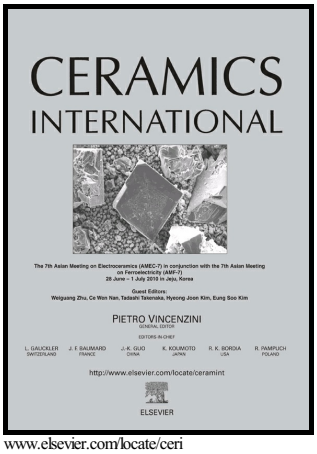

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Effect of five kinds of pores shape on thermal stress properties of thermal barrier coatings by finite element method

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Abstract

Thermal ablation is a very important technique to characterize the thermal properties of coating systems. On account of the concentration of thermal stress, thermal barrier coatings (TBCs) often break off from the substrate partly or completely during the thermal erosion. In this paper, the thermal erosion simulation of finite element geometric models based on the possible pore shapes were implemented, especially, the influence of pore shapes on the distribution of coating temperature, X component of stress, Y component of stress, XY-shear stress and von-Mises stress were focused on. The effects of the different porosity of square pore coatings on thermal insulation properties and thermal stresses were discussed in term of the simulation results. The simulation results indicate that different shape pores not only affect the thermal stress distribution above the contact area between the bond coating and top coating surface, but also affect the plastic deformation behavior of TBCs. The micromechanism was discussed in details in this study. The computed results verified that, the computational method can successfully predict thermal shear, crack initiation and normal failure mode of the studied TBCs. All the results are in good agreement with the corresponding experimental findings. The failure mechanism factors in this paper are of great importance to explain the failure micro-mechanism of TBCs.

Keywords: Shaping; thermal stress; failure analysis; finite element method