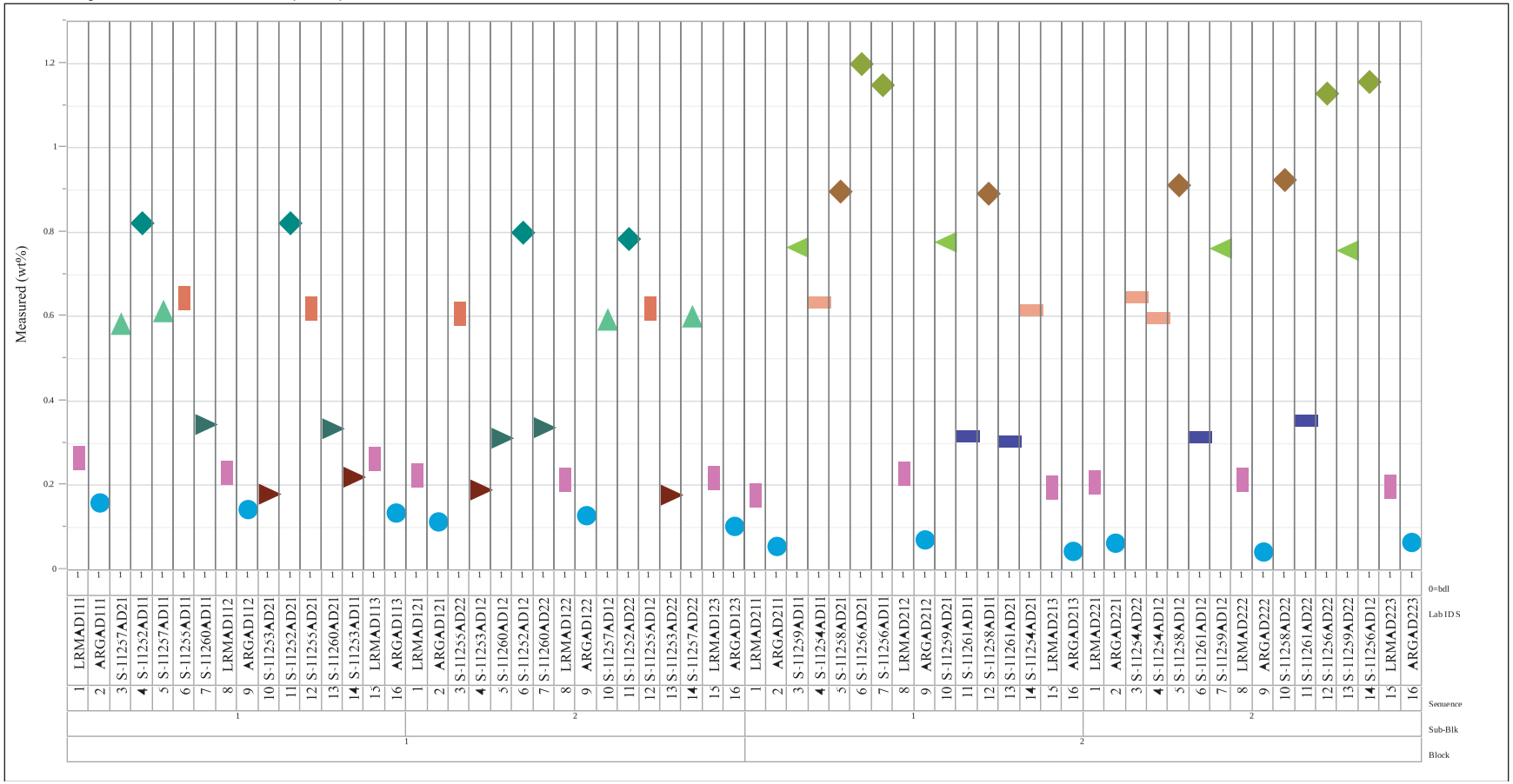


Exhibit B-1. Plots of Oxide Measurements in Analytical Sequence for the Set 2 Glasses (continued)

Oxide=TiO_2, Prep Method=AD
Variability Chart for Measured (wt%)

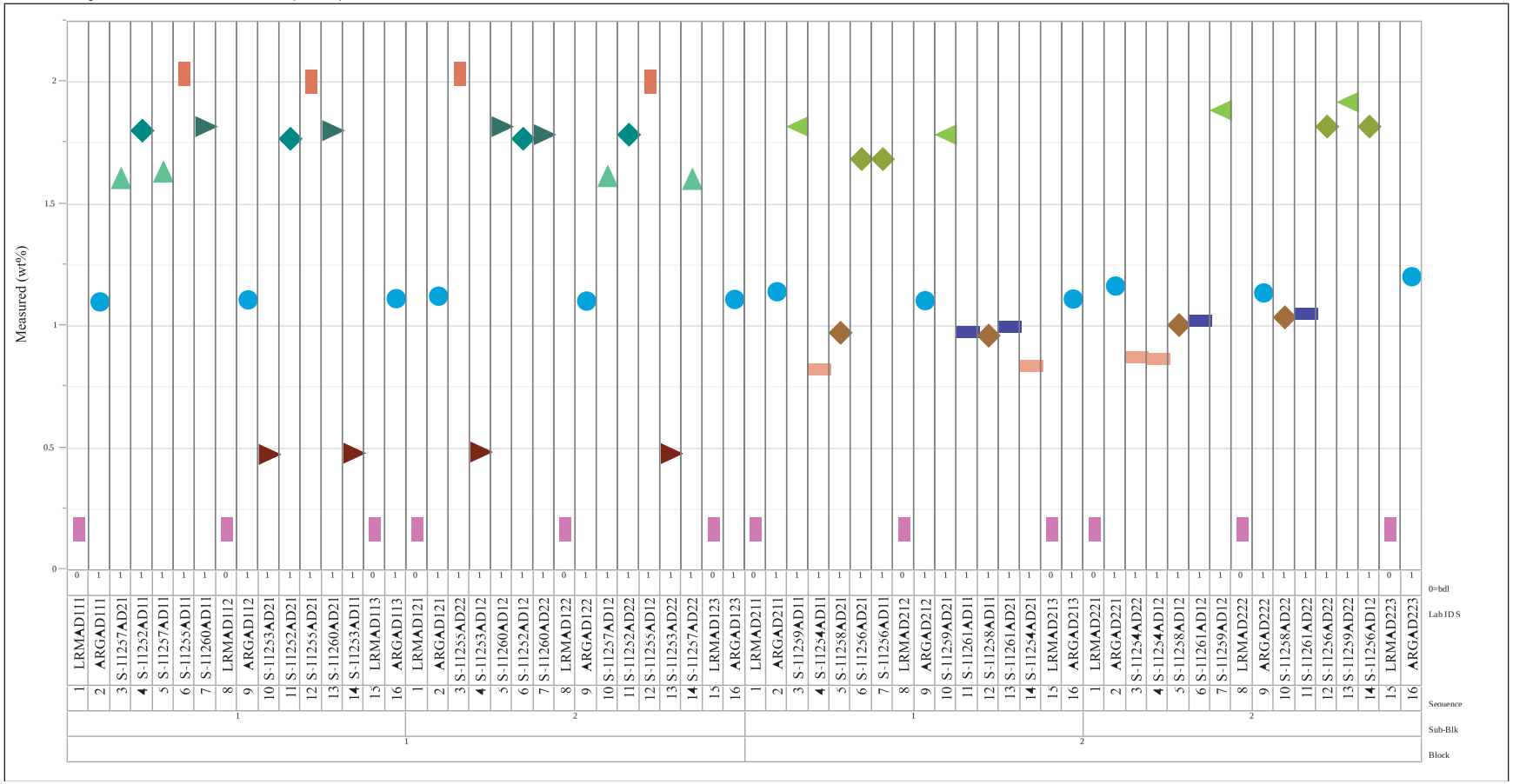


Exhibit B-1. Plots of Oxide Measurements in Analytical Sequence for the Set 2 Glasses (continued)

Oxide=V_2O_5, Prep Method=AD
Variability Chart for Measured (wt%)

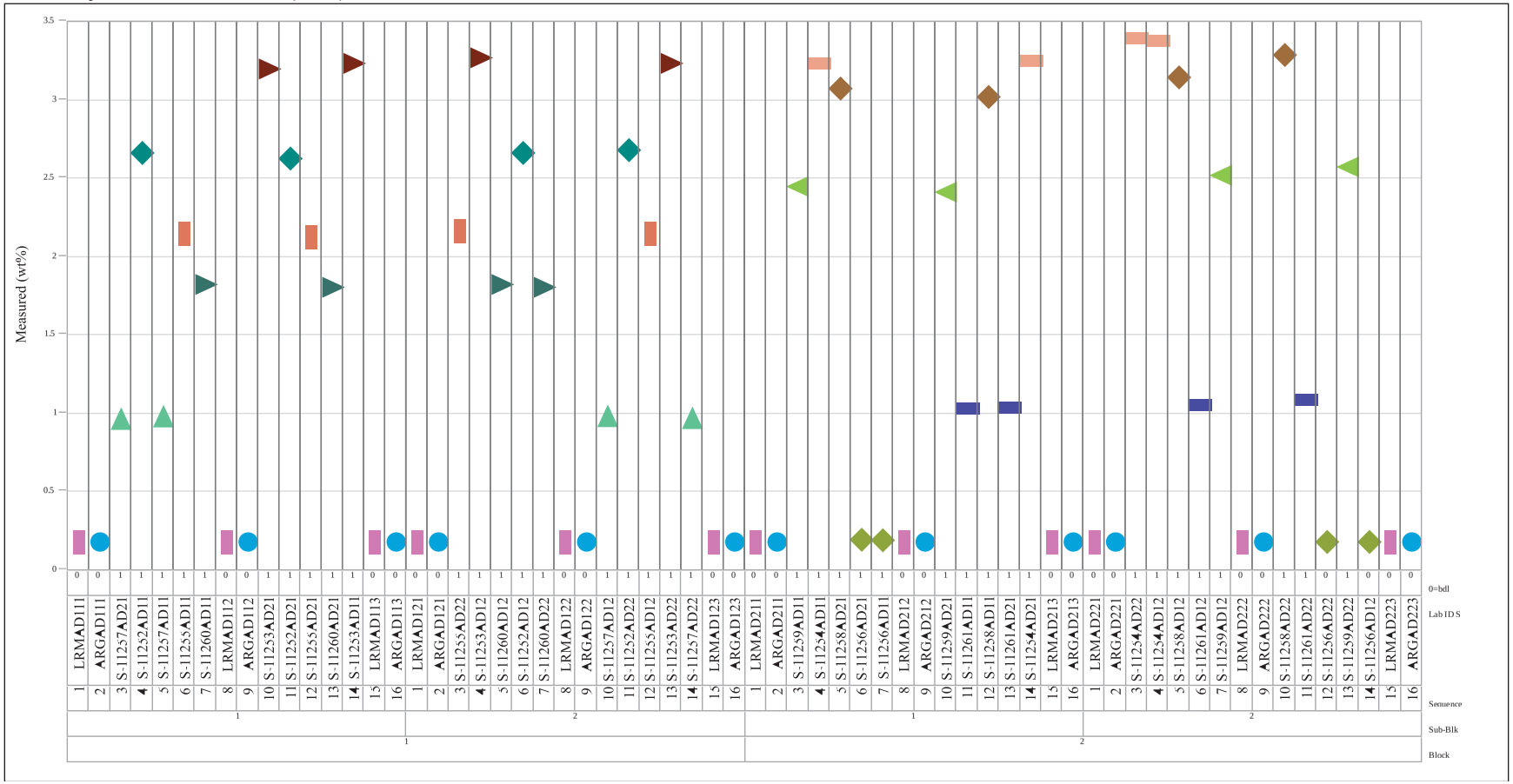


Exhibit B-1. Plots of Oxide Measurements in Analytical Sequence for the Set 2 Glasses (continued)

Oxide=ZnO, Prep Method=AD
Variability Chart for Measured (wt%)

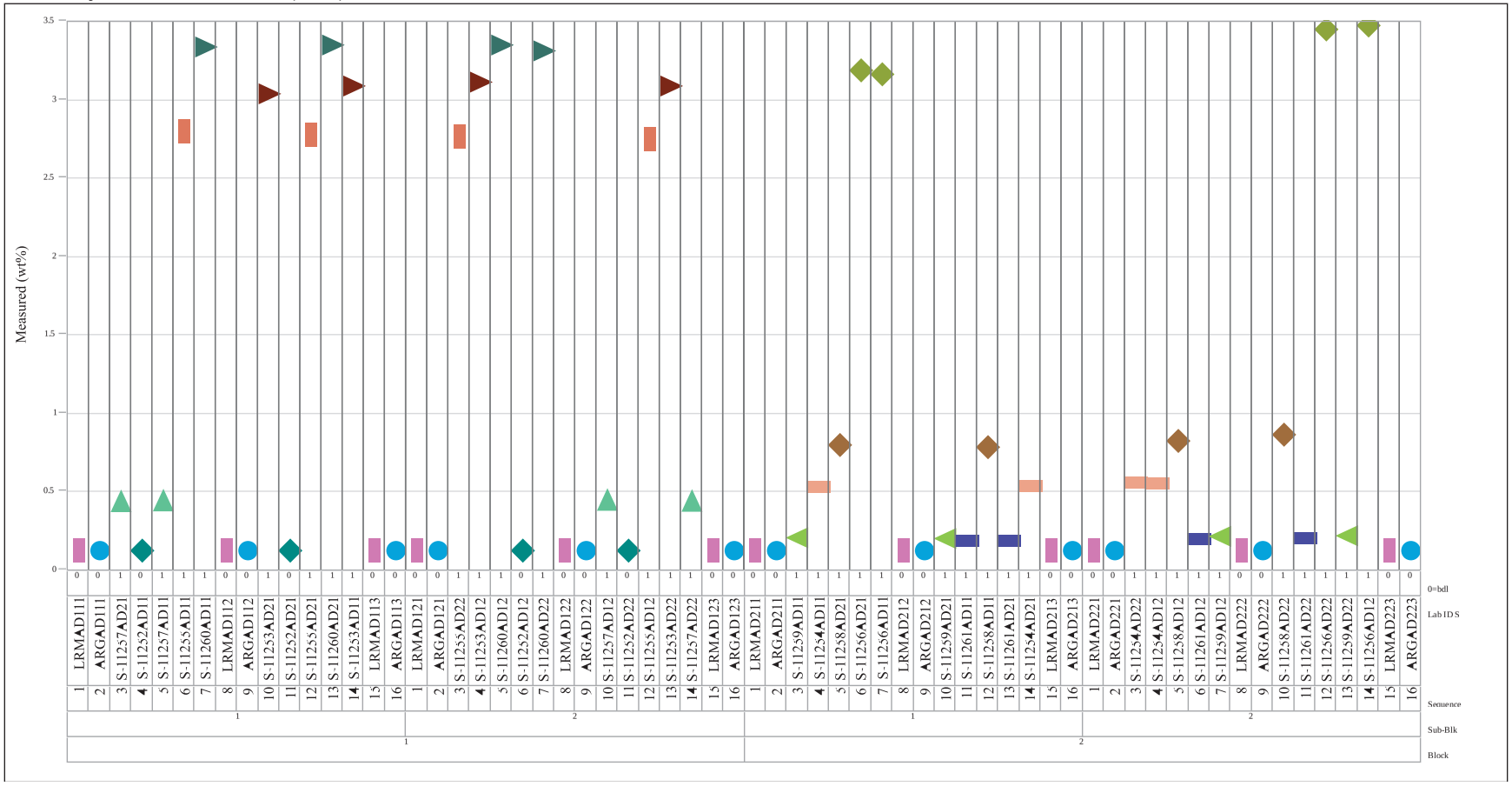


Exhibit B-1. Plots of Oxide Measurements in Analytical Sequence for the Set 2 Glasses (continued)

Oxide=ZrO_2, Prep Method=PF
Variability Chart for Measured (wt%)

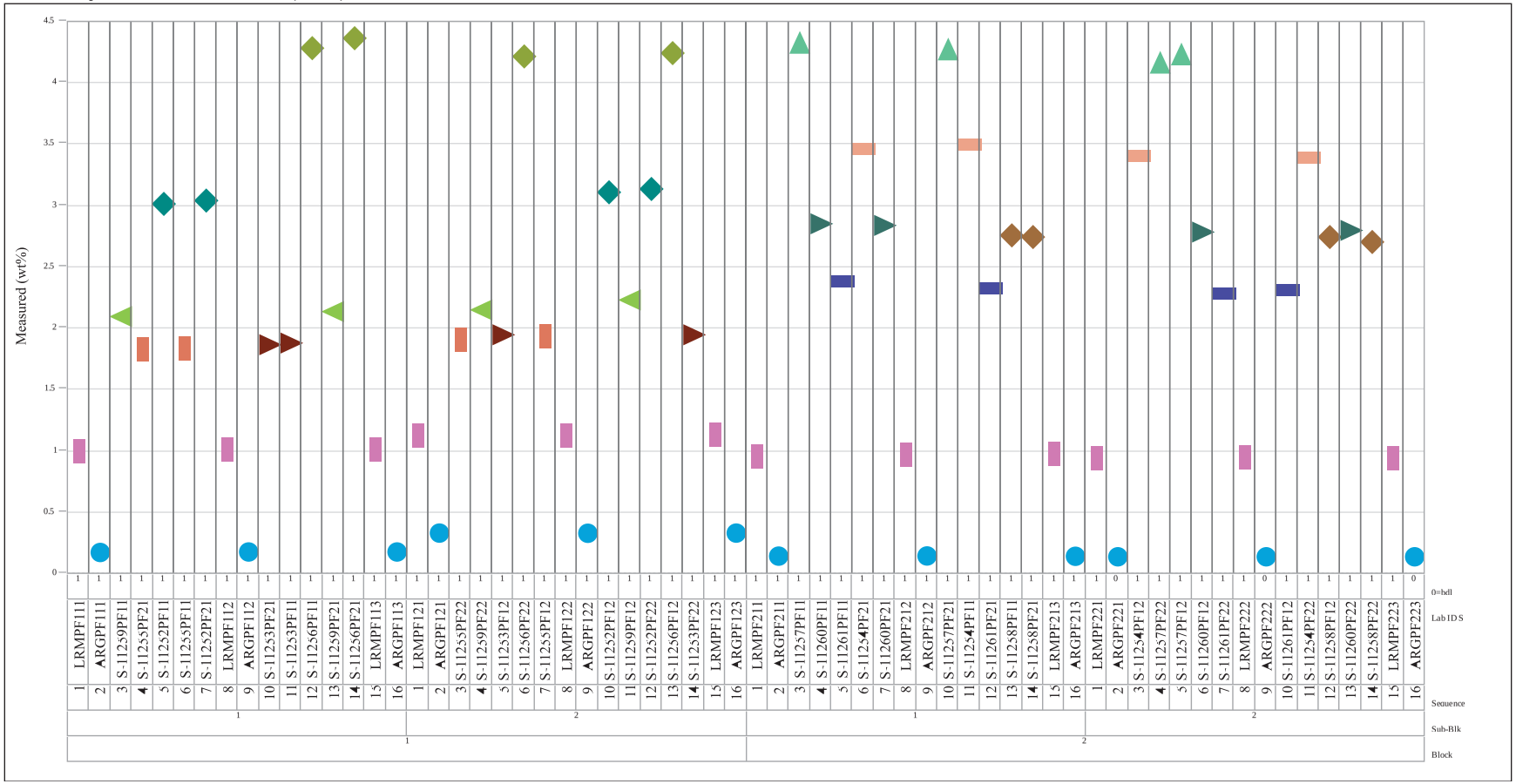


Exhibit B-2. Plots of Oxide Measurements by Set 2 Glass Identifier Grouped by Targeted Concentrations

Oxide=Al_2O_3, Prep Method=PF
Variability Chart for Measured (wt%)

