Contract No:

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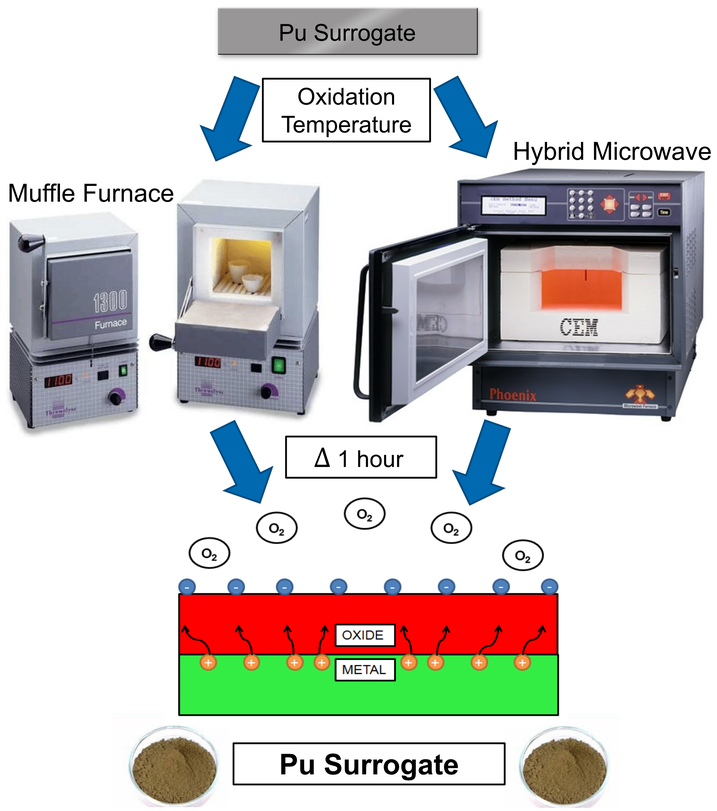
High-Temperature Oxidation of Plutonium Surrogate Metals and Alloys

Joshua C. Sparks, Kelsie E. Krantz, *Jonathan H. Christian, Aaron L. Washington II*

BACKGROUND

The Plutonium Management and Disposition Agreement (PMDA) is a nuclear non-proliferation agreement designed to remove 34 tons of weapons-grade plutonium from Russia and the United States. While several removal options have been proposed since the agreement was first signed in 2000, processing the weapons-grade plutonium to mixed-oxide (MOX) fuel has remained the leading candidate for achieving the goals of the PMDA. However, the MOX program has received its share of criticisms, which causes its future to be uncertain. One alternative pathway for plutonium disposition would involve oxidizing the metal followed by impurity down blending and burial in the Waste Isolation Pilot Plant (WIPP) in Carlsbad, New Mexico.

