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Abstract

Thermal barrier coatings (TBCs), consisting of a ceramic top coat and a metallic bond coat, offer resistance against high temperature degradation of turbine components. Cyclic oxidation of the bond coat, thermal stresses due to their thermal mismatches during cyclic operations, and sintering of the top coat are considered to be the common ways by which thermal barrier coatings fail. To reduce sintering, a nano structured high purity yttria stabilized zirconia (YSZ) was developed. The focus of this work is to compare the damage development of such high purity nano YSZ TBC during thermal cycling with a conventional YSZ TBC. Thermal cyclic fatigue (TCF) tests were conducted on both the TBC systems between 100 ^{o}C and 1100 ^{o}C with a 1h hold time at 1100 ^{o}C. TCF test results showed that conventional YSZ TBC exhibited much higher life compared to the high purity nano YSZ TBC. The difference in the lifetime is explained by the use of microstructural investigations, crack length measurements along the cross-section and the difference in the elastic modulus. Furthermore, stress intensity factors were calculated in order to understand the difference(s) in the damage development between the two TBC systems.