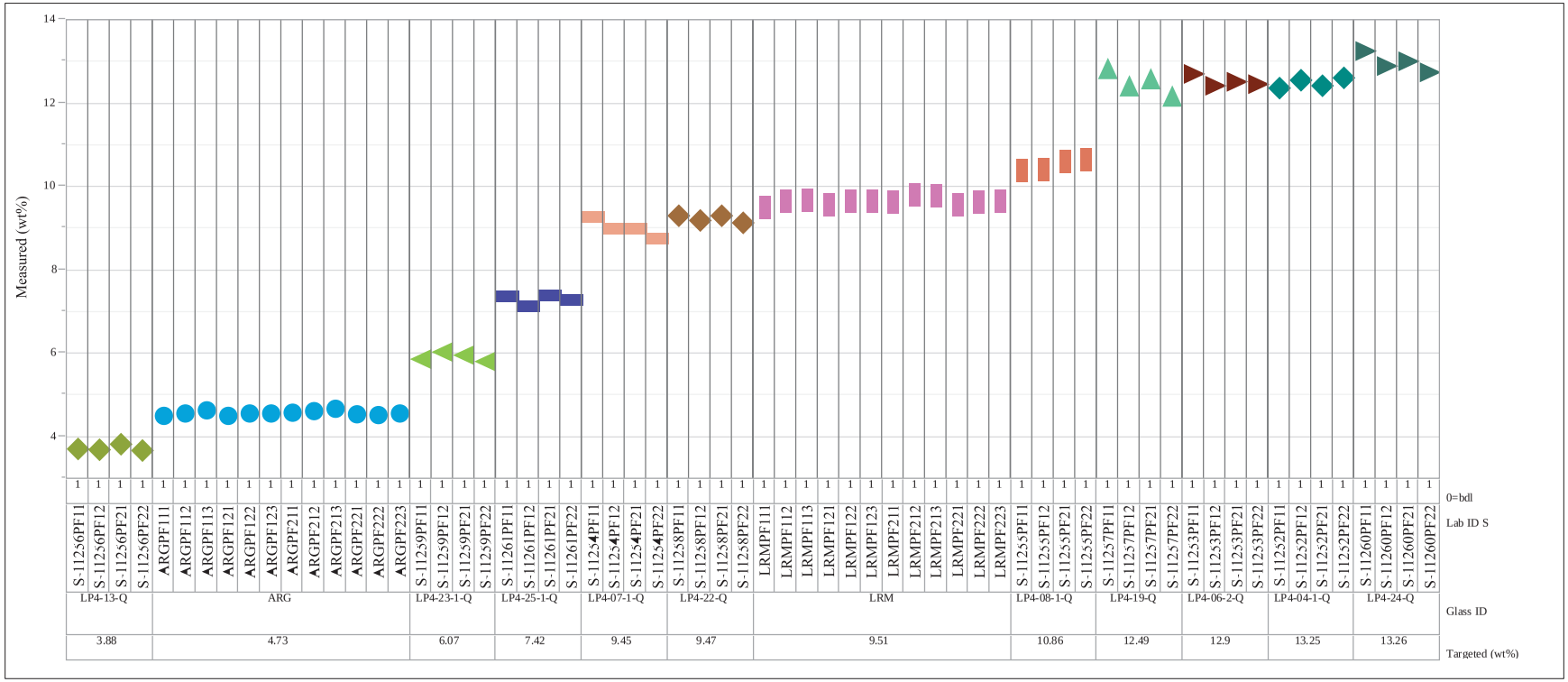


Exhibit B-2. Plots of Oxide Measurements by Set 2 Glass Identifier Grouped by Targeted Concentrations (continued)

Oxide=B_2O_3, Prep Method=PF
Variability Chart for Measured (wt%)

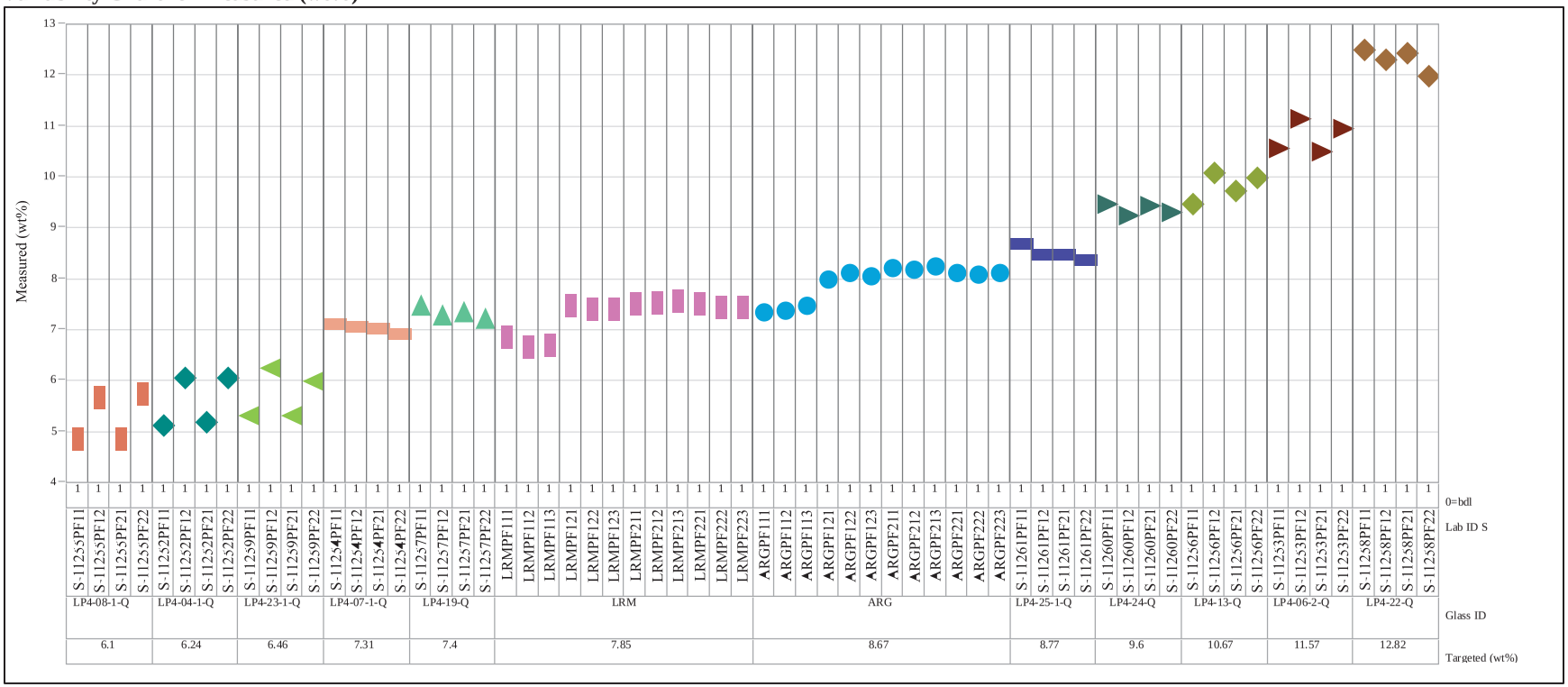


Exhibit B-2. Plots of Oxide Measurements by Set 2 Glass Identifier Grouped by Targeted Concentrations (continued)

Oxide=CaO, Prep Method=AD
Variability Chart for Measured (wt%)

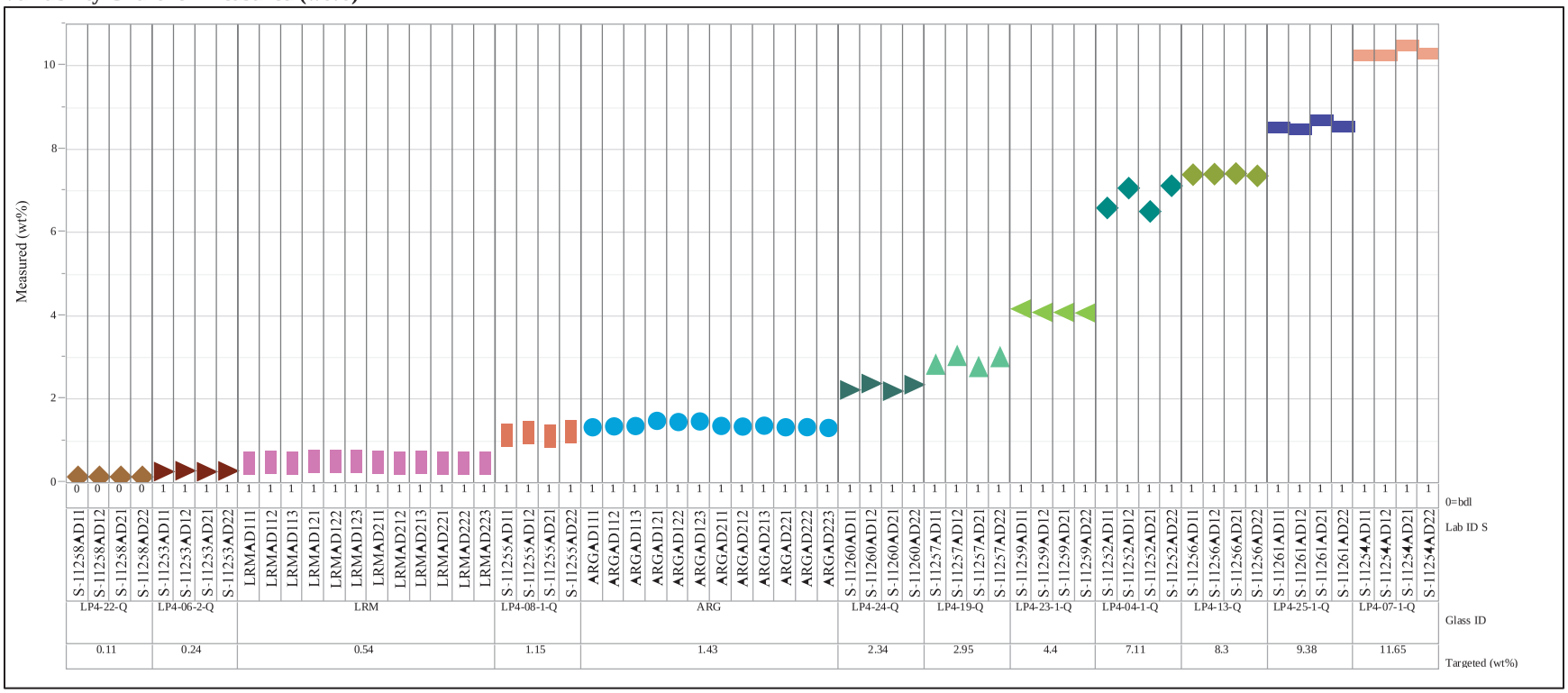


Exhibit B-2. Plots of Oxide Measurements by Set 2 Glass Identifier Grouped by Targeted Concentrations (continued)

Oxide=Cl, Prep Method=KH
Variability Chart for Measured (wt%)

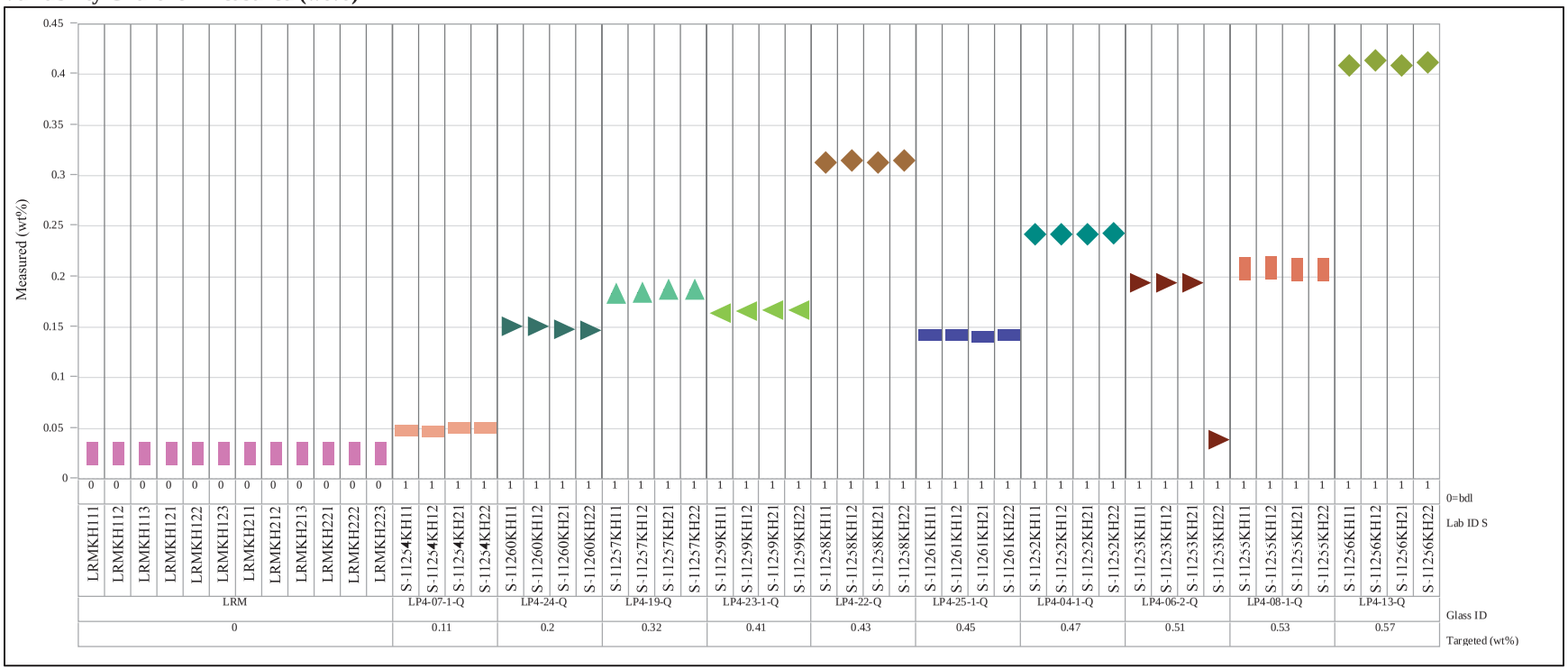


Exhibit B-2. Plots of Oxide Measurements by Set 2 Glass Identifier Grouped by Targeted Concentrations (continued)

Oxide=Cr_2O_3, Prep Method=AD
Variability Chart for Measured (wt%)

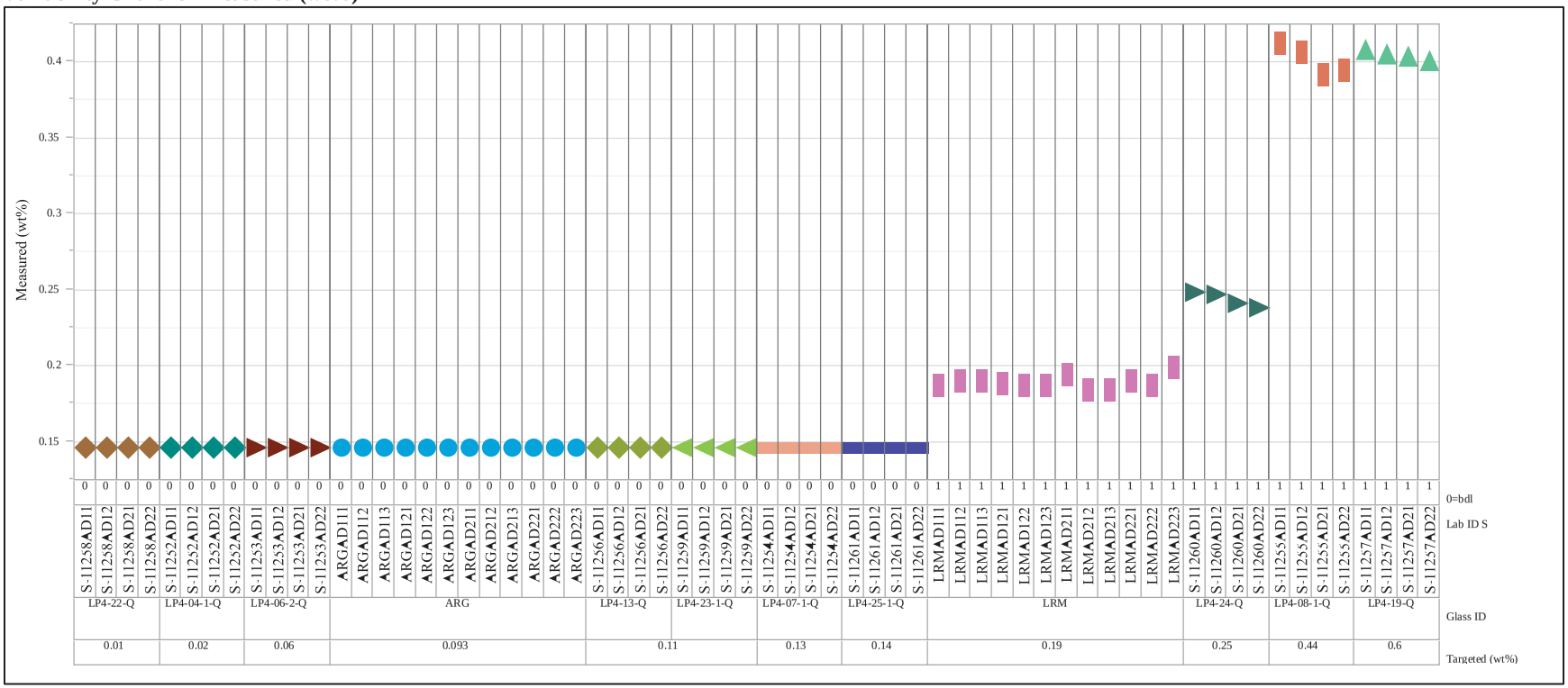


Exhibit B-2. Plots of Oxide Measurements by Set 2 Glass Identifier Grouped by Targeted Concentrations (continued)

Oxide=F, Prep Method=KH
Variability Chart for Measured (wt%)

