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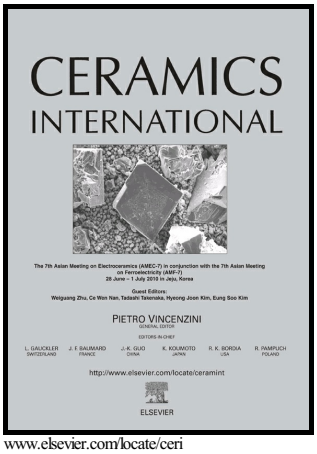

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Thermal cycling behavior of nanostructured 8YSZ，SZ/8YSZ and 8CSZ/8YSZ thermal barrier coatings fabricated by atmospheric plasma spraying

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Abstract

The nanostructured single-ceramic-layer (SCL) 8YSZ thermal barrier coatings (TBCs), double-ceramic-layer (DCL) $Sm_2Zr_2O_7$ (SZ)/8YSZ and SZ doped with 8wt.% CeO_2 nanoscale particles (8CSZ)/8YSZ TBCs were fabricated by atmospheric plasma spraying (APS) on nickel-based superalloy substrates with NiCoCrAlY as the bond coating. The thermal cycling behavior of the three as-sprayed TBCs was investigated systematically at 1000℃ and 1200℃. The results reveal that the thermal cycling lifetime of the nanostructured DCL 8CSZ/8YSZ TBCs is the longest among them, which is largely due to the fact that the intermediate layer buffer effect of the DCL structure, more porosity and improvement of thermal expansion coefficient from doping CeO_2 nanoparticles can relieve thermal stress to a great extent at elevated temperature. The failure mechanism of the nanostructured TBCs has been discussed in detail.

Keywords: Nanostructured thermal barrier coatings; Atmospheric plasma spraying; Nanoscale CeO_2 doping; Thermal cycling behavior

1. Introduction

Thermal barrier coatings (TBCs), which are refractory-oxide ceramic coatings, are widely used to protect metallic components of gas turbine and aircraft engines from thermal damage due to their excellent thermal insulation property [1-5]. Based on this