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Identification and Significance of Innovation

- Robust, low cost materials are desired for hot-gas propulsion components.
- Rhenium's inherent properties make it an excellent choice.
- However, the high cost of rhenium makes fabrication using conventional techniques prohibitive.
- Therefore, near-net-shape electrochemical forming (EL-Form™) techniques are being developed to produce rhenium, rhenium alloys, and rhenium coated composite materials for use as ACM hot-gas components and for other high temperature propulsion components.

TRL at the conclusion of Phase I: 3



Left: Re and W propulsion components produced by EL-Form processing
 Right: Lightweight EL-Form Re coated carbon nozzle and pintle

Phase I Summary

- EL-Form™ processing techniques were developed for producing a simulated ACM flow distributor.
- Material properties specimens were harvested from this deposit.
- Mechanical and physical properties tests showed the Re produced was equivalent to Re produced with standard EL-Form™ processing.
- Analysis of EL-Form™ Re coated graphite and carbon-carbon samples showed the importance of matching the coefficient of thermal expansion of the substrate and Re deposit to produce lightweight Re coated composite components.
- The Phase I results have demonstrated the ability of EL-Form™ processing techniques to produce ACM hot-gas components.

NASA and Non-NASA Applications

- Targeted NASA application is for the ACM valve assembly. Other NASA applications include in-space propulsion components, nuclear power/propulsion, oxygen generators, and lunar regolith processing.
- Targeted commercial applications include net-shape fabrication of refractory and platinum group metals for rocket nozzles, crucibles, heat pipes, and propulsion subcomponents; and advanced coating systems for x-ray targets, sputtering targets, turbines, rocket engines, wear and thermal/electrical insulation.

Firm Contacts

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NON-PROPRIETARY DATA