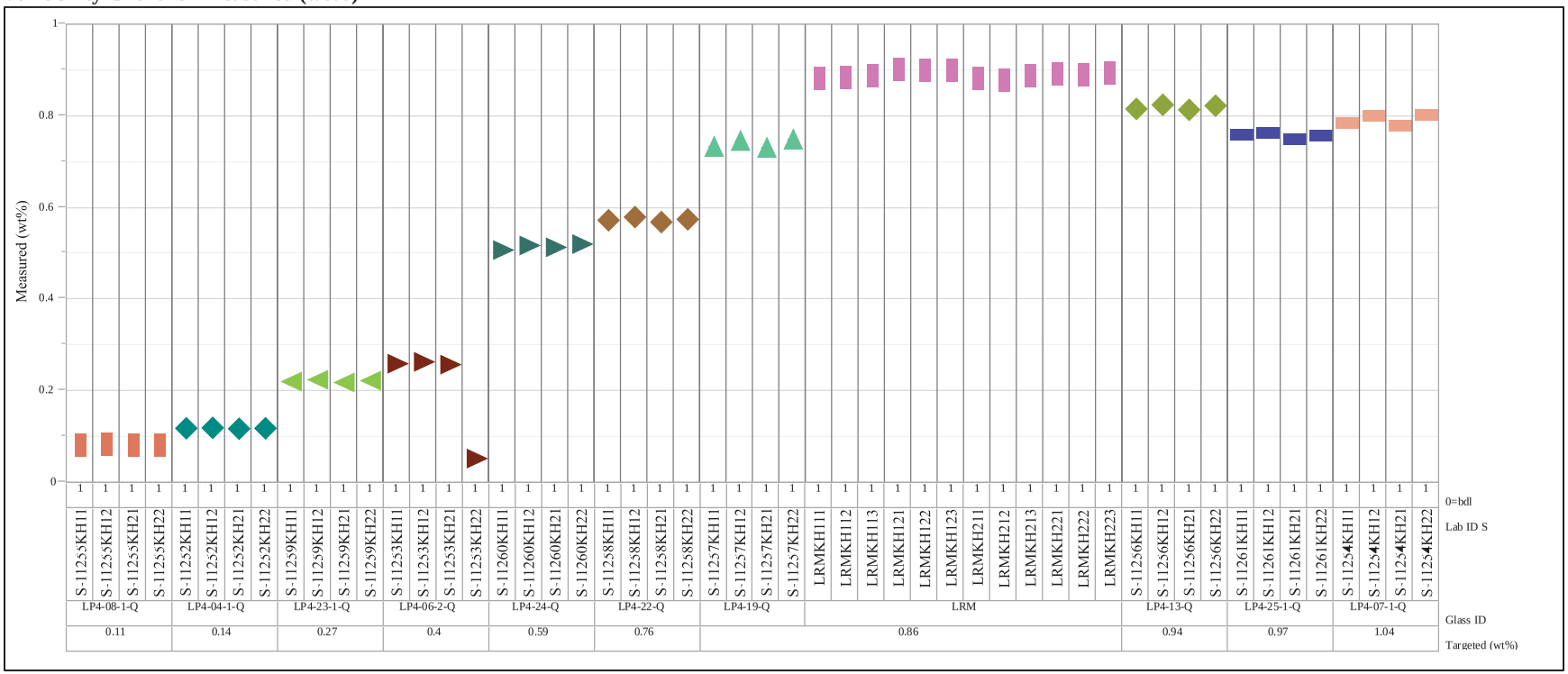
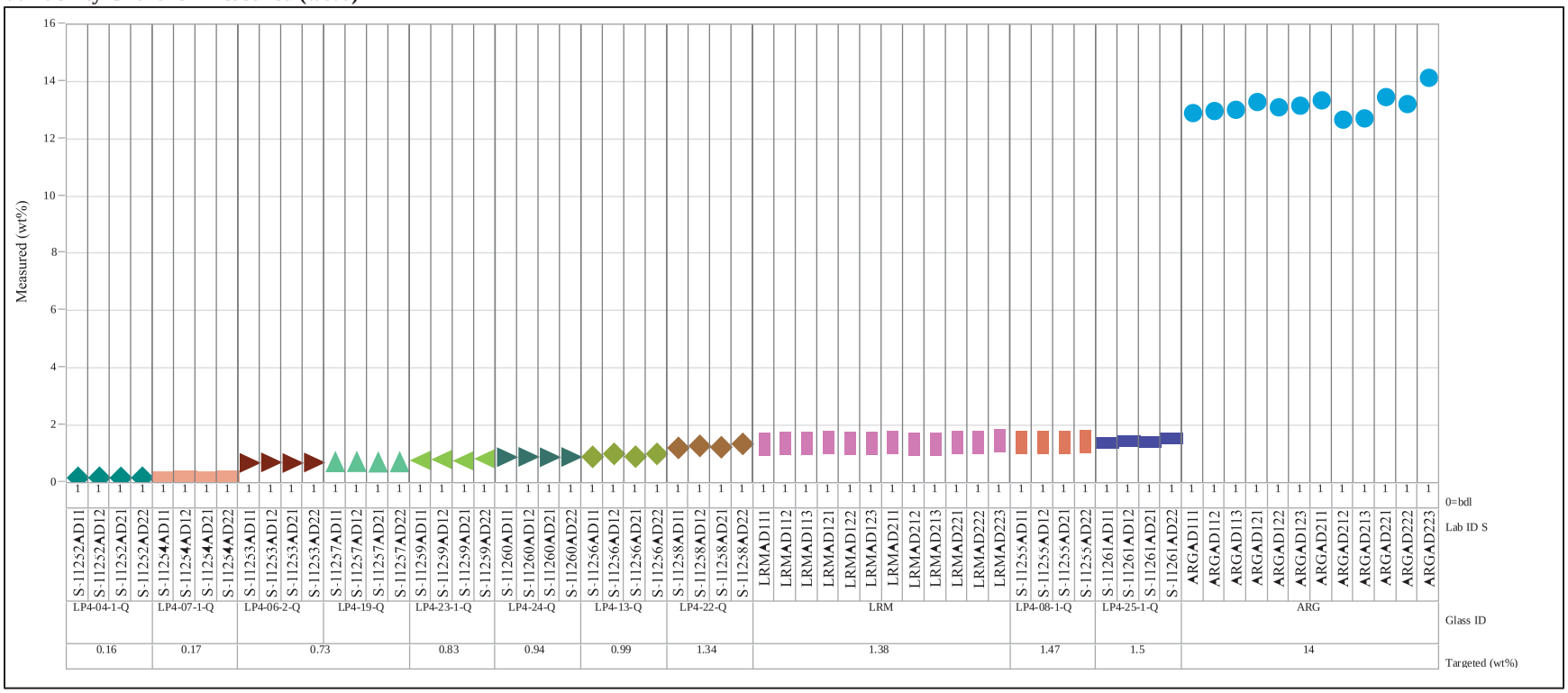


Exhibit B-2. Plots of Oxide Measurements by Set 2 Glass Identifier Grouped by Targeted Concentrations (continued)

Oxide=Fe_2O_3, Prep Method=AD
Variability Chart for Measured (wt%)



0.17

Exhibit B-2. Plots of Oxide Measurements by Set 2 Glass Identifier Grouped by Targeted Concentrations (continued)

Oxide=K_2O, Prep Method=AD
Variability Chart for Measured (wt%)

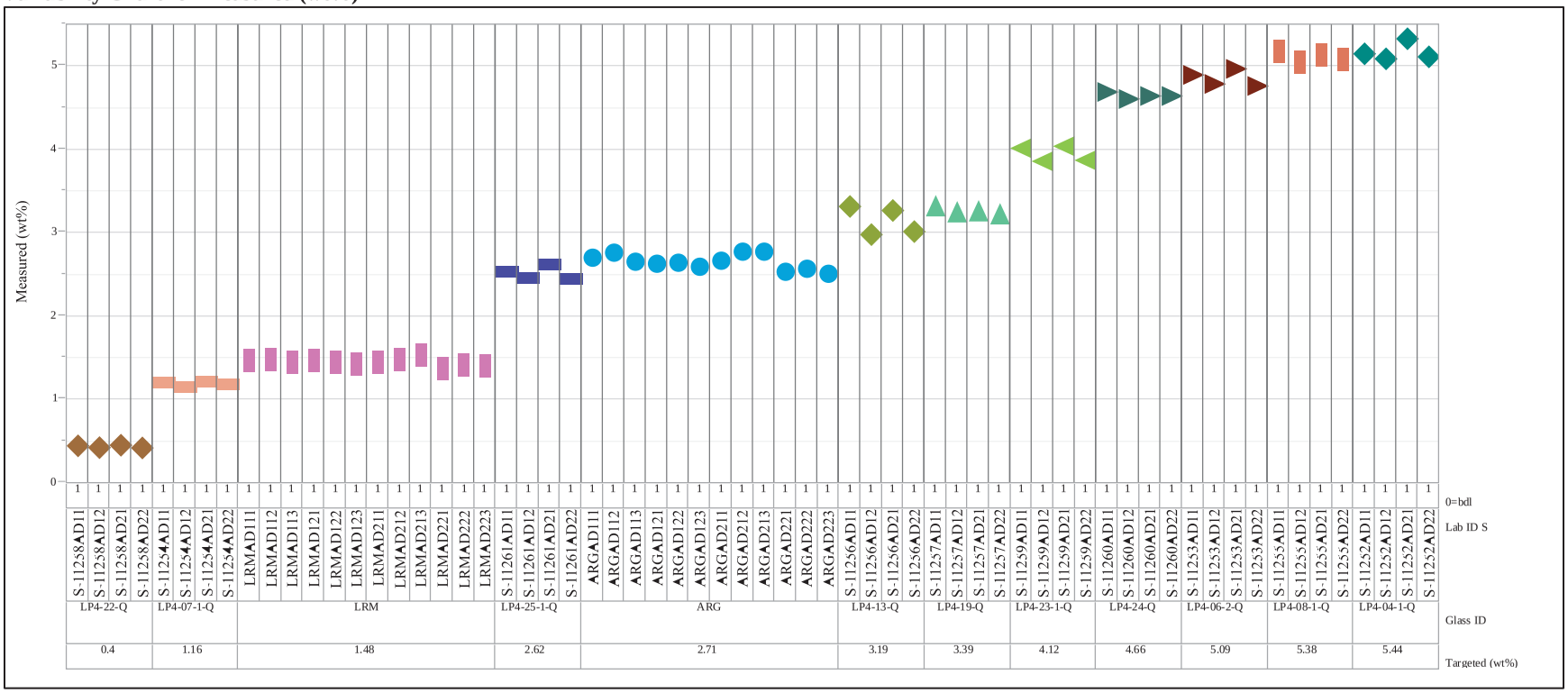


Exhibit B-2. Plots of Oxide Measurements by Set 2 Glass Identifier Grouped by Targeted Concentrations (continued)

Oxide=Li_2O, Prep Method=PF
Variability Chart for Measured (wt%)

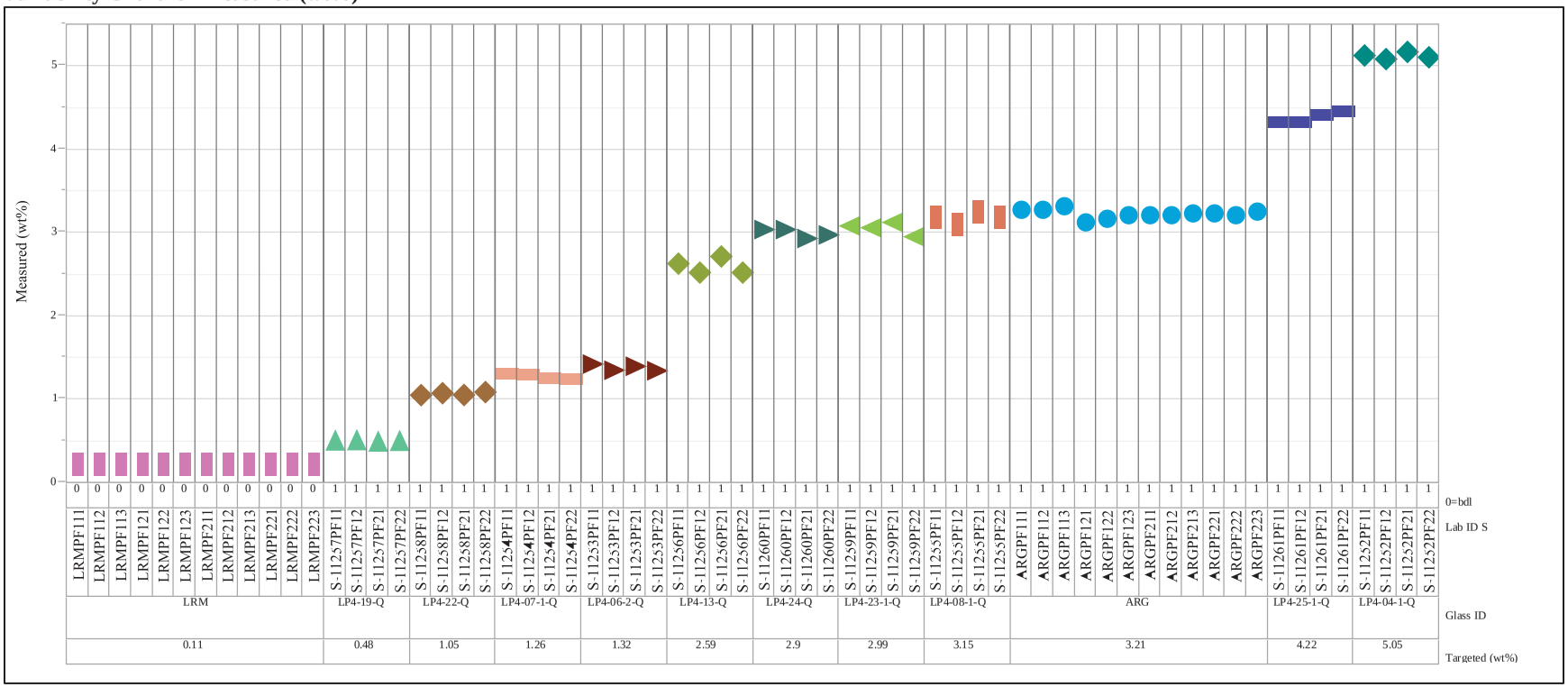


Exhibit B-2. Plots of Oxide Measurements by Set 2 Glass Identifier Grouped by Targeted Concentrations (continued)

Oxide=MgO, Prep Method=PF
Variability Chart for Measured (wt%)

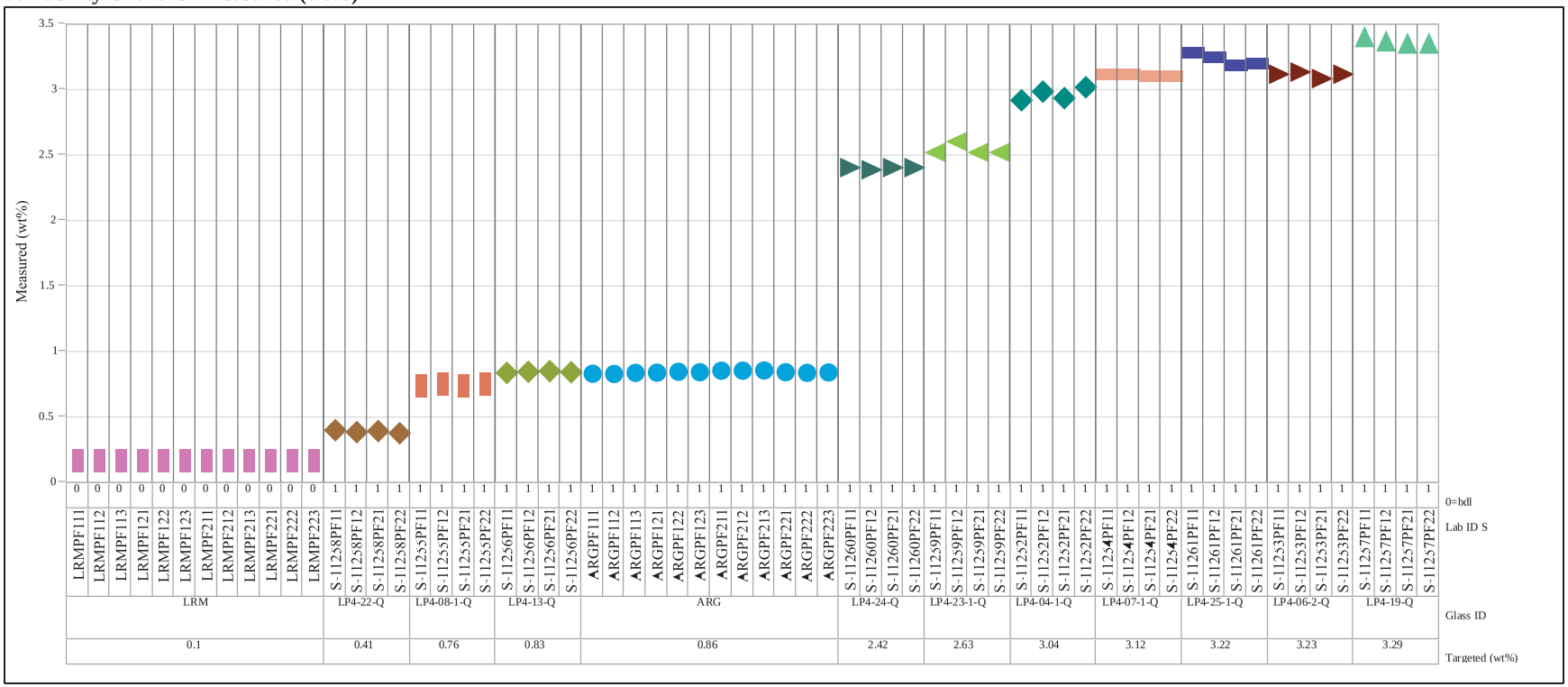


Exhibit B-2. Plots of Oxide Measurements by Set 2 Glass Identifier Grouped by Targeted Concentrations (continued)

Oxide=Na_2O, Prep Method=AD
Variability Chart for Measured (wt%)

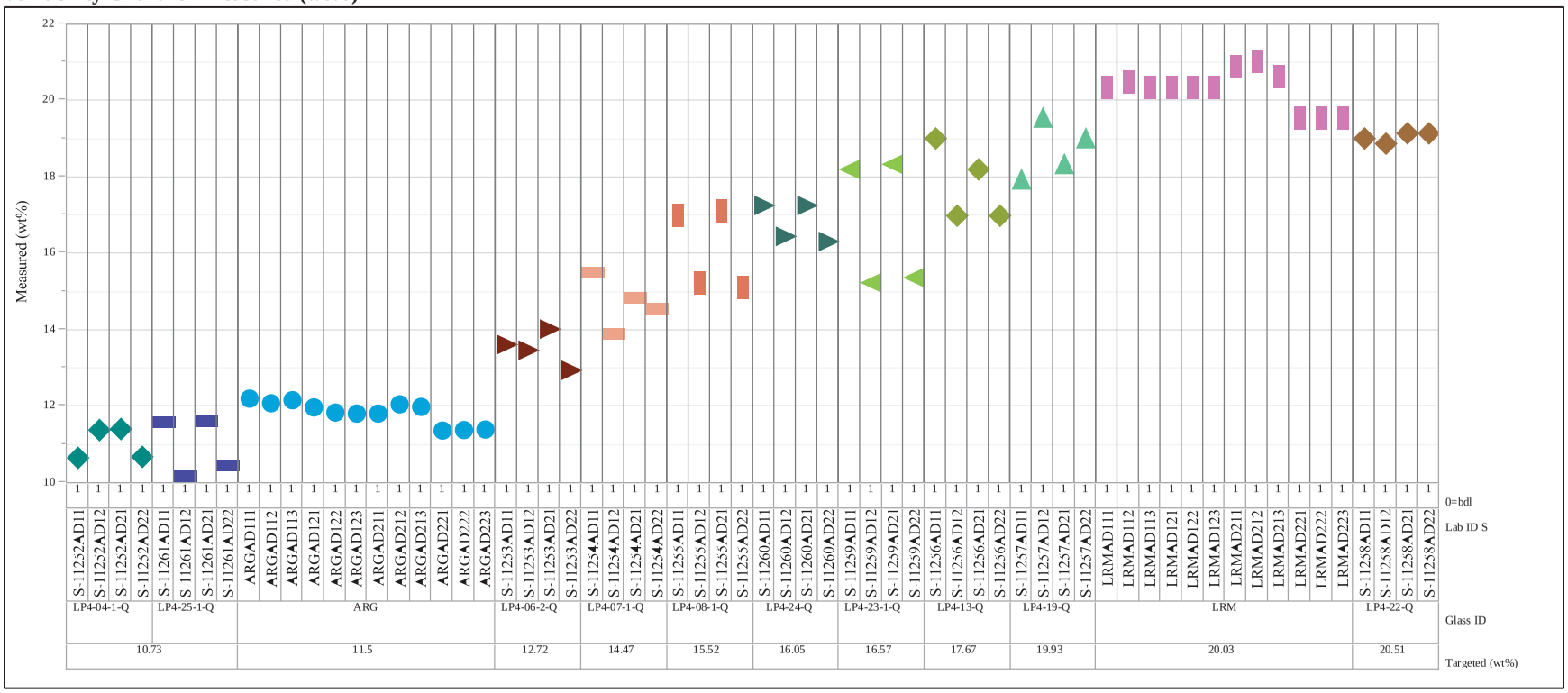


Exhibit B-2. Plots of Oxide Measurements by Set 2 Glass Identifier Grouped by Targeted Concentrations (continued)

Oxide=NiO, Prep Method=AD
Variability Chart for Measured (wt%)

