Effect of Feedstock Species on Thermal Durability of Thermal Barrier Coatings

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Thermal durability and stability of thermal barrier coatings (TBCs) are closely related with its microstructure and feedstock species. Numerous factors, besides the thermal and mechanical properties, have to be considered in practical applications of TBCs. There is therefore a need to the reliability and lifetime performance of the plasma sprayed TBC system. In this study, the microstructures in the top and bond coats of TBCs have been deposited different plasma spray process. The TBC system with the thicknesses of 500 and 200 μm in the top and bond coats, respectively, were prepared with the air plasma sprayed (APS) coating system using ZrO_2–8wt% Y_2O_3 powders for the top coats and vacuum-plasma sprayed coating system using Ni-based metallic powders for the bond coats. In order to investigate the improvement of thermal durability, the furnace cyclic test (FCT) was performed for the TBC samples at a temperature of 1100°C with a dwell time of 1 h for 1000 cycles. Porosity and pore size distribution were measured with the FCT, and the effects of feedstock species in the TBC on mechanical properties such as hardness and toughness were observed, including the adhesive strength before and after the FCT. The nominal pore size of as-prepared TBC system is dramatically reduced with increasing thermal exposed cycle. The harness and toughness values are increased to 1000 cycles. The influence of feedstock species on the microstructural evolution and thermal durability of TBC is discussed.