Thermal durability of thermal barrier coatings – effect of purity and monoclinic phase in feedstock powder

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Abstract

The effects of the purity and monocline phase of feedstock powder on the thermal durability in thermal barrier coatings (TBCs) were investigated through the jet engine thermal shock (JETS) test. Three kinds of feedstock powders, such as regular purity (YSZ), high purity (HP), and non-monoclinic phase (nMP) in 8 wt% yttria-stabilized zirconia, were deposited on the Ni-Co based bond coat by an air plasma spray (APS) process. The thicknesses of the top and bond coats were designed and controlled as 400 and 200 μm, respectively. In each cycle of JETS test, the top surface of TBC was heated with flame of 1400 ℃ for 25 s, and then cooled for 25 s using nitrogen gas. Regardless of feedstock species, all samples showed sound condition in the JETS test up to 2000 cycles. As the number of cycles increased over 2000, the lifetime of the TBC with HP powder was longer than those with the YSZ and nMP powders. The TBC with YSZ powder showed the shortest thermal durability in the TBC with YSZ powder. The relationship between feedstock species and thermal durability is extensively discussed, based on microstructure evolution and phase stability during the JETS tests.

Key works: Thermal barrier coating; Feedstock powder; Monoclinic phase; Purity; Thermal durability; Jet engine thermal shock test.