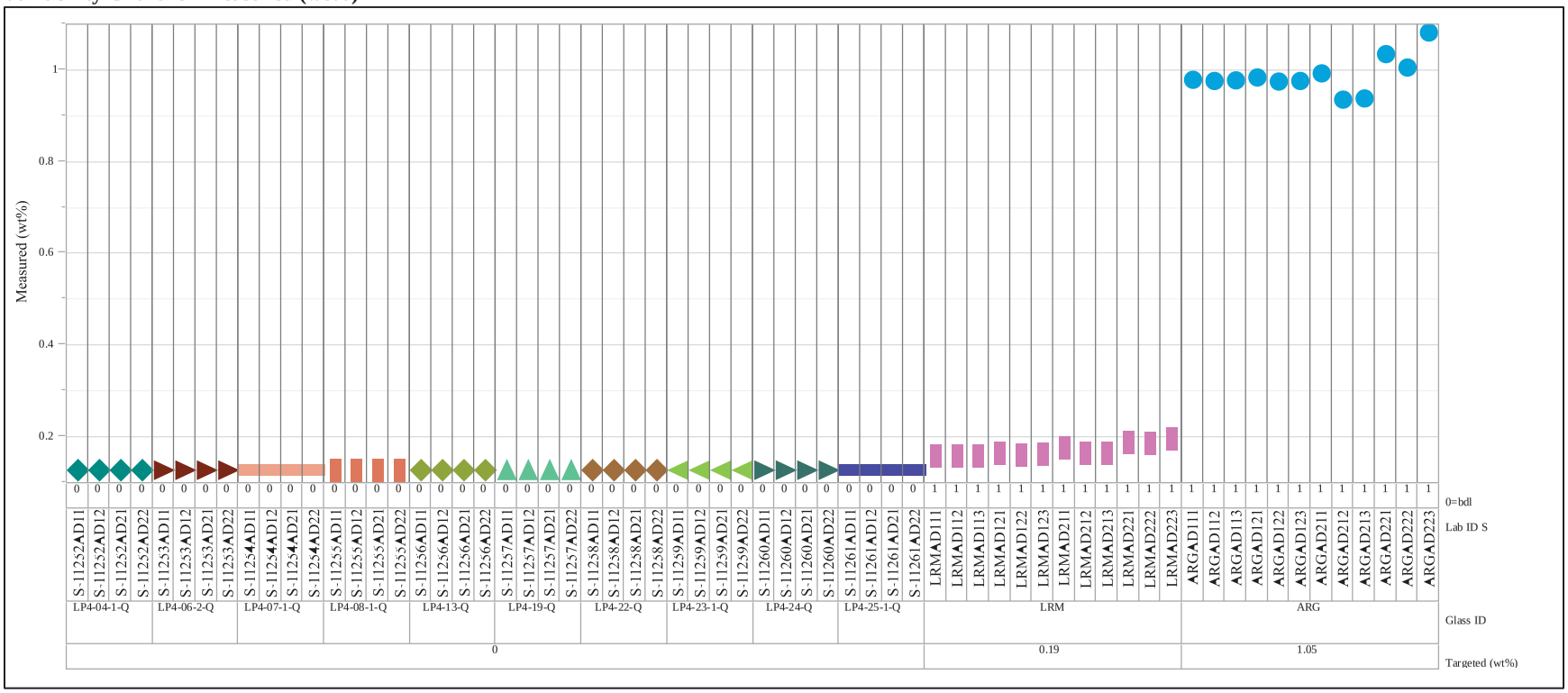


Exhibit B-2. Plots of Oxide Measurements by Set 2 Glass Identifier Grouped by Targeted Concentrations (continued)

Oxide=P_2O_5, Prep Method=AD
Variability Chart for Measured (wt%)

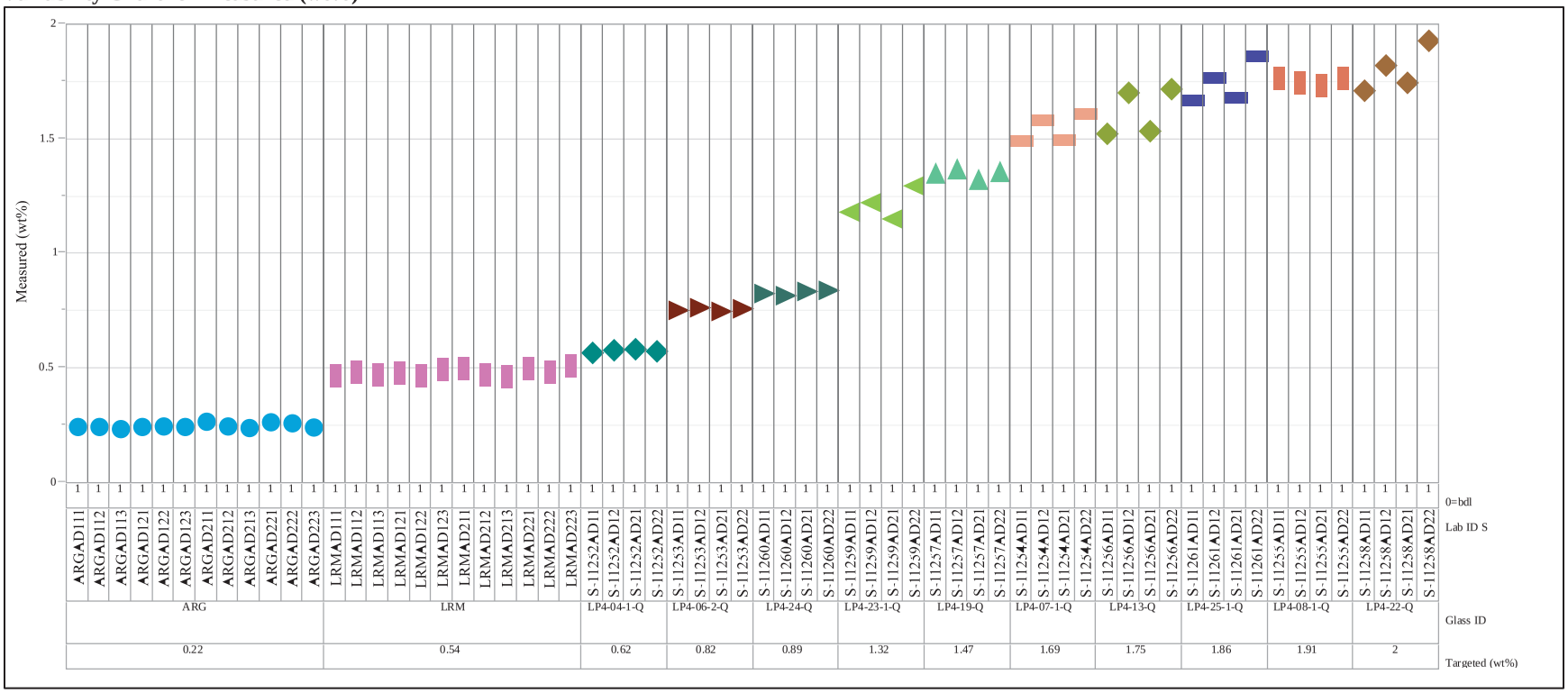


Exhibit B-2. Plots of Oxide Measurements by Set 2 Glass Identifier Grouped by Targeted Concentrations (continued)

Oxide=PbO, Prep Method=AD
Variability Chart for Measured (wt%)

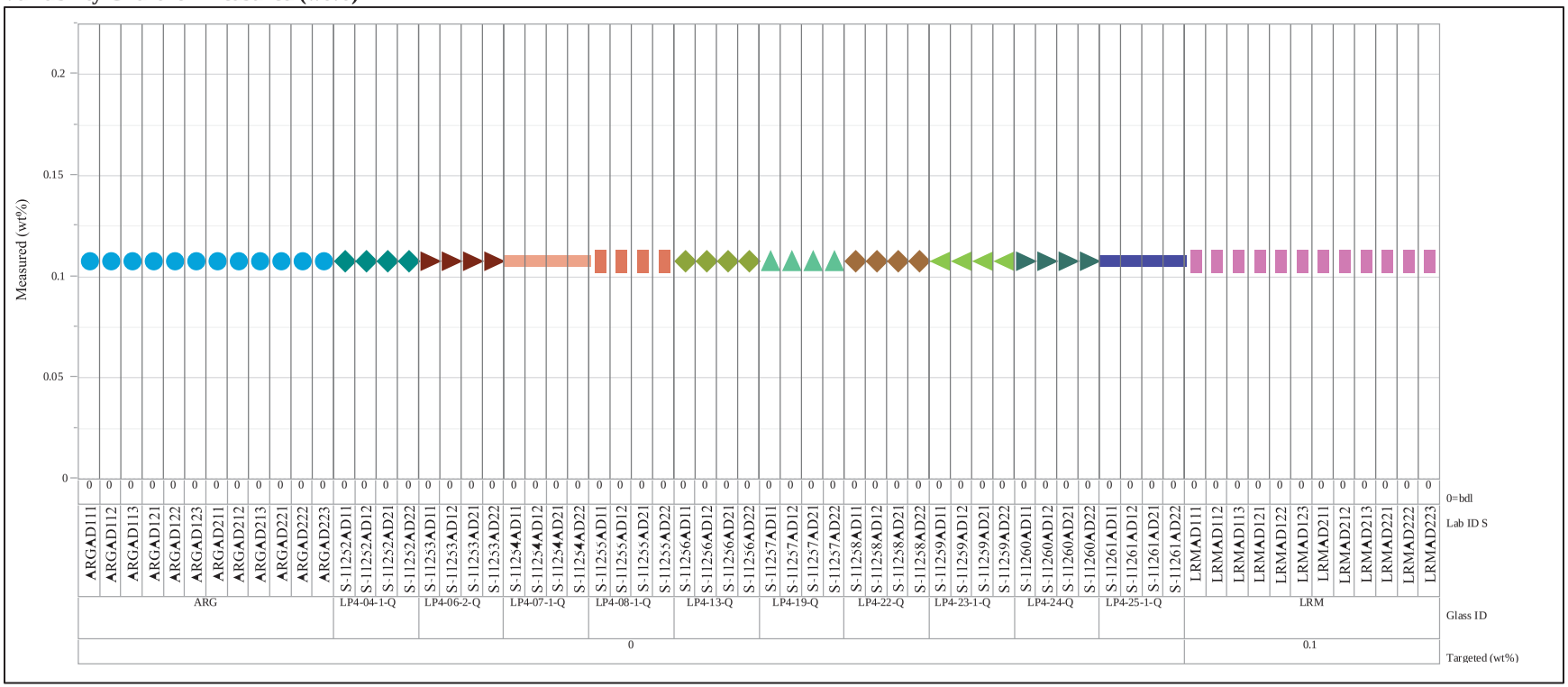


Exhibit B-2. Plots of Oxide Measurements by Set 2 Glass Identifier Grouped by Targeted Concentrations (continued)

Oxide=SiO_2, Prep Method=PF
Variability Chart for Measured (wt%)

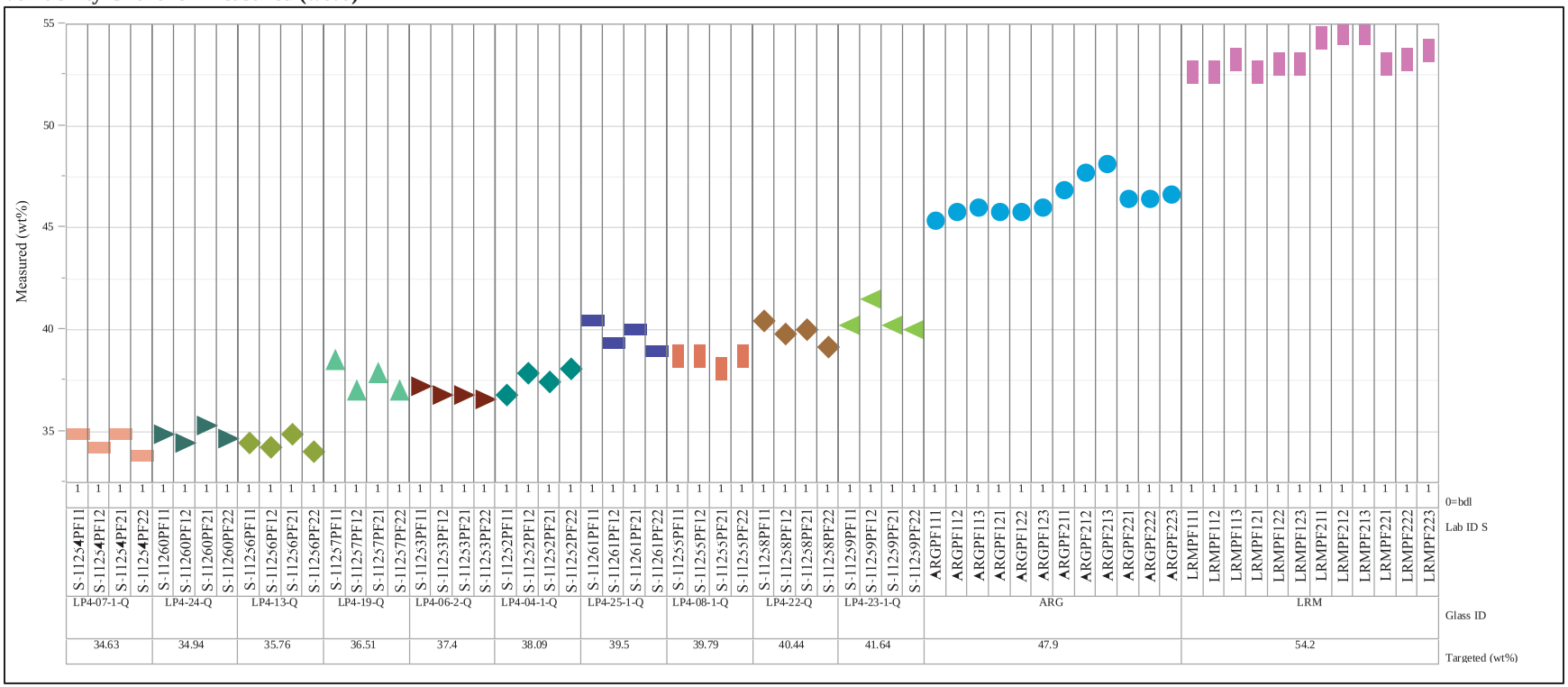


Exhibit B-2. Plots of Oxide Measurements by Set 2 Glass Identifier Grouped by Targeted Concentrations (continued)

Oxide=SnO_2, Prep Method=PF
Variability Chart for Measured (wt%)

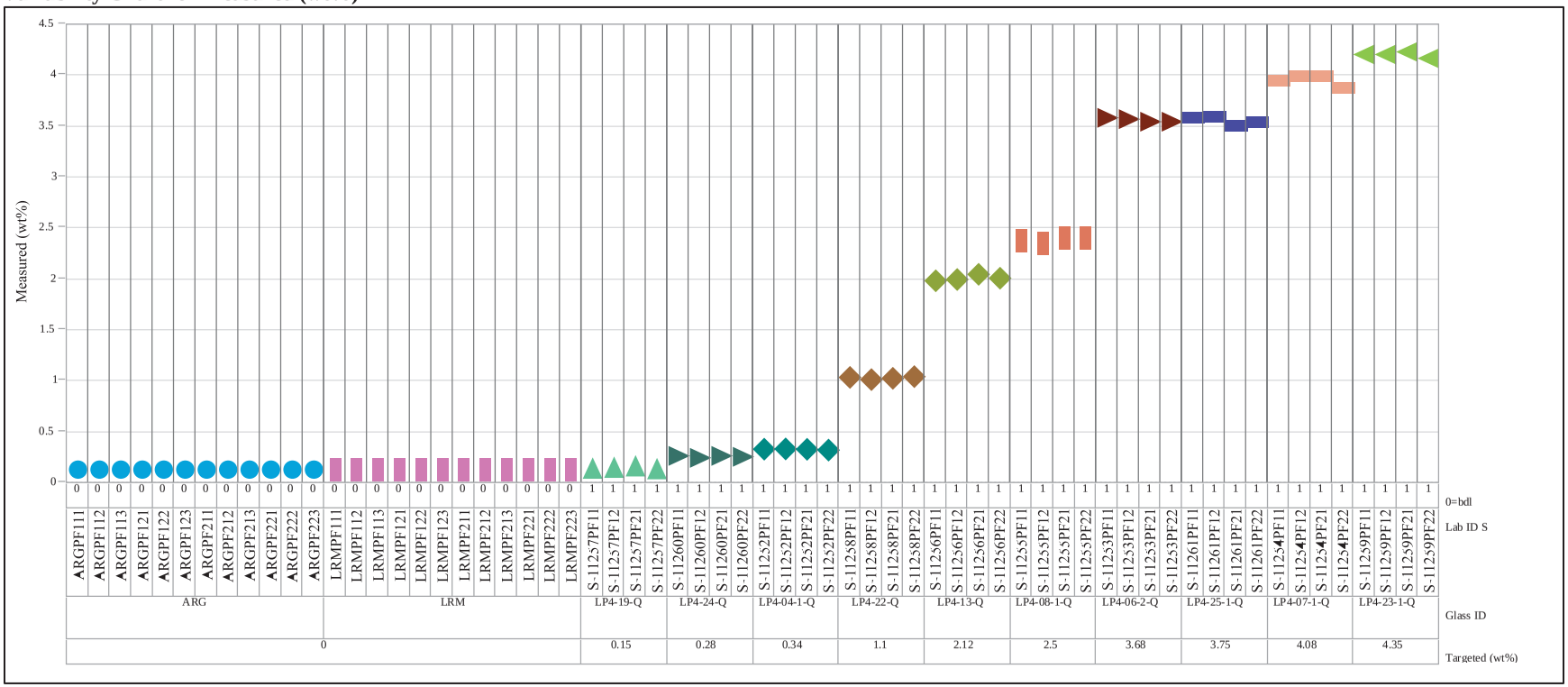


Exhibit B-2. Plots of Oxide Measurements by Set 2 Glass Identifier Grouped by Targeted Concentrations (continued)

Oxide=SO_3, Prep Method=AD
Variability Chart for Measured (wt%)

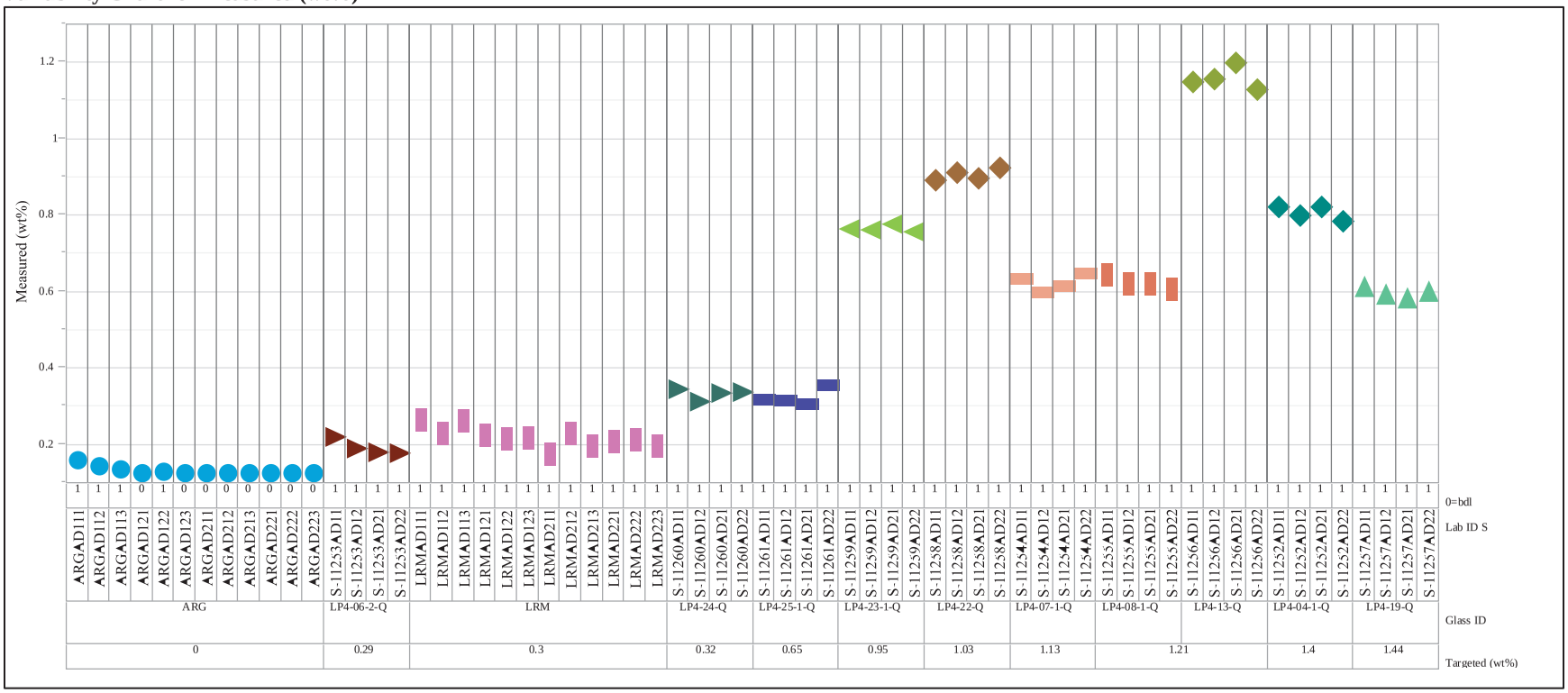


Exhibit B-2. Plots of Oxide Measurements by Set 2 Glass Identifier Grouped by Targeted Concentrations (continued)

Oxide=TiO_2, Prep Method=AD
Variability Chart for Measured (wt%)