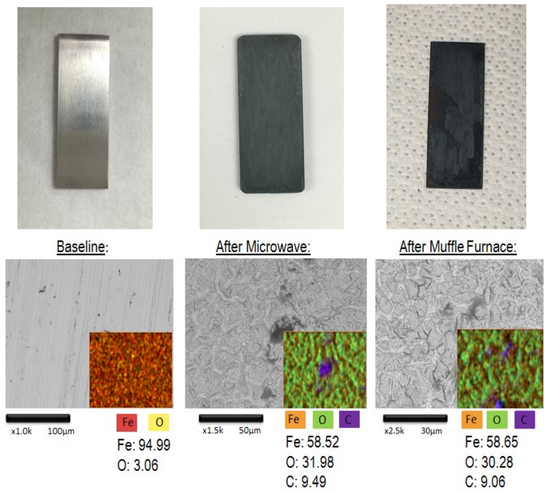
PROCEDURE



RESULTS

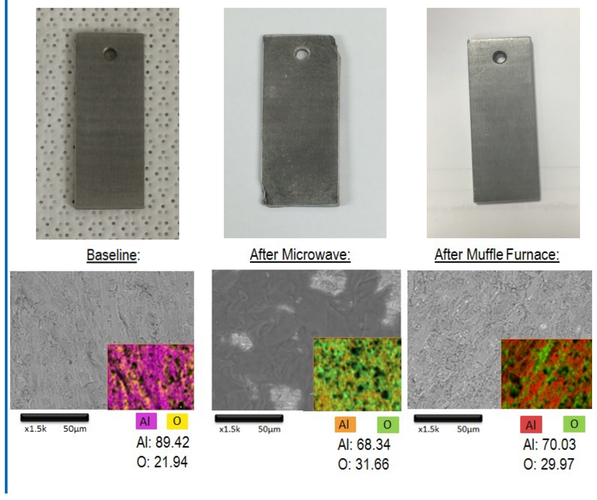
Iron

Heating at 930 °C	Hybrid Microwave (2.8 L Cavity)	Muffle Furnace (2 L Cavity)
Change in Mass	+ 0.321 g	+ 0.55 g
Time to Heat-up	19 min	43 min
Time to Cool-down to 136 °C	1 hr 15 min	6 hr 9 min

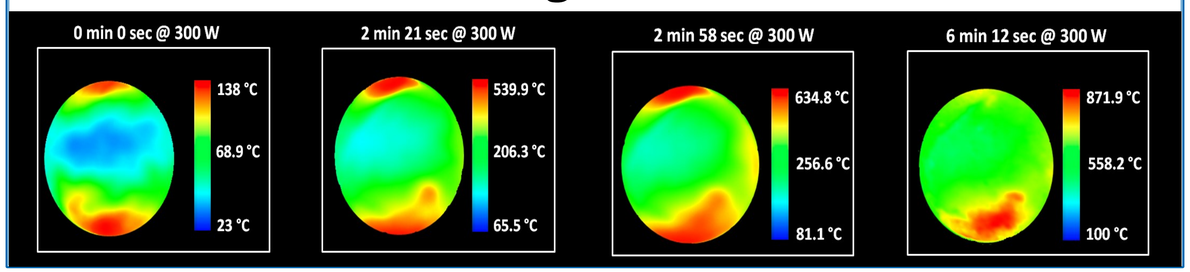


Aluminum

Heating at 650 °C	Hybrid Microwave (2.8 L Cavity)	Muffle Furnace (2 L Cavity)
Change in Mass	+ 0.001 g	- 0.001 g
Time to Heat-up	9 min 48 sec	26 min 13 sec
Time to Cool-down to 136 °C	1 hr 6 min	5 hr 13 min

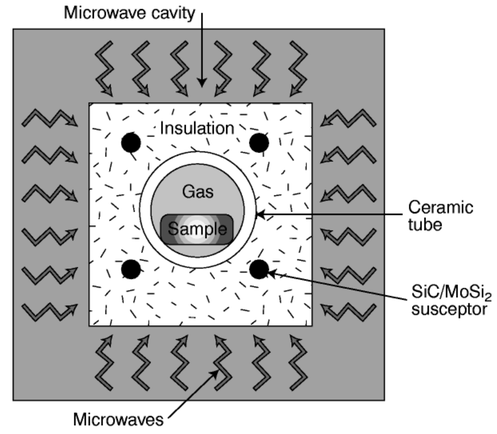


Direct Heating of SiC Crucible



CONCLUSIONS

- **Oxidation occurred similarly in the microwave and muffle furnace; however, the microwave process time was significantly faster.**
- **Faster ramp rates possible with hybrid microwave**
  - –Microwave heats-up @ **193 [L°C/min]**
  - –Muffle furnace heats-up @ **48 [L°C/min]**



FUTURE WORK

- **Analyze depth of the oxidation into the bulk of the metal**
- **Potential of exploring different Pu surrogates or Pu itself in a lab scale**

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