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Sintering resistance of advanced plasma-sprayed thermal barrier coatings with strain-tolerant microstructures

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Abstract. Sintering is one of the key issues in the high temperature service of thermal barrier coatings (TBCs), considering the continuously increasing operation temperature of gas-turbine for higher energy efficiency. Based on the conventional processing method of air plasma spraying (APS), suspension plasma spraying (SPS) technique has been developed recently, in order to improve the strain tolerance of TBCs. This strain tolerance of plasma-sprayed TBCs is largely effected by the sintering behavior, which is presently not fully understood. In this work, evolution of mechanical properties, in terms of Young's modulus and viscosity, is systematically investigated by in-situ three-point bending test at 1200 °C on free-standing coatings, including micro-cracked APS, segmented APS, vertically cracked SPS and columnar structured SPS TBCs and correlated to the microstructural evolution. Based on experimental results, power law relations are proposed for the sintering induced mechanical evolution, which deepen the understanding of the sintering behavior of plasma-sprayed TBCs.

Key words: Sintering; Plasma-spraying; Thermal barrier coatings; Mechanical properties

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