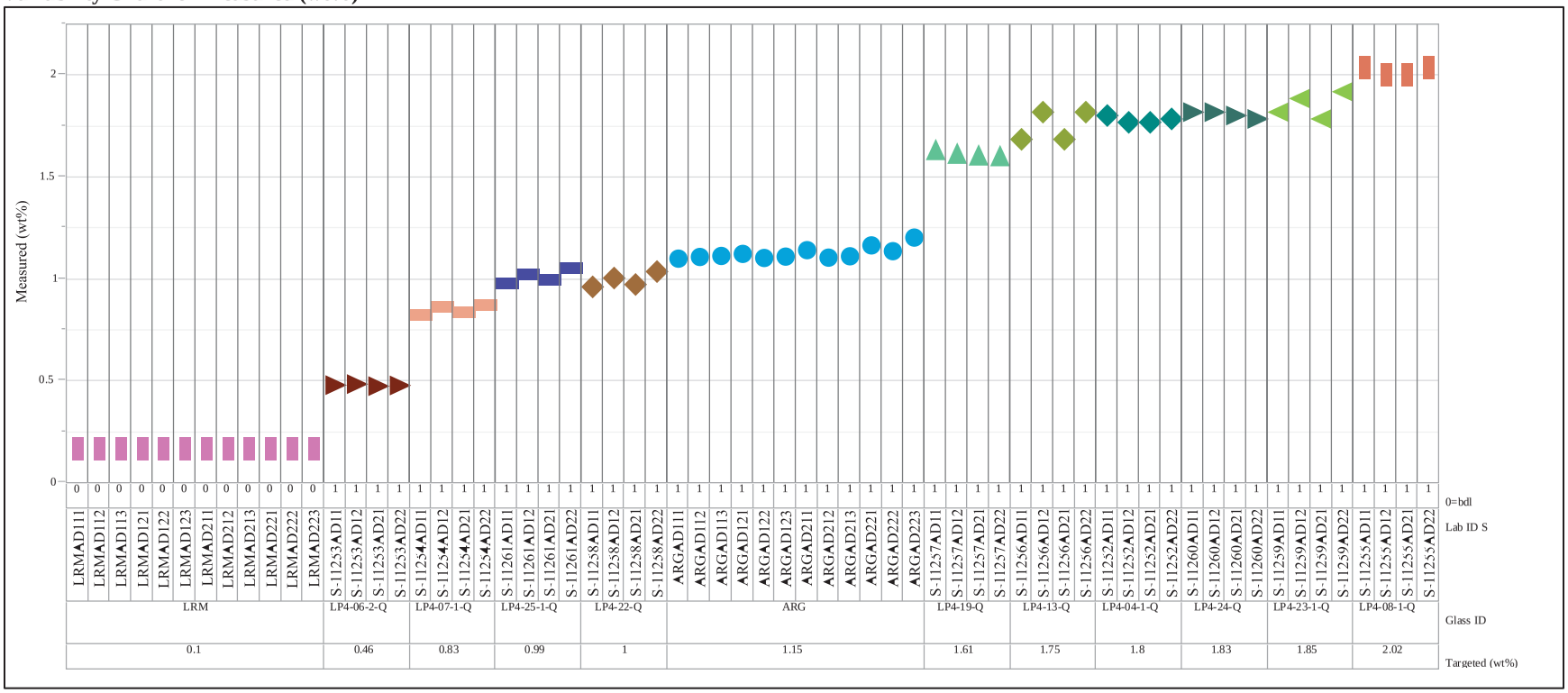


Exhibit B-2. Plots of Oxide Measurements by Set 2 Glass Identifier Grouped by Targeted Concentrations (continued)

Oxide=V_2O_5, Prep Method=AD
Variability Chart for Measured (wt%)

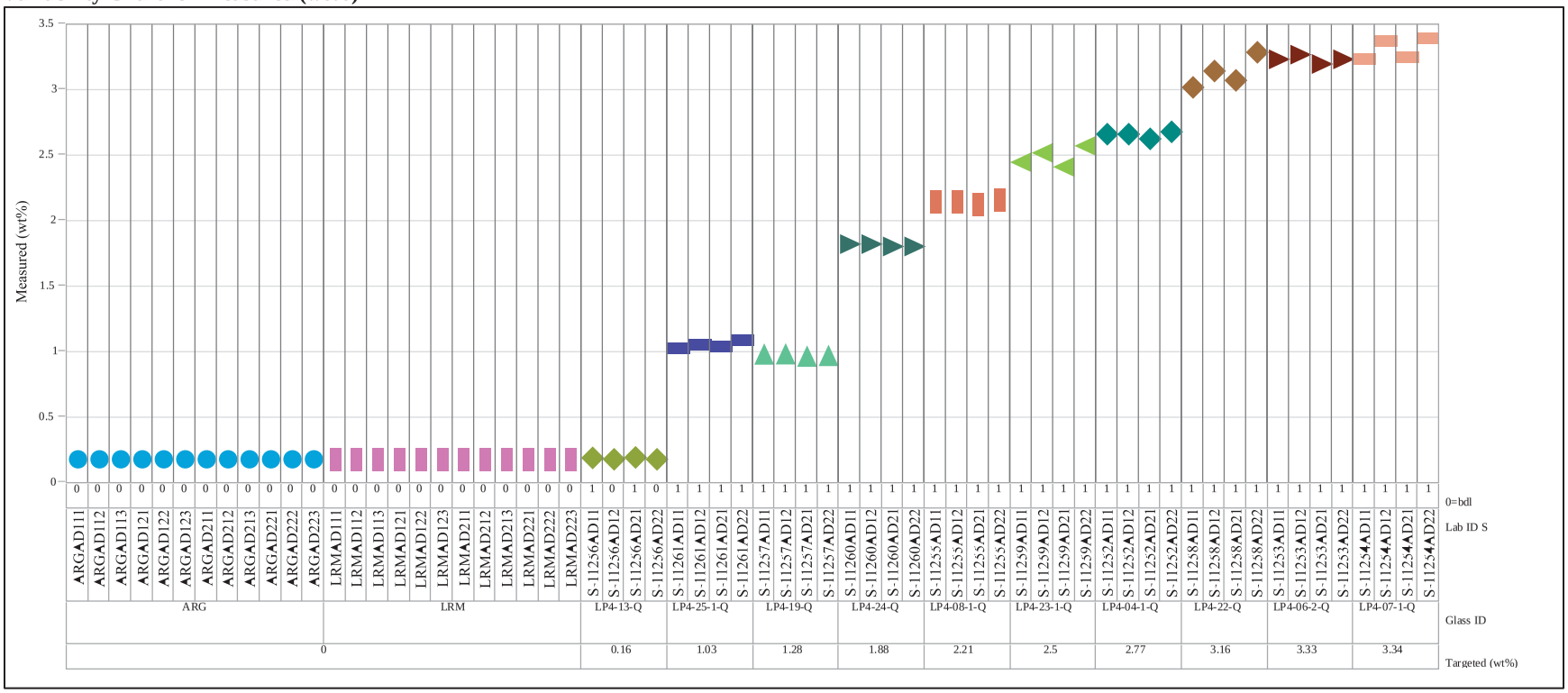


Exhibit B-2. Plots of Oxide Measurements by Set 2 Glass Identifier Grouped by Targeted Concentrations (continued)

Oxide=ZnO, Prep Method=AD
Variability Chart for Measured (wt%)

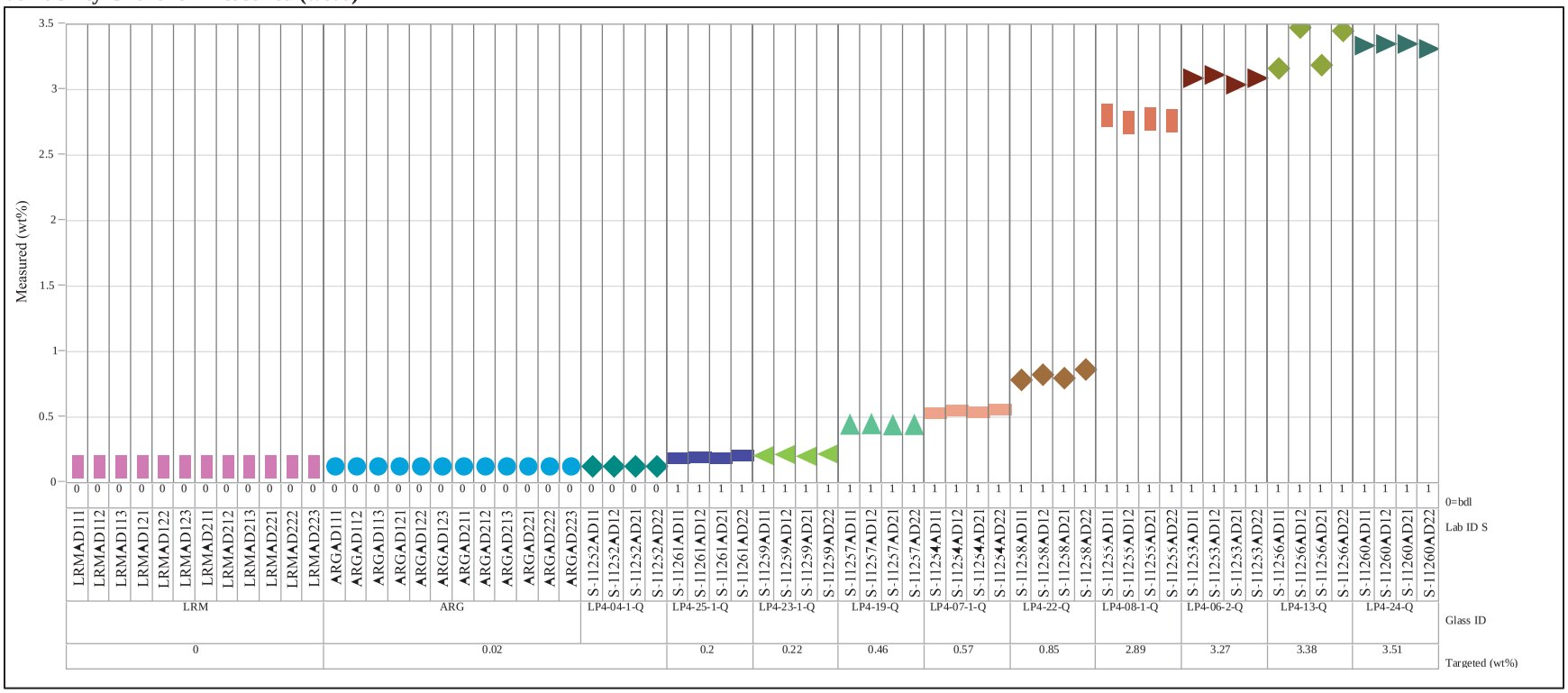


Exhibit B-2. Plots of Oxide Measurements by Set 2 Glass Identifier Grouped by Targeted Concentrations (continued)

Oxide=ZrO_2, Prep Method=AD
Variability Chart for Measured (wt%)

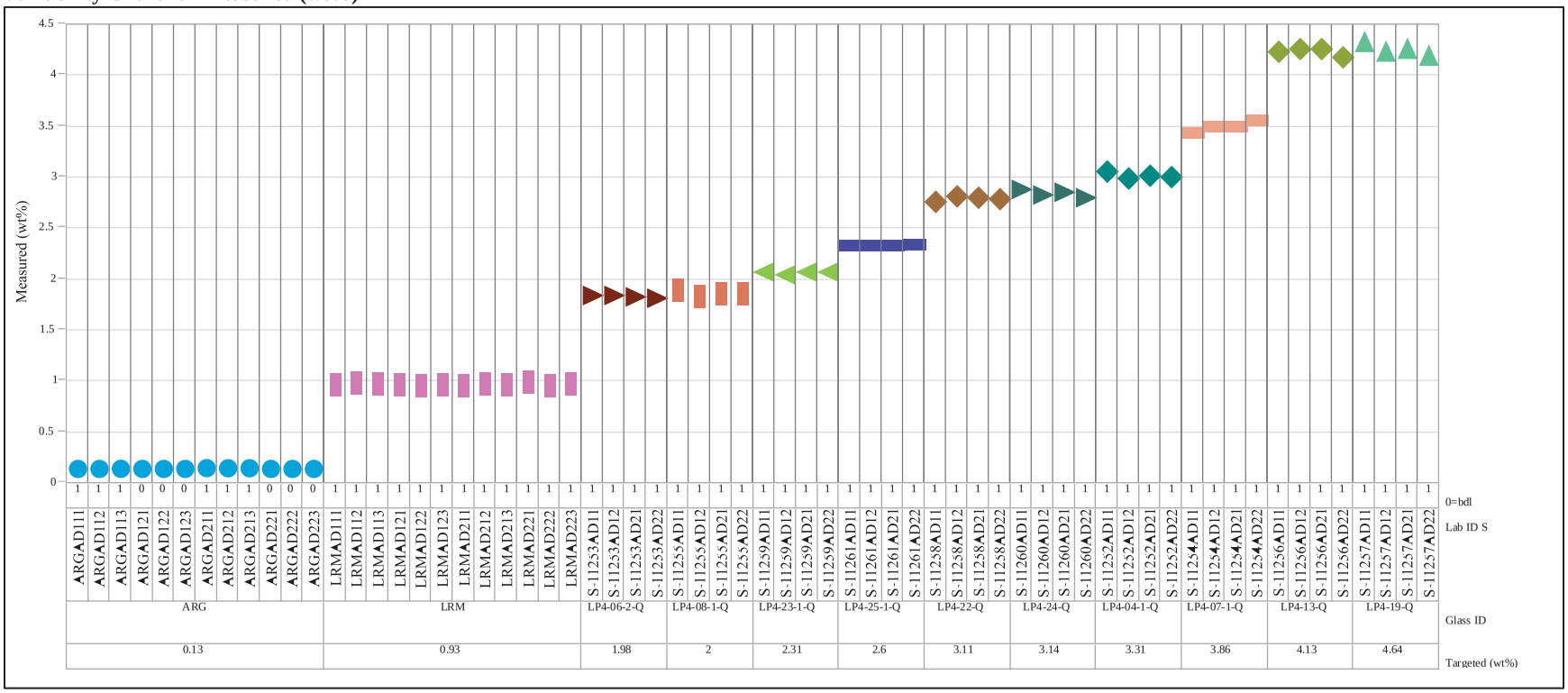
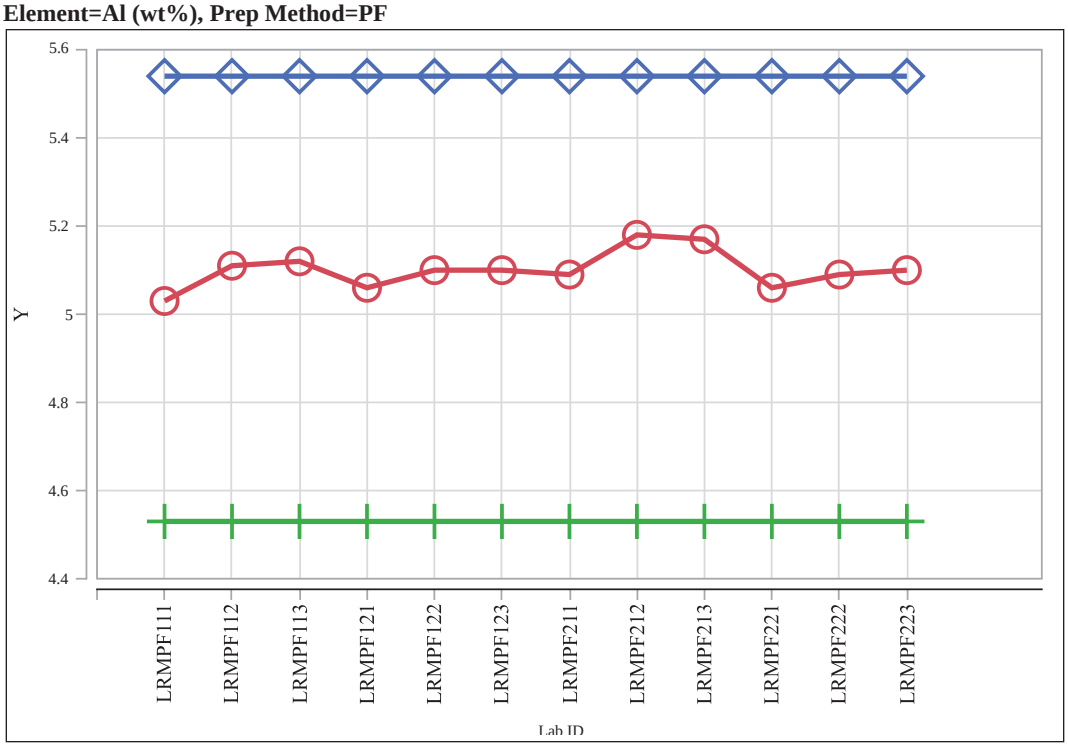
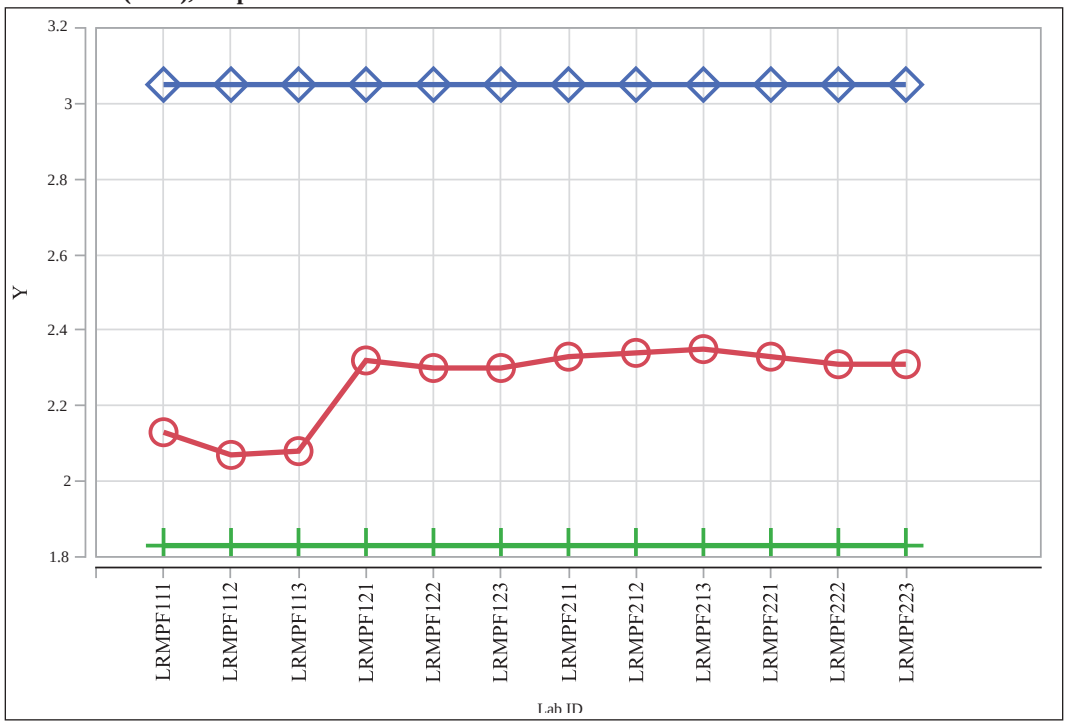


