PURDUE INNOVATES | Office of Technology Commercialization

Mechanically, Thermally, and Chemically-Robust (Oxidation/Corrosion-Resistant) High-Temperature Ceramic/Metal Composites

A new class of stiff, creep-resistant, and tough ceramic/metal composite materials enables high-performance, cost-effective heat exchangers and components capable of operating above 750 degrees Celsius.

There is a need for materials that can be used in devices at elevated temperatures in a variety of applications such as electrical power production, transportation, propulsion, and manufacturing of materials and chemicals. For example, the temperature ceiling of current materials used in the primary heater exchanger of Concentrated Solar Power (CSP) systems have inhibited the enhancement of the thermal-to-electrical efficiency for lower-cost CSP-derived electricity.

Researchers at Purdue University have developed a class of ceramic/metal composite materials for use at elevated temperatures. At such temperatures, these materials are stiff and creep resistant, tough (resistant to crack propagation), thermally cyclable, thermally conductive, electrically conductive, and resistant to oxidation in gases and corrosion in liquids. This material would allow for high-performance, cost-effective primary heat exchangers capable of heat transfer at temperatures greater than 750 degrees Celsius and elevated pressures.

Advantages:

-High Temperature Capability

-Stiffer and more Creep Resistant than Metal Alloys at High Temperatures

-Tougher and more Thermal Shock Resistant than Monolithic Brittle Ceramics

-High-Temperature Resistance to Corrosion in Oxidizing Environments

-Thermally Cyclable without Mechanical Degradation

Technology ID
2019-SAND-68340

Category
Energy & Power Systems/Power Generation
Materials Science & Nanotechnology/Composites & Hybrid Materials
Materials Science & Nanotechnology/Thermal Management Materials & Solutions

Authors
Kenneth H Sandhage

Further information
Will Buchanan
wdbuchanan@prf.org

View online

-Thermally Conductive

-Electrically Conductive

Potential Applications:

-Engine Components

-Piping

-Storage Containers

-Heat Exchangers

TRL: 1

Intellectual Property:

Provisional-Patent, 2018-07-03, United States | Provisional-Patent, 2019-05-02, United States | Utility Patent, 2019-07-03, United States

Keywords: Ceramic metal composite, high temperature materials, creep resistant, crack propagation resistant, thermally conductive, electrically conductive, oxidation resistant, corrosion resistant, heat exchangers, engine components