19953

Ceramic Reinforced Metals Provide Superior Corrosion Resistance and High Temperature Strength.

1. Impact
Transitioning to 700-750°C can dramatically reduce the size of required tanks, HX, and pump systems (reducing construction cost), while increasing thermodynamic efficiency (decreasing operating costs) of CSP plants.

2. Project Goal
Manufacture a prototype HX for demonstration and test - technical goals include:
- Flexural strength $\sigma$, 300-400MPa
- Flexural modulus $E$, 50-125GPa
- Thermal Conductivity $k$, >50W/mK at 750°C
- Salt and sCO2 corrosion <0.2 mm/year
- Lifetime operation >30,000hr at 750°C

3. Method(s)
Apply Powdermet’s HybriTherm and HybriMet high temperature, low corrosion, load-bearing thermally-conductive metal matrix composites to high-temperature heat exchangers.

4. Outcome(s)
Have compounded, molded and measured four HybriTherm cermets with thermal conductivity over 50 W/mK at 800°C and up to 5.4 times the thermal conductivity of Haynes 230.

Completed a preliminary design for prototype HX fabrication and tests.

5. Conclusion/Risks
Connection of the HX to the balance of the system emerged as an important issue to be addressed to enable testing our prototype HX at UWisc and to provide a production design. A task addressing brazing of super alloy tubing to cermet and pressure testing the joint at Brayton was added to our project.

6. Team
Powdermet Inc
University of Wisconsin – Madison
Brayton Energy, LLC
Sandia National Laboratory
California Nanotechnologies Inc