Quantitative investigation on the deformation modes and cracking behavior during cyclic torsional loading of extruded pure Mg and Mg-3Y alloy

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Abstract

This study explores the effect of adding 3wt.% Y to pure magnesium (Mg) on its mechanical behavior under cyclic torsional loadings at room temperature. The research examines deformation and cracking modes in both pure Mg and Mg-3Y samples. Deformation modes are monitored using quasi-in-situ EBSD observations coupled with slip trace analysis. The findings reveal that basal slip dominates the cyclic deformation throughout the fatigue life of the pure Mg sample, while both basal and pyramidal slip dominate the cyclic deformation in the Mg-3Y sample. Intergranular cracking is the primary cracking mode for both samples under cyclic torsional loadings. Basal and pyramidal slip PSB cracking serves as a primary transgranular cracking mode in the pure Mg and Mg-3Y samples, respectively. The study also investigates the underlying mechanism governing the activity of various deformation modes, cracking modes, and mechanical behavior.

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