

Project ID: 8383

HybriMet™ ceramic reinforced metal matrix composites surpass super alloys for the construction of CSP Gen 3 molten salt pumps at 720°C.

1. Impact

Pure Ni has a tensile strength of 180 MPa; Ceramic reinforced Ni has a tensile strength of 1018 MPa.

Cermet technology breaks the constraints of super alloys in physical properties and in cost.

2. Project Goal

- Demonstrate the ability of cermet material to enable the fabrication of long life pumps for the molten salt CSP system.
- Establish application relevant material design data and fabrication processes.
- Quote the pumps for the Gen3 Topic 1 demonstration.
- Advance the product commercialization

3. Method(s)

Demonstrate the ability of cermet material to enable the fabrication of long life pumps for the molten salt CSP system.

Establish application relevant material design data and fabrication processes.

Build and run molten salt tribology test facilities.

4. Outcome(s)

Built and ran a 75 gpm pump in 720°C chloride salt. Developed the first Pin on Disk and Tribology Test Bed to obtain erosion and wear data in molten salt. Demonstrated effectiveness of HybriMet NiWC3b cermet to provide corrosion resistant pump components.

Advanced the design of salt purification equipment and methods and the scale up of the purification process.

5. Conclusion/Risks

HybriMet NiWC3b cermet, as molded parts and as a coating, is a viable material for the economical production of molten salt pumps.

HybriMet technology shows promise for application to valves, salt tanks and heat exchangers.

The physical property data base needs to be extended beyond that generated in this program.

The validation pump needs to be run for additional time to demonstrate life.

6. Team

Powdermet Inc

Sulzer Pump

University of Wisconsin – Madison

High Temperature Systems Design



Figure 1. 75 gpm Validation Pump

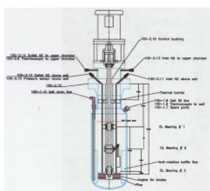


Figure 2 Tribology Test Bed

- The validation pump salt loop is capable of flow rates up to 75 GPM and temperatures up to 720 C.
- 2" Sch 40 SS316 piping
- with a control valve and venturi to control and measure flow
- System is fully instrumented with data logging via LabView
 - Temperature,
 - Gas pressure,
 - Salt flow,
 - Vibration
- System is modular and is accessible for maintenance and trouble shooting.



Figure 3 750C chloride salt test loop available for component evaluation at UWisc-Madison