Exhibit B-3. Acceptability Evaluation for Measurements of the LRM Standard Glass

Element=Al (wt%), Prep Method=PF



Element=B (wt%), Prep Method=PF



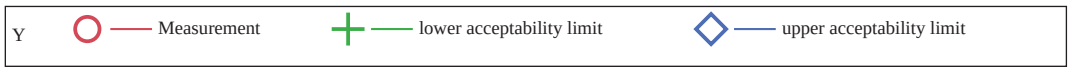
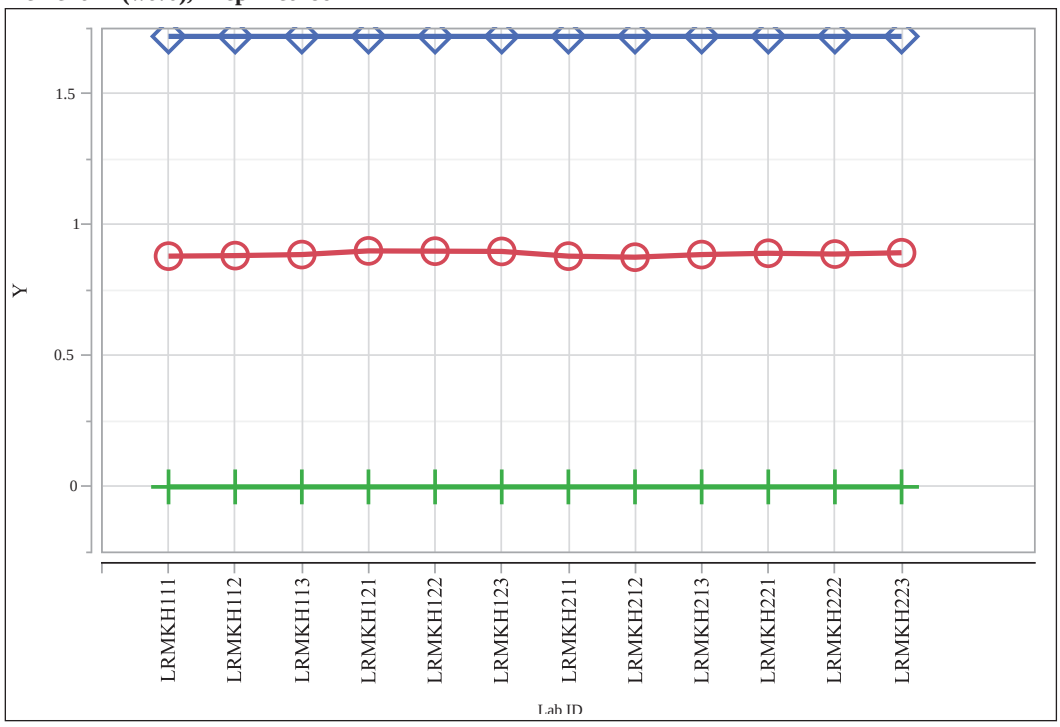
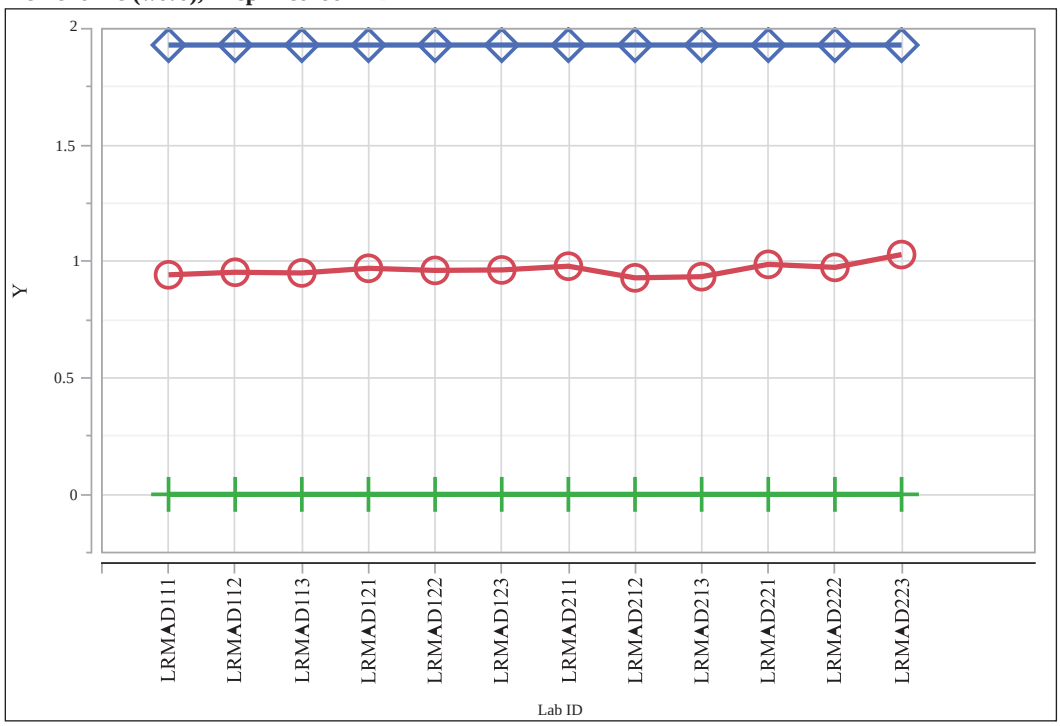


Exhibit B-3. Acceptability Evaluation for Measurements of the LRM Standard Glass (continued)

Element=F (wt%), Prep Method=KH



Element=Fe (wt%), Prep Method=AD



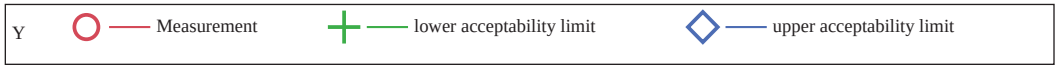
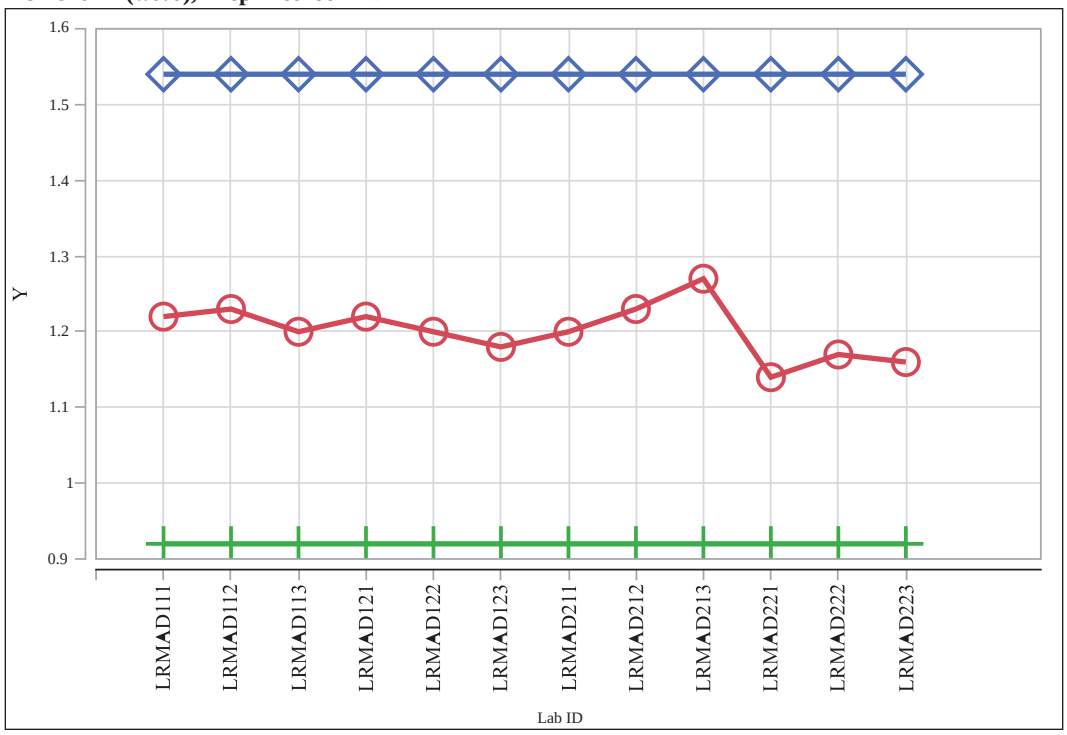
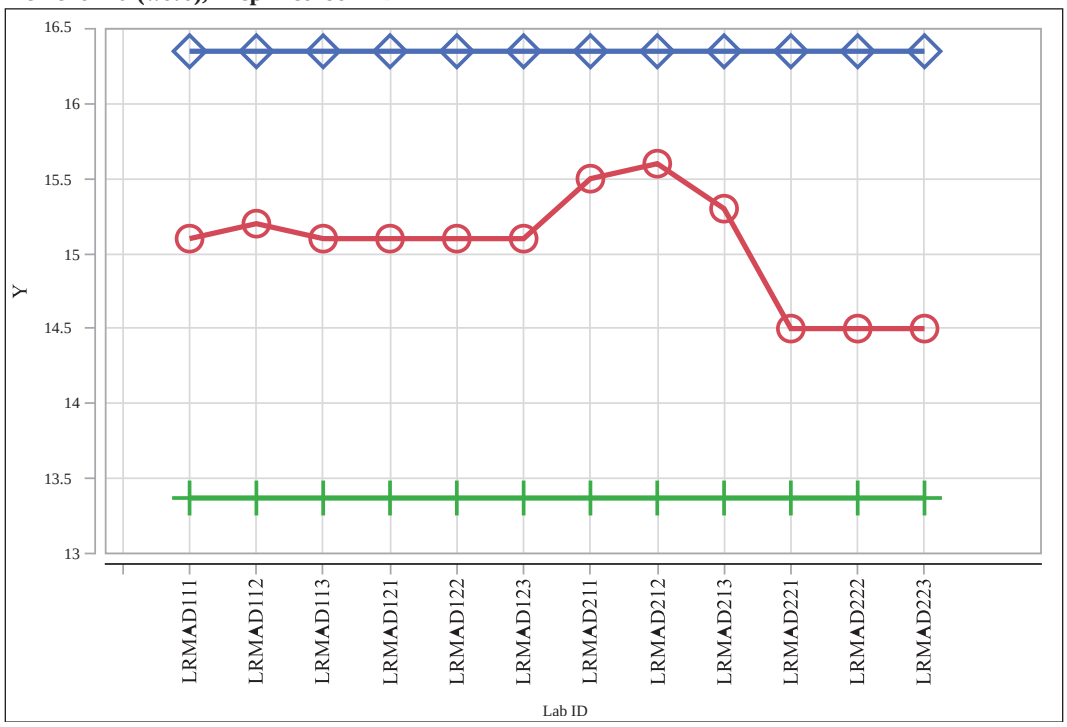


Exhibit B-3. Acceptability Evaluation for Measurements of the LRM Standard Glass (continued)

Element=K (wt%), Prep Method=AD



Element=Na (wt%), Prep Method=AD



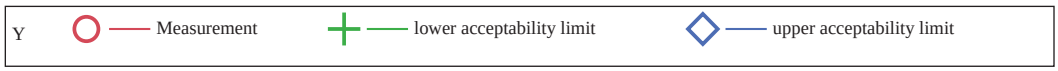
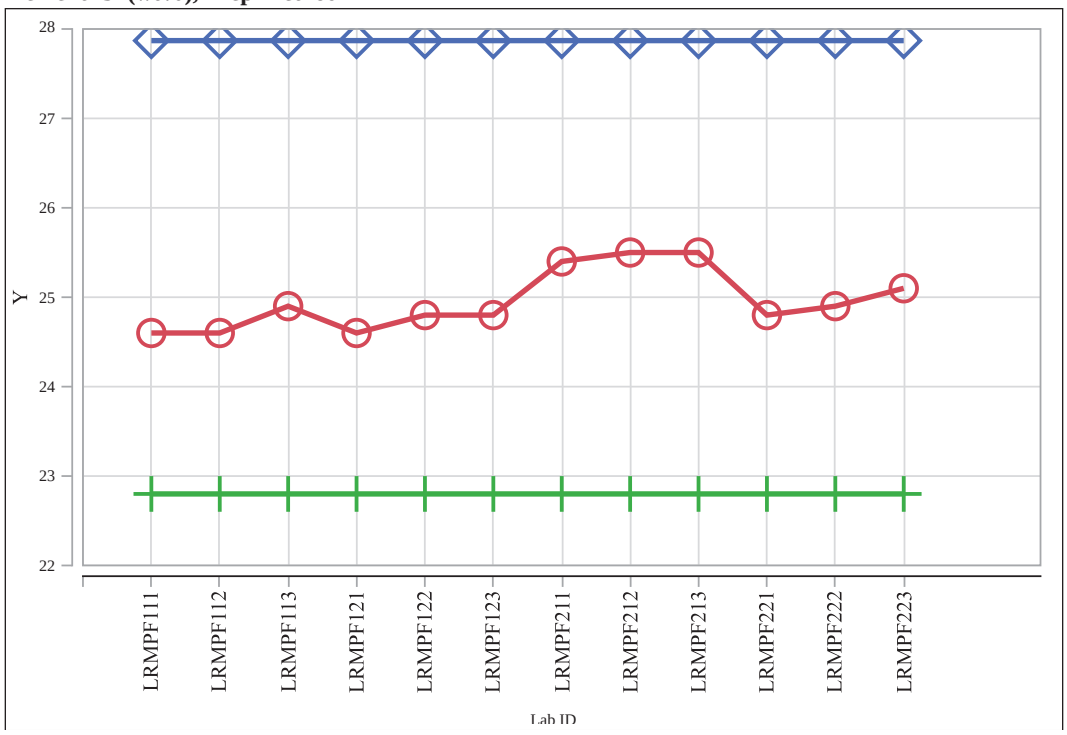
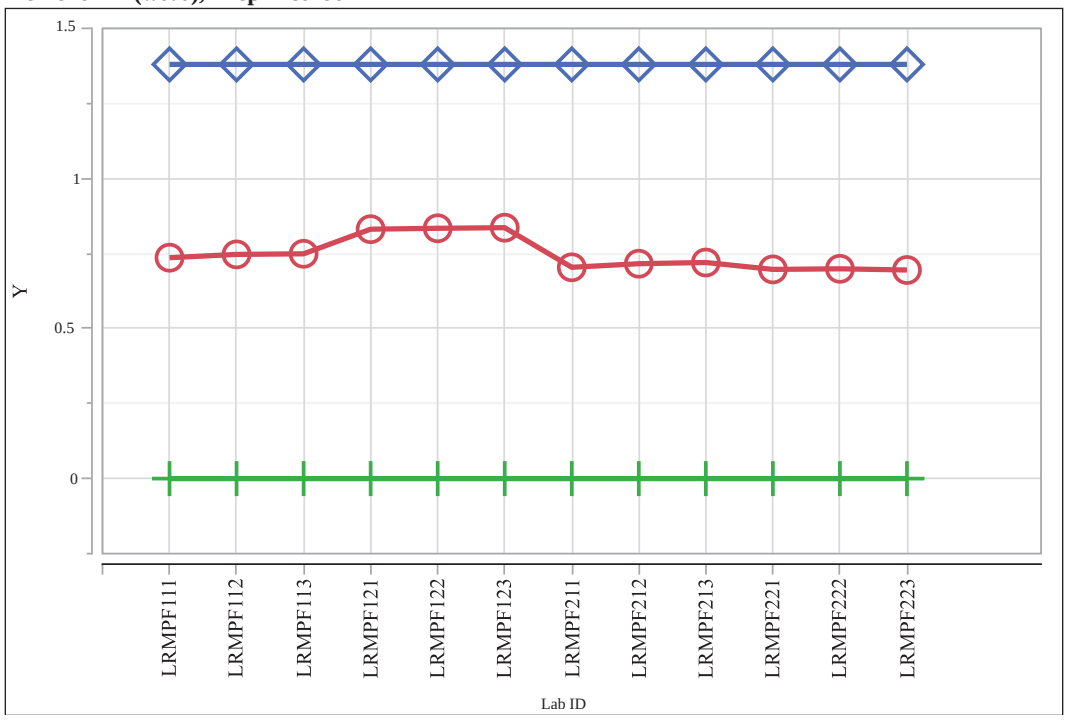


Exhibit B-3. Acceptability Evaluation for Measurements of the LRM Standard Glass (continued)

Element=Si (wt%), Prep Method=PF



Element=Zr (wt%), Prep Method=PF



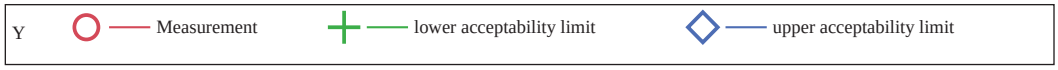
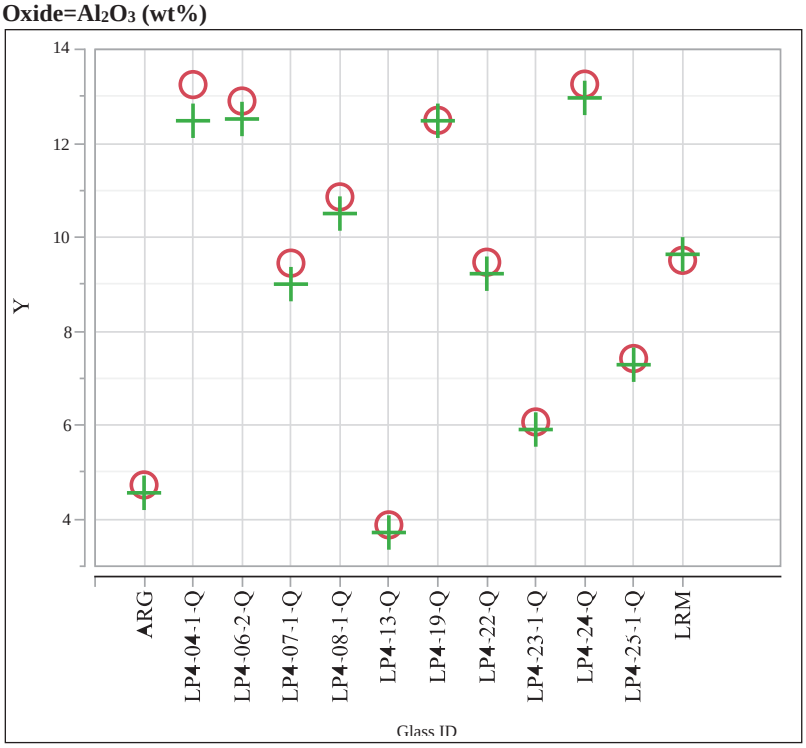


Exhibit B-4. Measured versus Targeted Concentrations by Set 2 Glass ID by Oxide

Oxide=Al_2O_3 (wt%)



Oxide=B_2O_3 (wt%)

