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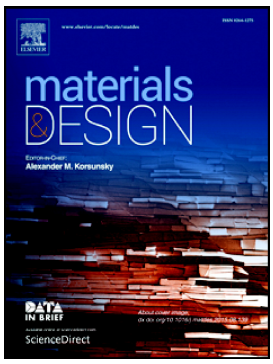

Spallation of thermal barrier coatings with real thermally grown oxide morphology under thermal stress

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Spallation of thermal barrier coatings with real thermally grown oxide morphology under thermal stress

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Abstract: Experimental observations display that there exist two types of cracks induced by thermally grown oxide (TGO) in electron beam physical vapor deposition (EB-PVD) thermal barrier coatings (TBCs), which will lead to the coating spallation. Up to now, the failure mechanism induced by TGO is not clear. In this work, a finite element model with real thermally grown oxide morphology for crack propagation in TBCs is established by taking the advantage of commercial finite element package (ABAQUS) and image processing technique (Coreldraw). The coating failure mechanism under thermal mismatch stress is investigated. Present analysis and discussions show that the horizontal crack tends to propagate through the top coat layer toward the interface during the cooling stage, while the interface crack initiates at the points located in the middle region and then propagates in two side directions simultaneously, and mode II fracture plays a dominant role in the whole crack propagation process. Finally, two failure mechanisms of the TC/TGO interface are proposed in this paper.

Key words: Thermal barrier coatings; Real thermally grown oxide morphology; Thermal stress; Crack propagation; Failure mechanism

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