

The role of formation of continues thermally grown oxide layer on the nanostructured NiCrAlY bond coat during thermal exposure in air

Abstract :

In recent years, the life expectancy of thermal barrier coatings is expected to be improved by applying the nanostructured NiCrAlY bond coat. The present paper reviews the main technique used in the synthesis of nano-crystalline NiCrAlY powders using a planetary ball mill and investigates the microstructural evolution of thermally grown oxide (TGO) layer on the conventional and nanostructured atmospheric plasma sprayed (APS) NiCrAlY coatings in thermal barrier coating (TBC) systems during oxidation. Microstructural characterization showed that the growth of Ni(Cr,Al)<sub>2</sub>O<sub>4</sub> (as spinel) and NiO on the surface of Al<sub>2</sub>O<sub>3</sub> layer (as pure TGO) in nano TBC system was much lower compared to that of normal TBC system during thermal exposure at 1150 °C. These two oxides play a detrimental role in causing crack nucleation and growth, reducing the life of the TBC in air. This microstructure optimization of TGO layer is primarily associated with the formation of a continuous, dense, uniform Al<sub>2</sub>O<sub>3</sub> layer (at first 24 h of isothermal oxidation at 1000 °C) over the nanostructured NiCrAlY coating.