

Nucleation and growth of twins during fracture of a fine grained magnesium alloy

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Twinning is an important mode of deformation in magnesium and its alloys. Twins also play an important role in the fracture of the alloys, by stress concentration of dislocations on the twin boundaries of the common $\{10-12\}$ type twins, or formation of $\{10-11\}$ - $\{10-12\}$ double twins. Dislocations also play important role in nucleation and growth of twins. Nucleation of twins and double twins, mainly $\{10-12\}$ type, has been subject of a number of studies, experimental as well as computational. In this study, nucleation of $\{10-11\}$ type twins has also been studied. Dislocation-twin interactions and nucleation of twins have been observed by high resolution TEM under a crack surface of a fracture toughness tested fine grained Mg-Zn alloy. Subgrain and low angle grain boundary formation by dislocation slip leads to nucleation of $\{10-11\}$ twins. Twin multiplication occurs by nucleation and growth by interaction of dislocation slip with twins. Basal and prismatic slips were found prominently inside $\{10-11\}$ twins as well as in the matrix. Nucleation of $\{10-11\}$ twins was found in form of stacks of nano-sized domains twin-related to each other. Nucleation of $\{10-11\}$ twins on single tilt grain boundaries by stress concentration caused by dislocation pile up has also been observed. Some results of computational studies have been confirmed, while some new mechanisms of twin nucleation will be proposed.

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