Lifetime performance of Yb-Gd-Y-based thermal barrier coatings with buffer layer in thermally graded mechanical fatigue environments

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Abstract

The effects of buffer layer on the crack generation and thermal fatigue behaviors of Yb-Gd-Y-stabilized zirconia (YGYZ) based thermal barrier coatings (TBCs) were investigated through thermally graded mechanical fatigue (TGMF) test. Double buffer layers were introduced to enhance the thermomechanical properties in the YGYZ based TBC systems, deposited with the regular and high purity 8YSZ buffer layers. TGMF tests were performed at 1100 ^{o}C with a tensile load of 60 MPa, till 50% spallation of the top coat or cracking at the interface between the top and bond coats. The multilayer TBCs showed longer lifetime performance compared to the single layer YGYZ based TBCs, showing delamination and/or cracking at the interface between the buffer layer and the top coat in the multilayer TBCs. The feedstock purity in the buffer layer was also effective in enhancing the lifetime performance of YGYZ based TBC system in the thermal and mechanical environments. Failure mechanisms in the layered TBCs were investigated and discussed based on the crack initiation and propagation behaviors observed through the TGMF tests.

Keywords: Thermal barrier coating; Buffer layer; Purity; Thermally graded mechanical fatigue test; Thermal durability