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PROCEEDINGS

Segment Crack Formation and Density Regulation in Air Plasma Sprayed Coatings

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ABSTRACT

Air Plasma Sprayed (APS) Thermal Barrier Coatings (TBCs) have been widely used in land-based gas engines for enhancing the high temperature performance due to their outstanding thermal insulation and high durability. Introducing the segment cracks into APS-TBCs to enhance its durability has been quite attractive approaches nowadays. Qualitative conclusions have been drawn to explore the mechanisms on segment crack formation in the past decades. This article acts as a quantitative study of segment crack formation and crack density regulation mechanism in APS Yttria-Stabilized Zirconia (YSZ) TBCs with experimental observations and analytical calculations. An in-situ stress measurement method is developed through a self-developed in-situ beam curvature measurement equipment to monitor the quenching stress evolution during deposition. Therefore, the influence mechanisms among deposition parameters, peak quenching stress and segment crack formation are summarized. A shear-lag model is used to describe the stress fields in APS TBC in deposition stage, further cracking analysis and segment crack density analysis have been carried out to verify the experimental results. The linear relationship among temperature variation, peak quenching stress, coating microstructures and segment crack densities is concluded and the influence of preheating temperature and passage thickness on peak stress is analyzed. The analytical and experimental results can be further applied to predict and optimise the coating characteristics with given processing parameters.

KEYWORDS

Segment coatings; temperature variation; peak quenching stress; cracking energy model; crack density regulation

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