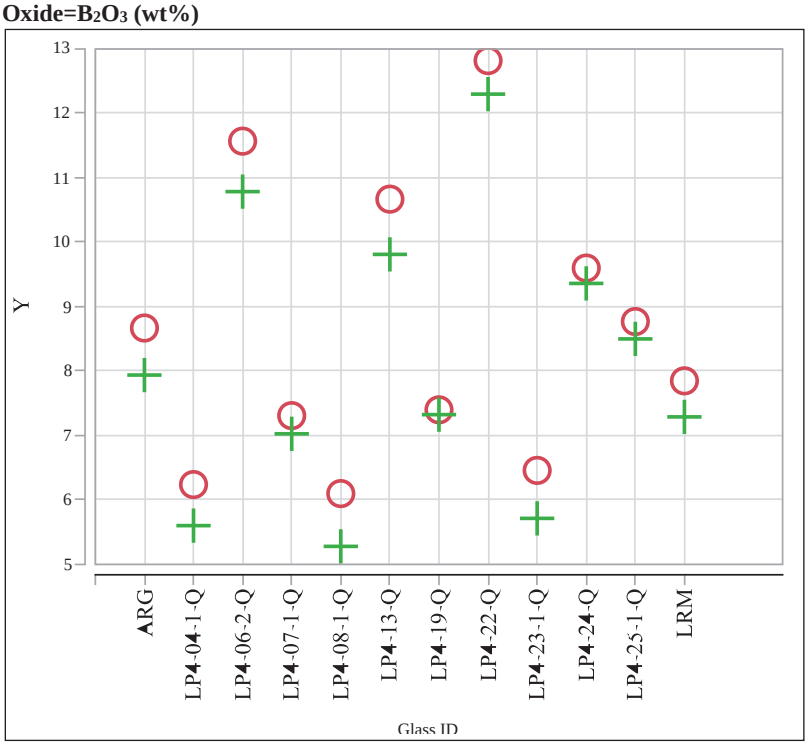
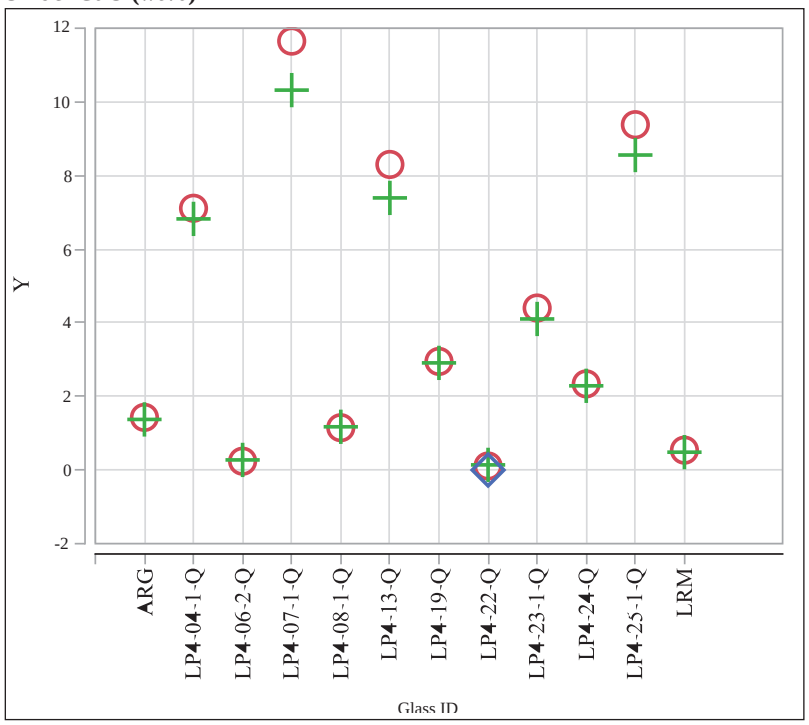
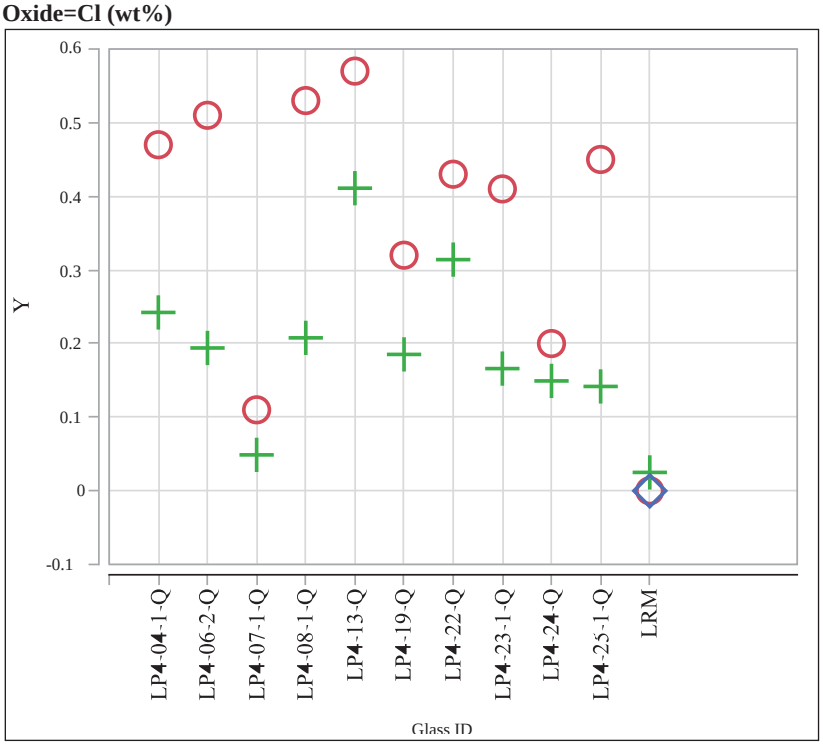


Exhibit B-4. Measured versus Targeted Concentrations by Set 2 Glass ID by Oxide (continued)

Oxide=CaO (wt%)



Oxide=Cl (wt%)



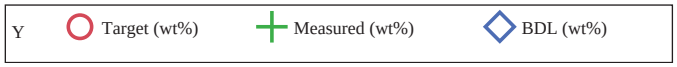
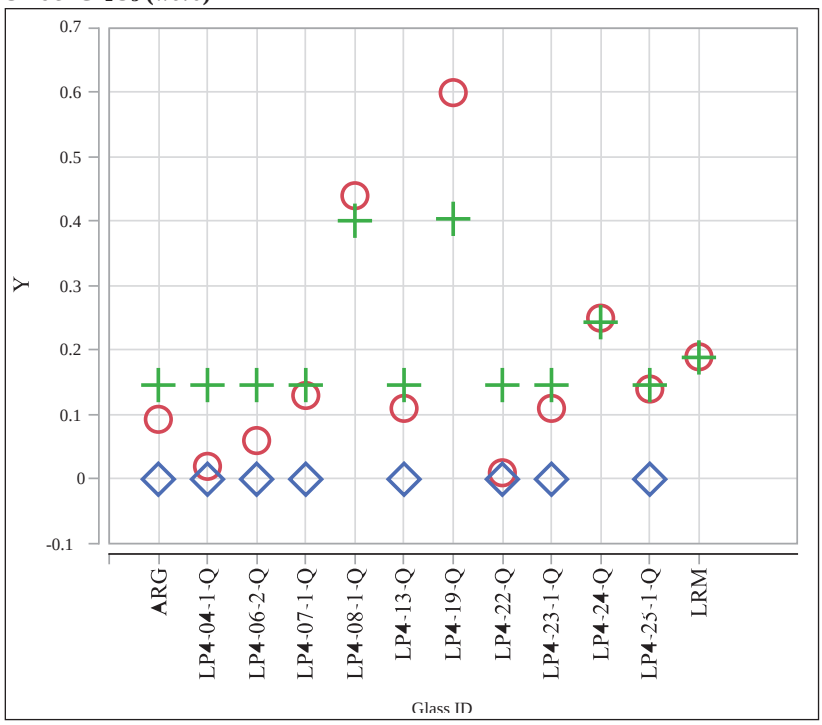
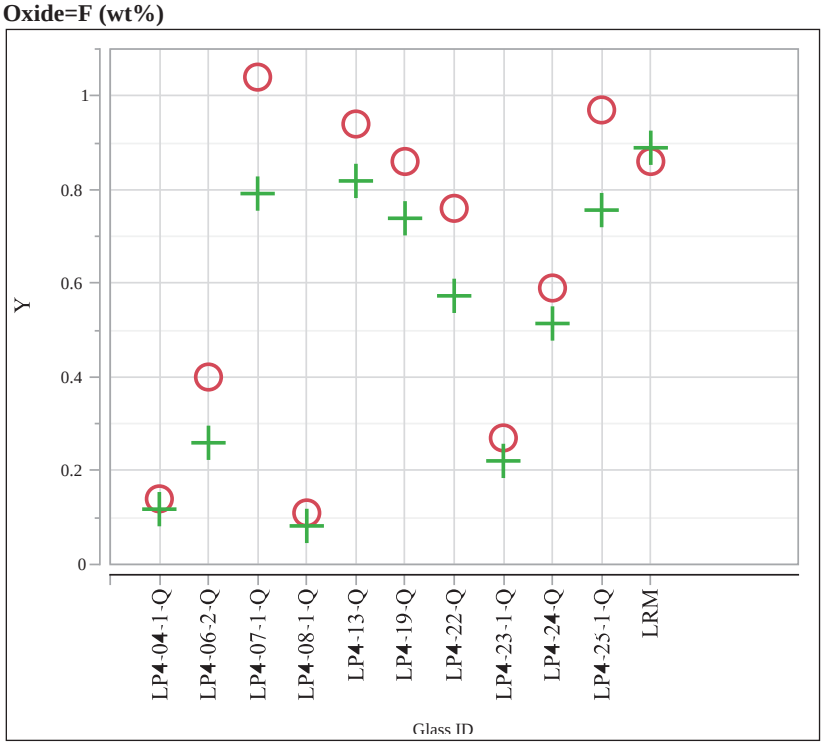


Exhibit B-4. Measured versus Targeted Concentrations by Set 2 Glass ID by Oxide (continued)

Oxide=Cr_2O_3 (wt%)



Oxide=F (wt%)



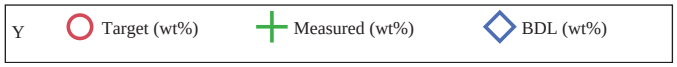
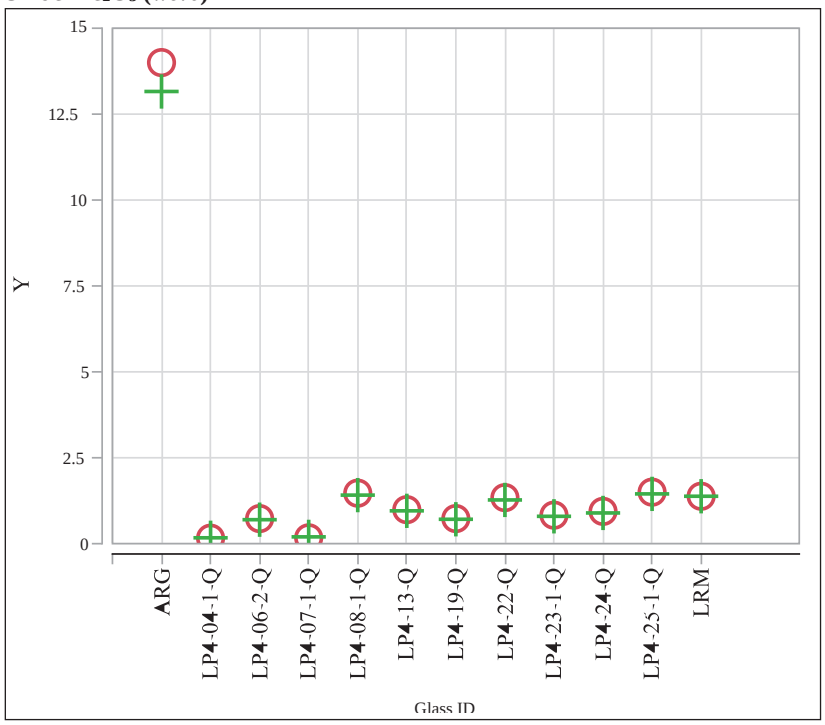
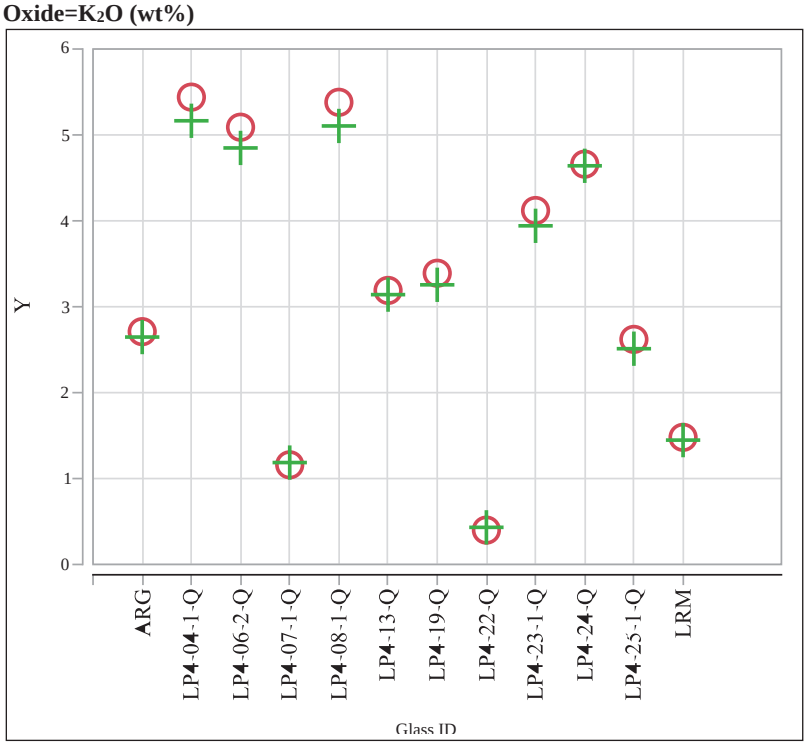


Exhibit B-4. Measured versus Targeted Concentrations by Set 2 Glass ID by Oxide (continued)

Oxide=Fe_2O_3 (wt%)



Oxide=K_2O (wt%)



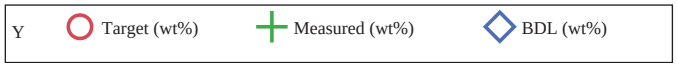
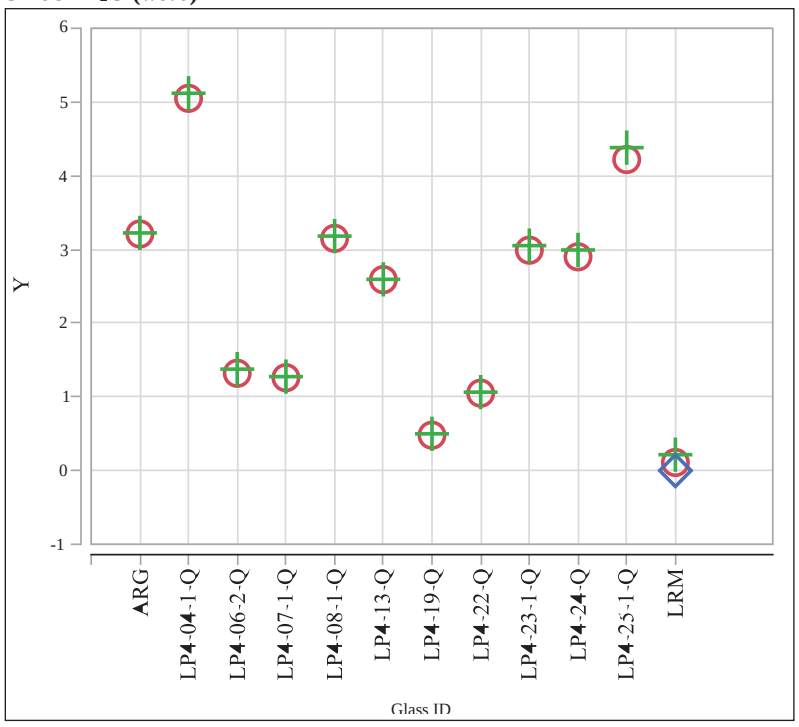


Exhibit B-4. Measured versus Targeted Concentrations by Set 2 Glass ID by Oxide (continued)

Oxide=Li_2O (wt%)



Oxide=MgO (wt%)

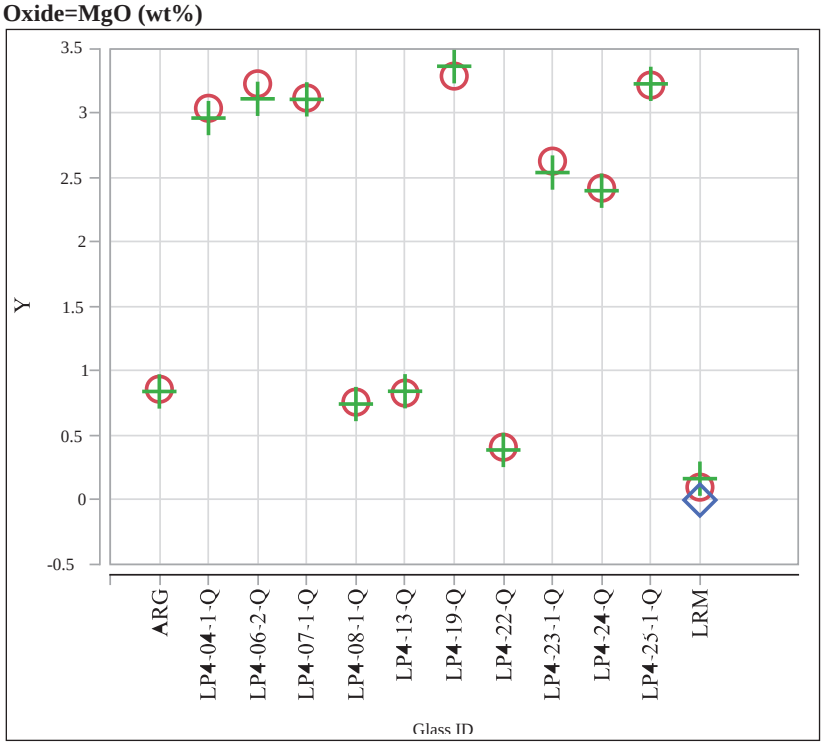
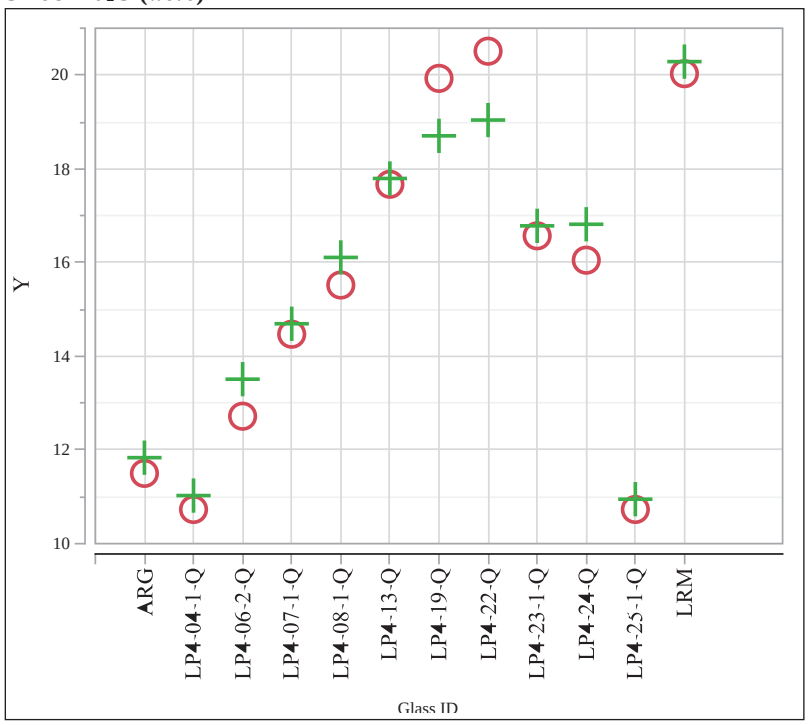


Exhibit B-4. Measured versus Targeted Concentrations by Set 2 Glass ID by Oxide (continued)

Oxide=Na_2O (wt%)



Oxide=NiO (wt%)

