

Analysis of Fatigue Crack Propagation Behaviour In Sic Particulate Al₂O₃ Whisker Reinforced Hybrid MMC

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ABSTRACT

The fatigue crack propagation behaviour of a cast hybrid metal matrix composite (MMC) was investigated and compared with the crack propagation behaviour of MMC with Al₂O₃ and Al alloy in this article. Three dimensional (3D) surface analysis is carried out to analyze the crack propagation mechanism. All three materials clearly show near threshold and stable crack growth regions, but the rapid crack growth region is not clearly understood. The crack propagation resistance is found higher in hybrid MMC than that of MMC with Al₂O₃ whisker and the Al alloy in the low ΔK region. The crack propagation in the hybrid MMC in the near-threshold region is directed by the debonding of reinforcement-matrix followed by void nucleation in the Al alloy matrix. Besides, the crack propagation in the stable- or midcrack-growth region is controlled by the debonding of particle-matrix and whisker-matrix interface caused by the cycle-by-cycle crack growth along the interface. The transgranular fracture of the reinforcement and void formation are also observed. Due to presence of large volume of inclusions and the microstructural inhomogeneity, the area of striation formation is reduced in the hybrid MMC, caused the unstable fracture.

DOI: 10.1088/1757-899X/114/1/012115