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PROCEEDINGS

Over Temperature of the Thermal Barrier Coating System with Local Spallation

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ABSTRACT

The capacity to maintain operational temperatures within safe thresholds is paramount for the longevity of thermal barrier coating systems (TBCs). Nonetheless, TBC spallation during service can lead to localized over temperature, which may result in catastrophic failure. In this study, we examine the phenomenon of over temperature in locally spalled TBCs through a combination of numerical simulations and experimental investigations. We perform numerical calculations to determine the temperature distributions in locally spalled TBCs with varying spallation depths and diameters, and we analyze the correlation between the maximum temperature within the spalled regions and the dimensions of the spallation based on dimensional analysis. Subsequently, we conduct experimental studies to explore the localized over temperature induced by spallation in TBCs, validating our findings through the established relationship between peak temperature and spallation size. We evaluate the impact of gas temperature (ranging from 1700 K to 1800 K), spallation depth (from 0.2 mm to 0.6 mm), and spallation diameter (spanning 0 to 20 mm) on the maximum temperature observed in locally spalled TBCs. Moreover, we determine a critical spallation threshold for TBCs, beyond which over temperature becomes a concern. Our findings underscore the critical significance of TBCs spallation size in the thermal management of gas turbines.

KEYWORDS

Thermal barrier coating system; over temperature; local spallation; spallation size

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