

Investigating the effect of Y on boundary-dislocation interactions in Mg-Y using quasi in-situ nanoindentation and electron channeling contrast imaging

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Solute-defect interactions have been proven essential to grain boundary engineering employed in the development of novel high-performance Magnesium alloys. We aim at unraveling the influence of solutes on the mechanical response of grain boundaries by investigating a tensile twin boundary (TB) decorated with Y atoms compared to the counterpart boundary in pure Mg. Quasi in situ nanoindentation, electron channeling contrast imaging (ECCI), a non-destructive SEM method based on the detection of backscatter electrons, and high-resolution electron backscatter diffraction (HR-EBSD) were employed to first induce localized deformation in the vicinity of a twin boundary and subsequently analyze the corresponding mechanical grain boundary response. Interactions between emitted dislocations and the twin boundary were investigated according to the indents distance from the boundary, the presence of solutes and the dislocation type. The presented combined approach of quasi in-situ nanoindentation and ECCI observations is an effective and non-destructive method for the investigation of nanomechanical phenomena advancing the current knowledge of solute effects on mechanical grain boundary properties [1]. Corresponding molecular dynamics simulations are currently in progress to complement and deepen the understanding of the complex interplay between solutes, dislocations and grain boundaries.

Reference :

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