



Design and composition of thermal and environmental barrier coatings for high temperature operations

A design of high temperature resistance thermal and environmental barrier coatings that leads to better performance and reduced cost.

IP Status: Provisional Patent Application Filed

Applications

- Gas Turbines
- Jet Engines
- Manufacturing Plants

Key Benefits & Differentiators

- **Better Performance:** Proposed technology would be beneficial for protection of structural components in high operating temperature applications (such as gas turbines, jet engines, etc.) leading to better performance.
- **Reduced Cost:** Reduction in damage or replacement of parts due to high temperature withstanding capability would lead to reduced cost.

Technology Overview

The development of structural materials with the ability to work in high temperatures is critical to achieve improved efficiency and performance from applications such as gas turbines and jet engines. Existing technologies use Ni-based superalloys and SiC-based ceramic matrix composites, which do not provide quality performance at high operating temperatures.

Prof. David Poerschke at the University of Minnesota has developed a design for coating materials that provides better protection for high temperature operations. The technology proposes both single and multilayer thermal and environmental barrier coating architectures. The design is based on a dense inner layer which would prevent ingress of combustion gases and a porous outer layer which would support a majority of the temperature gradient. Niobium based alloys have been used in these systems. With a combination of the proposed design architecture and Nb based systems, a surface temperature of 1700 °C was reachable. The designs consider the need for thermal stability (high melting temperature and phase stability) and address thermal misfit strains that arise due to differential coefficient of thermal expansion (CTE) between materials in either a single layer or multilayer architecture.

Phase of Development

TRL: 3-4

Design has been shown to provide protection at high temperature of 1700 °C for Niobium based systems.

Desired Partnerships

This technology is now available for:

Technology ID

2022-054

Category

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Researchers

- [David Poerschke, PhD.](#), Assistant Professor, Department of Chemical Engineering and Materials Science

References

1. Yu, Yueh-Cheng, and David L. Poerschke. , <https://doi.org/10.1016/j.surfcoat.2021.128007>, Surface and Coatings Technology (2021): 128007.