Innovative Molybdenum Alloy for Extreme Operating Conditions

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Identification and Significance of Innovation

- Molybdenum has been identified as a promising material for many high temperature NASA applications.
- However, the ductile to brittle transition temperature of Mo is above room temp, which makes fabricating complex components extremely difficult by conventional fabrication techniques.
- Innovative dispersion strengthened, Mo-Re alloys will be developed using VPS forming techniques and through the proper selection of thermodynamically stable ceramic dispersoids.
- These alloys have the potential to operate at temperatures greater than 1800ºC for extend durations.

Examples of near net shape formed alumina lined, Mo-Re cartridge tubes that were produced by VPS forming. In addition, a TaC exterior coating was applied to each tube.

Technical Objectives and Work Plan

- Demonstrate the ability to produce enhanced, dispersion strengthened Mo-Re components using near net shape, Vacuum Plasma Spray (VPS) forming techniques.
- Evaluate mixing techniques to ensure a uniform distribution of constituents is achieved.
- Produce Mo-Re samples with varying amounts of oxide and nitride dispersoids based on zirconium and hafnium.
- Perform preliminary mechanical tests on spray formed dispersion strengthened Mo-Re deposits to determine the effect of the dispersoids on mechanical properties.
- Metallurgical analysis to determine the effect of the dispersoids on as-sprayed and heat treated microstructures.
- Identify promising compositions and critical parameters for extensive evaluation during the Phase II investigation.

NASA and Non-NASA Applications

- Nuclear power generation and propulsion, chemical propulsion, furnace cartridges/crucibles for microgravity, heat pipes, heat shields, high temperature electrical contacts, heat exchangers, high temperature creep resistant structures and components.

- Commercial technologies include, aerospace and defense industries, nuclear power generation, propulsion, welding electrodes, x-ray targets, warhead penetrators, high temperature furnace components, heat exchangers, heat pipes.

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NON-PROPRIETARY DATA