

High Temperature Thermal Dual-Barrier Coating

A new anti-corrosive, high-temperature dual-barrier coating significantly increases gas turbine efficiency by controlling thermal conductivity and minimizing heat radiation transport up to 1600 degrees C.

Researchers at Purdue University have developed a new high temperature thermal dual-barrier coating for increasing gas turbine efficiency. Current thermal barrier coatings (TBC) are often made of a single layer porous yttria stabilized zirconia (YSZ) material which exhibits excellent thermal, mechanical, and chemical stability as well as enables heat to flow as conduction, but thermal radiation carries more heat with higher temperature. Purdue researchers have created an anti-corrosive coating with a top layer consisting of three thin metal layers with YSZ between them and a bottom layer connecting the metastructure to the bond-coating. The metal layers are made of nano-islands, such as semi-continuous metallic alloy thin films, to allow easy integration and reduce thermal conductivity by providing random phonon propagation and screening for thermal radiation. In testing with a 100-micron thick section of the new material where the top layer was 60 microns thick, transmission of heat radiation was minimized between 0.5 and 20 microns achieving less than 20% thermal radiation transport at temperatures up to 1600 degrees C.

Advantages:

- Reduces Thermal Radiation
- Controls Thermal Conductivity
- Anti-Corrosive
- High-Temperature Applications

Potential Applications:

- Thermal Barrier Coating
- Materials Research and Design

Technology ID

2021-JACO-69259

Category

Chemicals & Advanced
Materials/Coatings, Adhesives &
Sealants
Aerospace & Defense/Thermal
Management & Combustion
Optimization
Materials Science &
Nanotechnology/Thermal
Management Materials &
Solutions

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-Gas Turbines

Technology Validation:

The new material developed by Purdue researchers has been tested for its ability to minimize thermal radiation.

TRL: 3

Intellectual Property:

Provisional-Gov. Funding, 2021-01-12, United States | PCT-Gov. Funding, 2022-01-11, WO | Utility-Gov. Funding, 2022-01-11, United States

Keywords: high temperature thermal dual-barrier coating, gas turbine efficiency, thermal barrier coatings, TBC, yttria stabilized zirconia, YSZ, anti-corrosive coating, nano-islands, semi-continuous metallic alloy thin films, thermal radiation transport, Coatings, Corrosion Resistant, Gas Turbine, High Temperature, Material Development, Materials and Manufacturing, Materials Engineering, Materials Science, mechanical metamaterials, Metallurgical Engineering, Metals, Metamaterials, Micro & Nanotechnologies, Microfabrication, Thermal Conductivity, Thermally Conductive, Yttrium Oxide