Low cycle fatigue behavior and mechanism of Al-3.5Si-0.5Mg-0.4Cu

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Abstract

In this article, the low cycle fatigue(LCF) behavior of a low silicon cast aluminum alloy Al-3.5Si-0.5Mg-0.4Cu with T6 treat-state at room temperature is investigated by extracting samples from aluminum steering knuckles. Initial microstructure, cyclic stress response behavior and fatigue fracture are studied. Low cycle fatigue experiment results and behavior performance of 6 different total strain amplitudes are included. OM, SEM, XRD and TEM are carried out to observe pre(post)-fatigue microstructures and fracture. The results demonstrate that cracks initiate from surface or subsurface defects and higher total strain amplitude leads to larger sum area of fatigue crack initiation region and steady crack propagation region, and wider fatigue striation bandwidth. Furthermore, crack propagates along the interface between eutectic silicon and α -Al under low strain amplitude while crack grows through eutectic silicon particle if higher strain amplitude is applied.

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