Plasma Processes, Inc.

Smart Crucibles for Materials Processing in Microgravity

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Description and Objectives

- Crucibles comprised of a ceramic liner in direct contact with a metal jacket are desired for better heat transfer rates.
- However because the gap present in a conventional SACA is eliminated with this design, methods for the incorporation of instrumentation such as a failure detection system based on krypton gas and placement of thermocouples are needed.
- Smart crucibles that incorporate thermocouple grooves and a reservoir for krypton gas storage within the wall of a crucible will be developed.

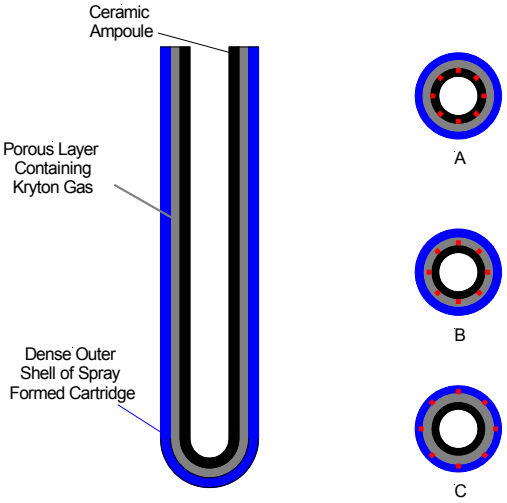
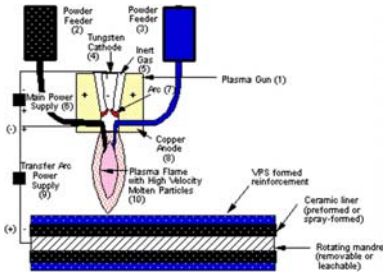


Figure 1 – Schematic of the proposed smart crucible showing the krypton gas reservoir, which completely surrounds the ampoule for optimum failure detection, and potential locations for TC grooves: A) ampoule, B) porous krypton layer and C) metal reinforcement.

Approach

•Vacuum Plasma Spray (VPS) forming will be used.

•Parameters will be developed for producing a porous reservoir within the wall of a spray formed crucible.



•Determine the minimum wall thickness needed to maintain $<10^{-6}$ sccs of He at room and elevated temperatures.

•Development of removable filler materials for filling the TC grooves during close-out of the crucible.

Subcontractor

None

Schedule and Deliverables

- 6 months for development of the processes, fabrication of test articles, and characterization.
- Spray formed crucible with reservoir for krypton gas storage.
- Spray formed crucible with integral TC grooves within the wall of the crucible.

NASA and Commercial Applications

- High quench rate crucibles with integral TC grooves and a failure detection method for the QMI and the BUNDLE programs.
- Components with integral failure detection methods
- Rocket motors, heat pipes, power generation, electronics

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