Fabrication and Characterization of Thermal Barrier Coating of Yttrium Stabilized Zirconia by Suspension Plasma Spray and EBPVD Method

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To meet the demand for the higher operating temperatures of gas turbines, extensive research efforts have been carried out attempting to enhance the performance of thermal barrier coatings (TBCs) in the field of coating process as well as topmost layer materials. Fabrication of TBCs with segmented microstructures has been widely studied with various coating processes such as suspension plasma spray (SPS), plasma spray physical vapor deposition (PS-PVD), and electron beam physical vapor deposition (EBPVD). One the other hand, rare-earth zirconate system is one of the most promising candidates for replacing yttira-stabilized zirconia (YSZ) in TBC applications.

In this study, thermal barrier coatings of YSZ or rare-earth added zirconate system are fabricated via suspension plasma spray and EBPVD method. At first, the SPS process is applied to produce TBCs with a segmented structure by using YSZ suspension. Four different experiment sets are carried out by controlling the ratio between surface roughness of substrate and feed stock size in order to examine the effect of size ratio on the microstructure of SPS-prepared coatings. Secondly, Lanthanum/gadolinium zirconate coatings are fabricated by suspension plasma spray. Phase formation, microstructures, and thermal conductivities are examined with the deposited coatings of lanthanum/gadolinium zirconate compositions. The third set of experiment is controlling columnar structure of YSZ coatings prepared by EBPVD as a function of rotation speed. The possibilities of these coatings for TBC application are also discussed.