High Temperature Thermal Dual-Barrier Coating

Track Code: 2021-JACO-69259

Categories:
- Materials and Manufacturing
- Micro & Nanotechnologies

Keywords:
- Coatings
- Gas Turbine
- Material Development
- Materials and Manufacturing
- Materials Science
- mechanical metamaterials
- Metallurgical Engineering
- Metals
- Metamaterials
- Micro & Nanotechnologies
- Microfabrication
- Thermally Conductive
- Yttrium Oxide

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
-Gas Turbines

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

People:

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Intellectual Property:

Application Date: January 12, 2021
Type: Provisional-Gov. Funding
Country of Filing: United States
Patent Number: (None)
Issue Date: (None)

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