TENSION-COMPRESSION FATIGUE OF NEXTEL™ 720/ALUMINA COMPOSITE AT 1200 °C IN AIR AND IN STEAM

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Summary: Tension-compression fatigue behavior of an oxide-oxide ceramic matrix composite was investigated at 1200°C in air and steam environments. The composite is comprised of an alumina matrix reinforced with Nextel 720 alumina-mullite fibers woven in an eight harness satin weave (8HSW). The composite has no interface between the fiber and matrix, and relies on the porous matrix for flaw tolerance. Tension-compression fatigue behavior was studied for fatigue stresses ranging from 60 to 120 MPa at a frequency of 1.0 Hz. The R ratio (minimum stress to maximum stress) was -1.0. Fatigue run-out was defined as 105 cycles and was achieved at 80 MPa in air and at 70 MPa in steam. Steam reduced fatigue lives by an order of magnitude. Specimens that achieved fatigue run-out were subjected to tensile tests to failure to characterize the retained tensile properties. Specimens subjected to prior fatigue in air retained 100% of their tensile strength. The steam environment severely degraded tensile properties. Tension-compression fatigue was considerably more damaging than tension-tension fatigue. Composite microstructure, as well as damage and failure mechanisms were investigated.