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Nitin P. Padture

School of Engineering, Brown University

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ATTACK OF THERMAL BARRIER COATINGS BY MOLTEN SILICATE DEPOSITS (SAND, ASH) AND ITS MITIGATION

Nitin P. Padture
School of Engineering, Brown University, USA

Ceramic thermal barrier coatings (TBCs) are used to insulate and protect hot-section metallic components in gas-turbine engines for aircraft propulsion and electricity generation. However, the higher temperatures and extreme conditions in high-efficiency engines are making TBCs prone to deposition of undesirable silicates ingested by the engines, engendering new materials issues. The undesirable silicates (calcium-magnesium-alumino-silicate glass or CMAS) can be in the form of sand and volcanic ash in the case of aircraft engines, and coal fly ash in the case of syngas-fired engines used for electricity generation. The understanding of mechanisms by which these types of deposits damage conventional yttria-stabilized zirconia (7YSZ) TBCs will be presented. Demonstration and understanding of approaches to mitigate this type of damage in new TBCs will also be presented, together with a discussion of guidelines for the development of future TBCs for gas-turbine engines based on modeling and analysis.