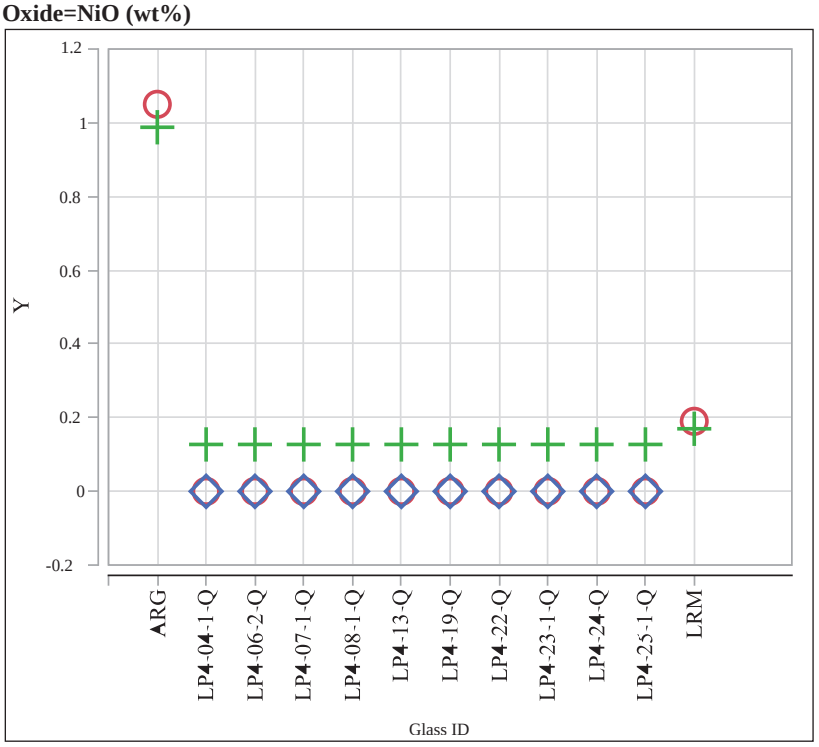
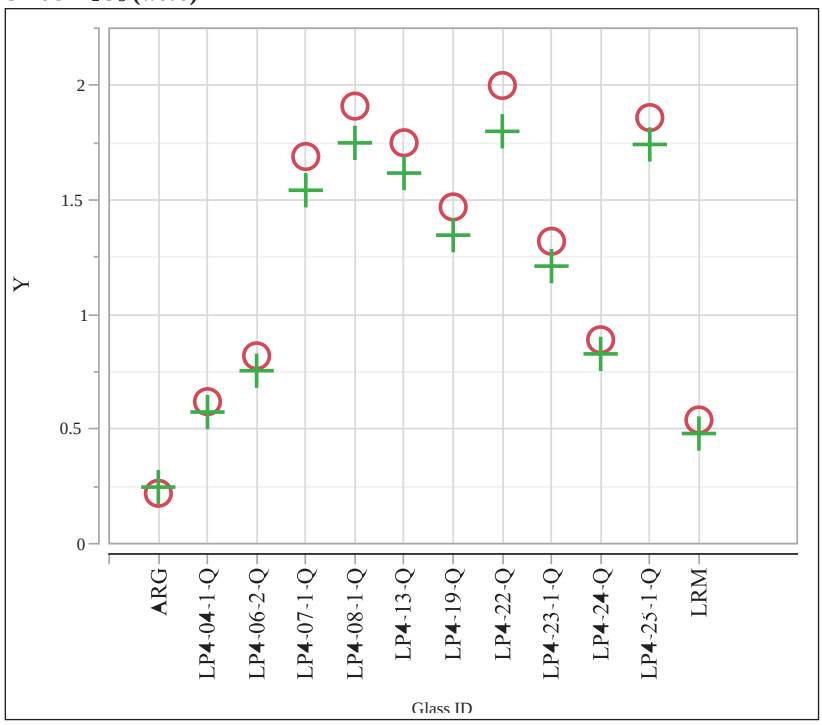
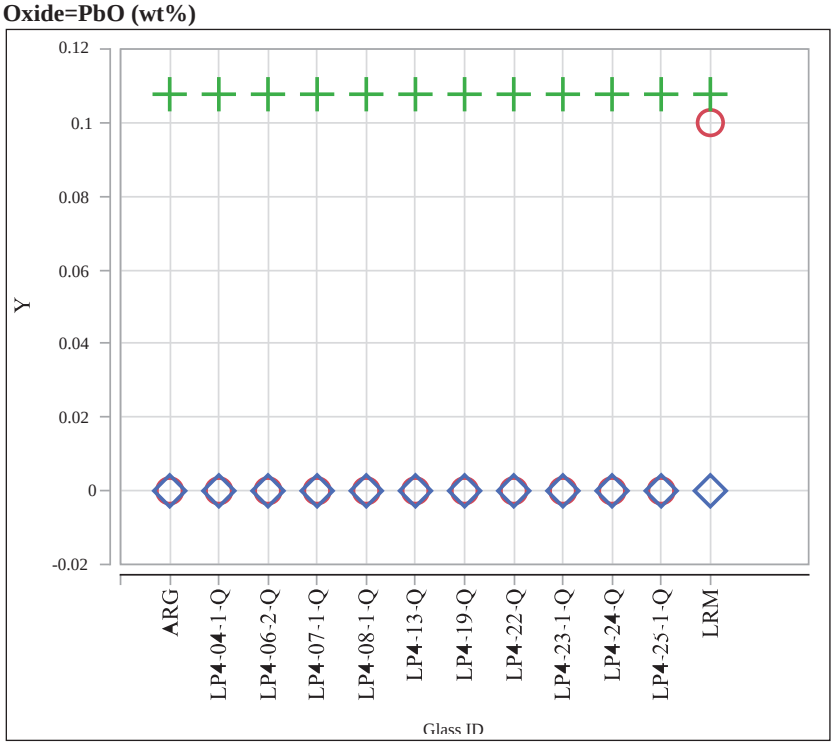


Exhibit B-4. Measured versus Targeted Concentrations by Set 2 Glass ID by Oxide (continued)

Oxide=P_2O_5 (wt%)



Oxide=PbO (wt%)



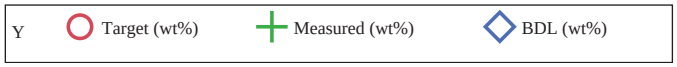
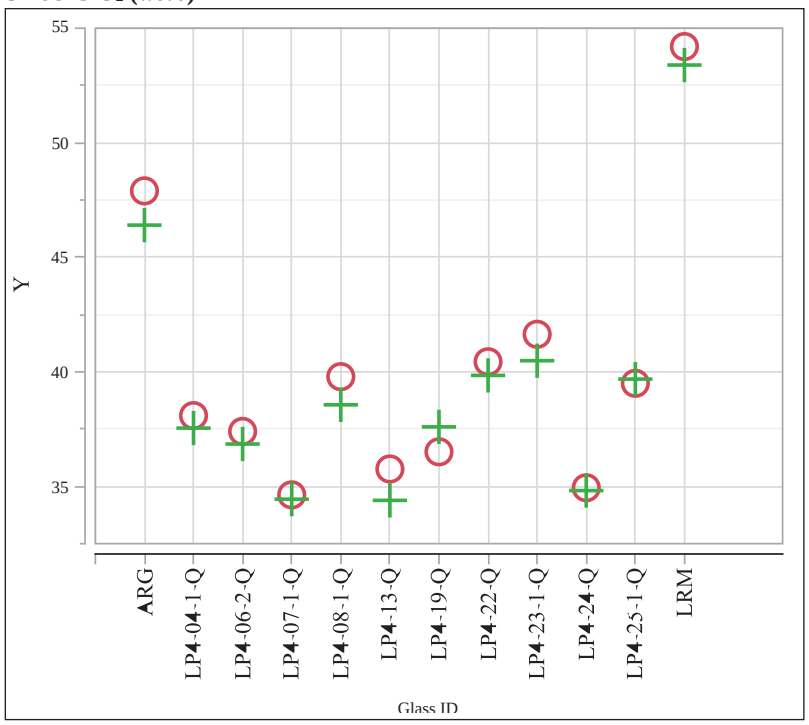
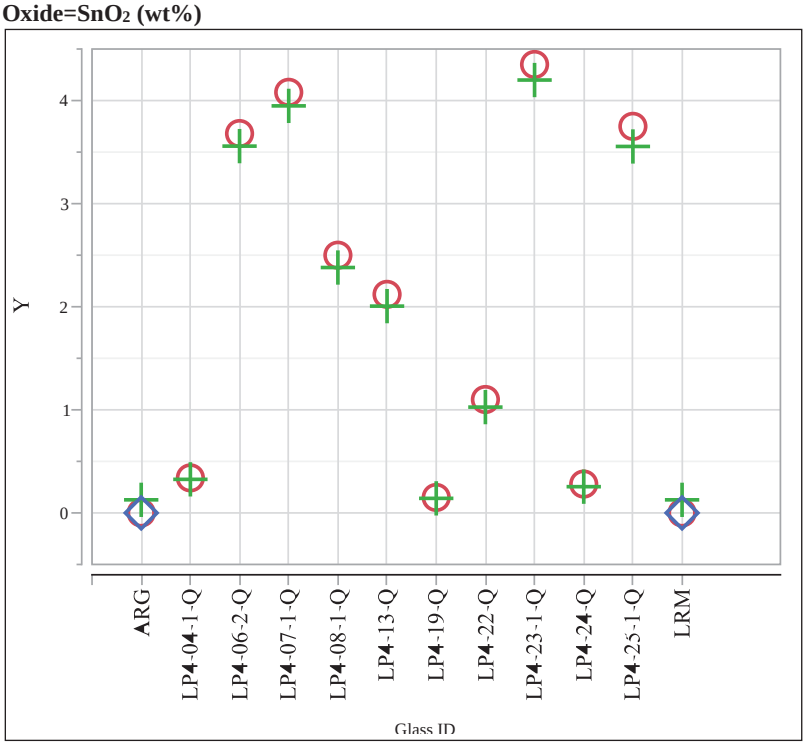


Exhibit B-4. Measured versus Targeted Concentrations by Set 2 Glass ID by Oxide (continued)

Oxide=SiO_2 (wt%)



Oxide=SnO_2 (wt%)



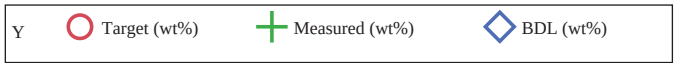
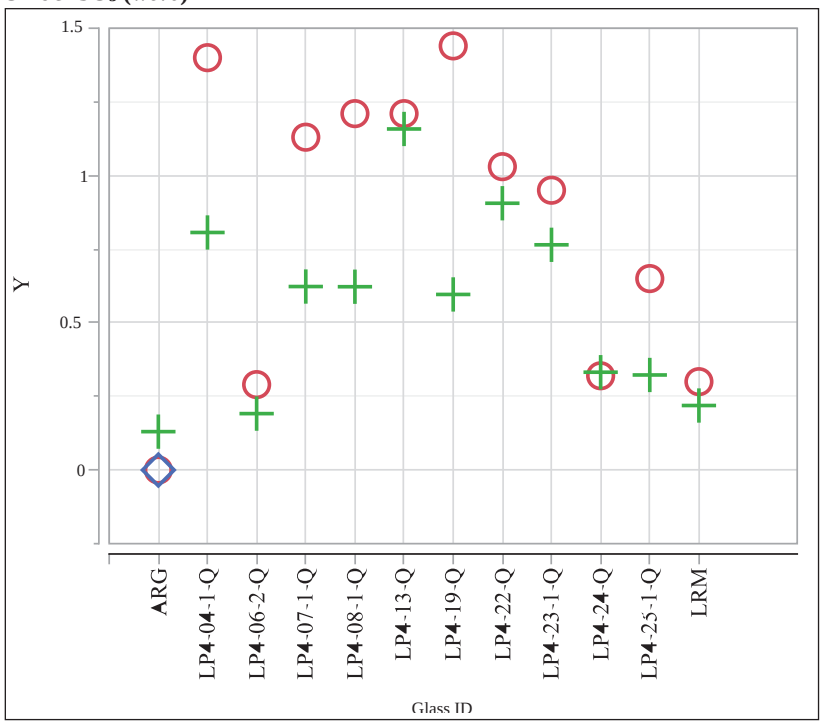
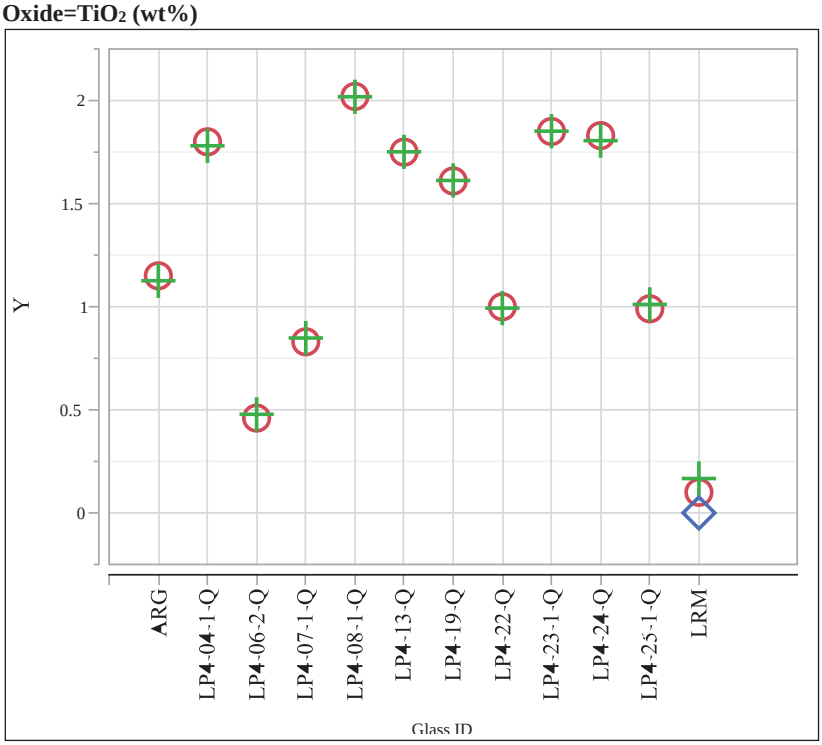


Exhibit B-4. Measured versus Targeted Concentrations by Set 2 Glass ID by Oxide (continued)

Oxide=SO_3 (wt%)



Oxide=TiO_2 (wt%)



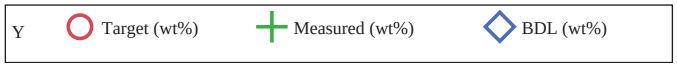
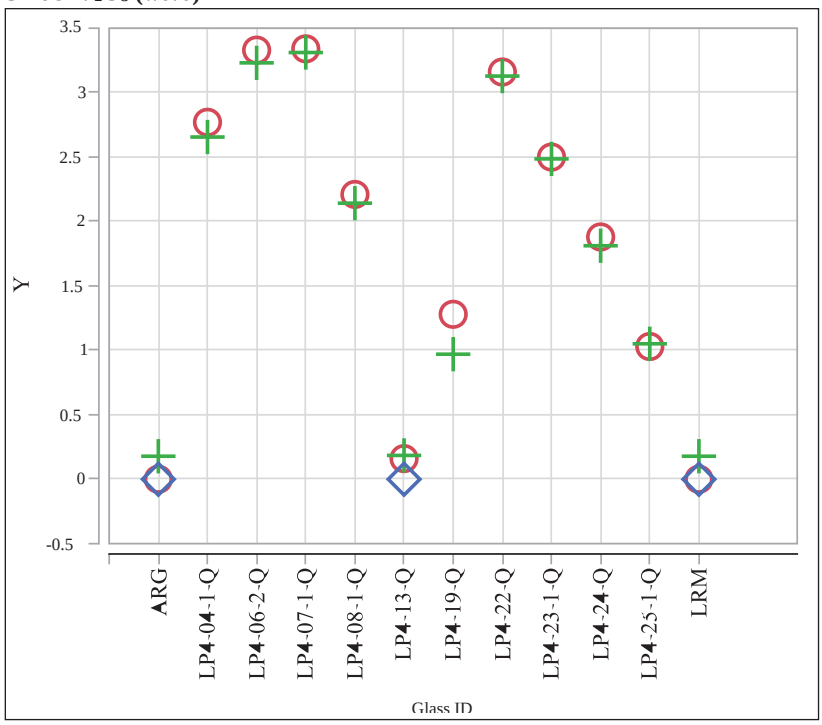
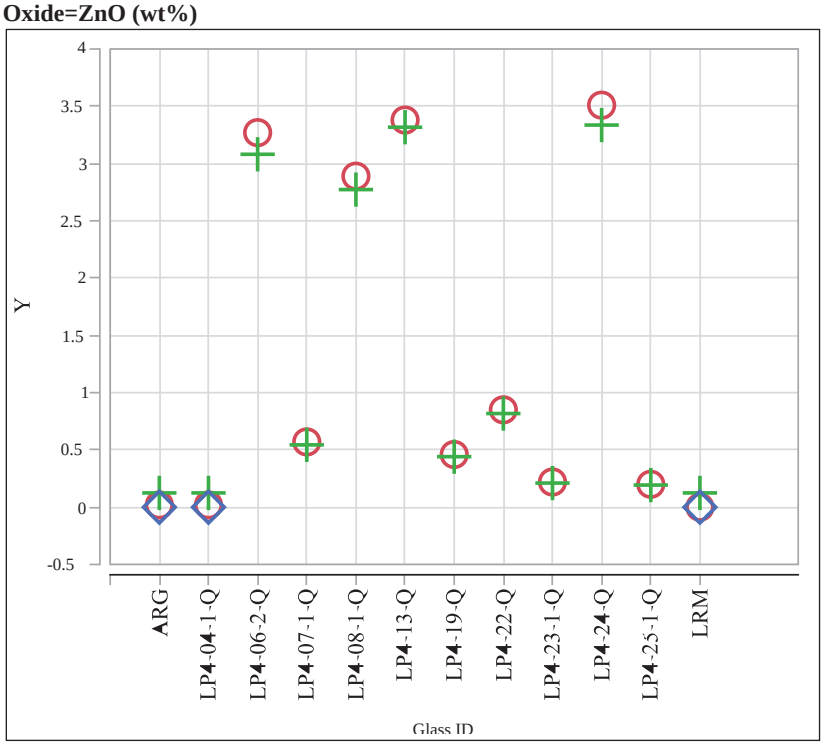


Exhibit B-4. Measured versus Targeted Concentrations by Set 2 Glass ID by Oxide (continued)

Oxide=V_2O_5 (wt%)



Oxide=ZnO (wt%)



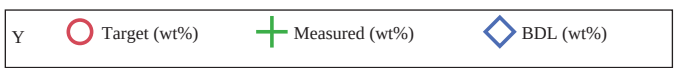
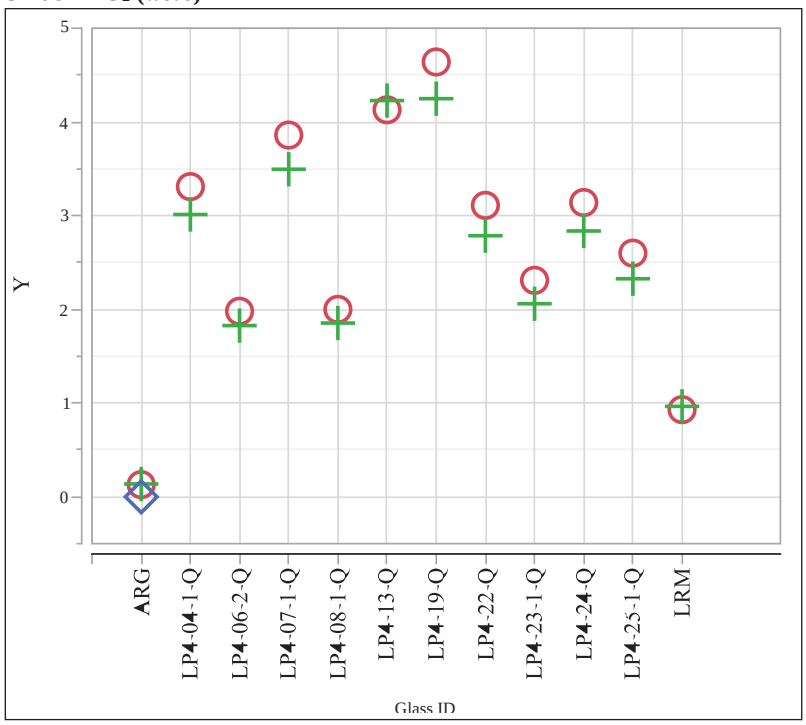
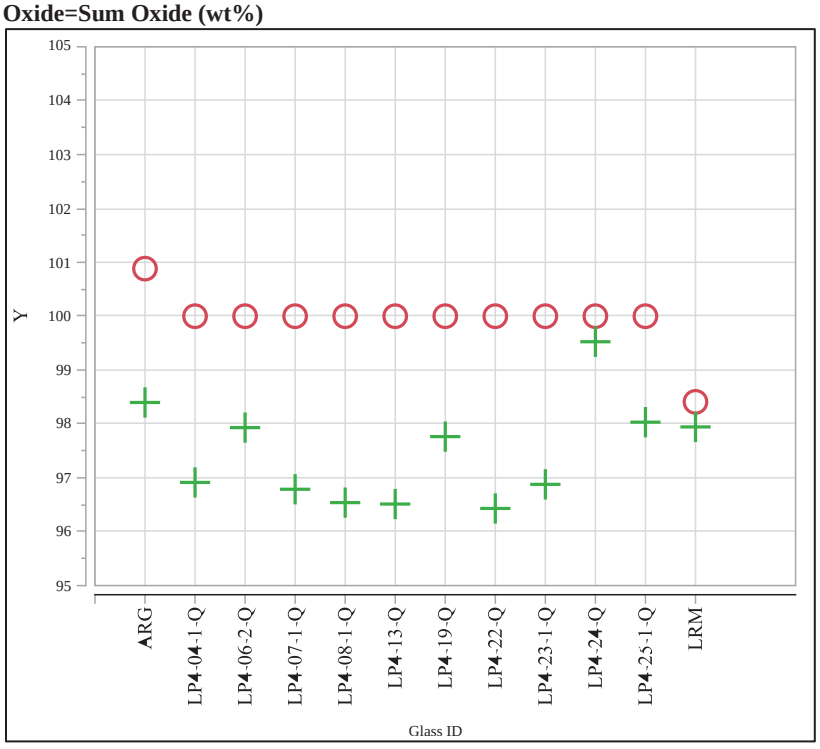


Exhibit B-4. Measured versus Targeted Concentrations by Set 2 Glass ID by Oxide (continued)

Oxide=ZrO_2 (wt%)



Oxide=Sum Oxide (wt%)



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