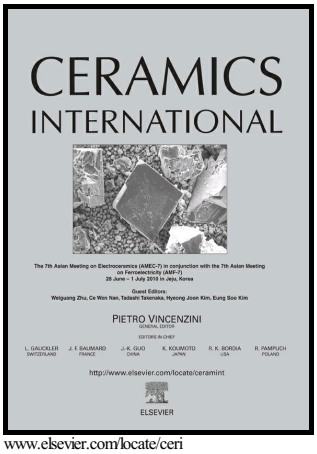

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Abstract

In the present work, gadolinium zirconate ($Gd_2Zr_2O_7$) coatings have been developed on Inconel-718 substrates by electron beam physical vapor deposition (EB-PVD) technique. The structural, morphological and mechanical properties as a function of substrate temperature have been investigated by X-ray diffraction (XRD), scanning electron microscopy (SEM), atomic force microscopy (AFM), nanoindentation and scratch tests. XRD analysis revealed that the coatings showed cubic defect fluorite phase, and no secondary phase formation was observed in the coatings during deposition. The decrease in the lattice constant of the fluorite phase with increasing deposition temperature was explained on the basis of strain relaxation and vacancy concentration. Increased surface roughness of the coatings has been found with increasing substrate temperature as a result of increased crystallite size. An improved coating adhesion achieved for the coating deposited at higher substrate temperature of 973 K was confirmed by scratch test. Nanoindentation measurements indicated higher hardness (7.7 GPa) and resistance to plastic deformation and better capability to accommodate deformation energy for the coatings prepared at higher deposition temperature.

Keywords:

EB-PVD, Gadolinium zirconate, Substrate temperature, Morphology, Nanoindentation, TBCs.