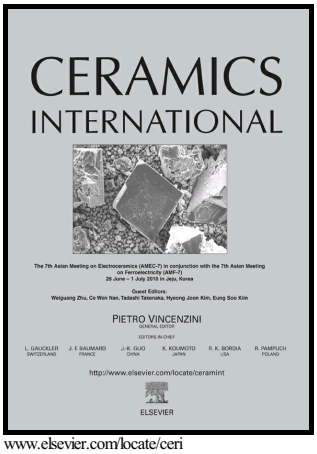

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Microstructural, Mechanical and Thermal Shock Properties of Triple-layer TBCs with Different Thicknesses of Bond Coat and Ceramic Top Coat Deposited onto Polyimide Matrix Composite

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Abstract

In this study, a triple-layer thermal barrier coating (TBC) of Cu-6Sn/NiCrAlY/YSZ was deposited onto a carbon-fiber reinforced polyimide matrix composite. Effects of different thicknesses of YSZ ceramic top coat and NiCrAlY intermediate layer on microstructural, mechanical and thermal shock properties of the coated samples were examined. The results revealed that the TBC systems with up to 300 μm top coat thicknesses have clean and adhesive coating/substrate interfaces whereas cracks exist along coating/substrate interface of the TBC system with 400 μm thick YSZ. Tensile adhesion test (TAT) indicated that adhesion strength values of the coated samples are inversely proportional to the ceramic top coat thickness. Contrarily, thermal shock resistance of the coated samples enhanced with increase in thickness of the ceramic coating. Investigation of the TBCs with different thicknesses of NiCrAlY and 300 μm thick YSZ layers revealed that the TBC system with 100 μm thick NiCrAlY layer exhibited the best adhesion strength and thermal shock resistance. It was inferred that thermal mismatch stresses and oxidation of the bond coats were the main factors causing failure in the thermal shock test.

Keywords: TBC; YSZ; NiCrAlY; Adhesion strength; Thermal shock; Residual stress.

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