

PS-PVD THERMAL/ENVIRONMENTAL BARRIER COATINGS WITH NOVEL MICROSTRUCTURES

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Plasma spray physical vapor deposition (PS-PVD) technology has attracted increasing attention due to its promising potential in processing advanced functional coatings such as thermal/environmental barrier coatings (TBCs) by flexibly tailoring the coating microstructure architecture in a broad range. In this work, yttria stabilized zirconia (YSZ) TBCs with a novel quasi-columnar structure were prepared by co-deposition of vapor phase and nano-clusters using PS-PVD and the associated deposition mechanism was discussed. The thermo-physical and mechanical properties, sintering resistance and thermal shock life of the coating were investigated. The thermal conductivity is in a range of 0.7~1.0 W/mk between 200 °C and 1200 °C and the average life is ~4000 cycles during thermal shock testing in which the coating surface was heated to 1200 °C within 20 s and held at the temperature for 5 min by gas flame. Noted that the quasi-columnar TBC revealed much better resistance to glassy CaO-MgO-Al₂O₃-SiO₂ (CMAS) adsorption than those TBCs produced by air plasma spray (APS) and electron beam physical vapor deposition (EB-PVD) and some attempts were made to understand the related mechanisms.

Ytterbium silicate/mullite/Si environmental barrier coatings (EBCs) were sprayed onto SiC ceramic matrix composites (CMC) by PS-PVD. The dense ytterbium silicate coating deposited at 65 kw is mainly composed of ytterbium disilicate resulting from vapor-phase deposition, whereas the layered coating at 40 kw is mainly ytterbium monosilicate from liquid deposition.