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Role of Internal Oxidation on the Failure of Air Plasma Sprayed Thermal Barrier**Coatings with a Double-layered Bond Coat**

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Abstract

Failure of air plasma sprayed (APS) thermal barrier coatings (TBCs) with a double-layered bond coat was investigated. The bond coat consists of a dense layer near the substrate side and a porous layer on the surface. Both were made of NiCoCrAlY alloy and deposited using high velocity oxygen-fuel technique. After thermal cycling, a large amount of internal oxides formed (up to 45% in volume fraction), introducing a significant volume expansion both in in-plane and perpendicular direction in the bond coat. However, the presence of the ceramic top coat can suppress the bond coat in-plane swelling thus lowering the internal oxidation rate. Compared with the fully dense bond coat, the interface roughness of the porous bond coat increases significantly when internal oxidation occurs. There is a strong correlation between the internal oxidation and the interface roughness. In addition, both the beneficial and detrimental effects of internal oxidation on TBC failure were discussed. It is proposed that a fully dense bond coat with a proper surface roughness should have a longer thermal cycling

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