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Temperature Induced Structure Degradation of Yttria-Stabilized Zirconia Thermal Barrier Coatings

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Abstract

The structural aspects of yttria-stabilized zirconia (YSZ) thermal barrier coatings grown on a polycrystalline alumina substrate have been studied as a function of annealing time at 1250 °C with the use of electron microscopy, X-ray diffraction, and Raman spectroscopy. Upon the high temperature exposure, the feathery morphology of the columnar grains of the as-deposited coatings smoothens out with the concurrent development of surface undulations and grain coarsening. It is shown that the grain coarsening results in significant voiding along the merged grain boundaries and inside YSZ grains. The nucleation and growth of the high density of voids is related to the clustering of vacancies supplied from the merged gaps between columnar grains and subgrains within the columnar grains. The continued development of the voids leads to the formation and propagation of large cracks within the columnar grains, which

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