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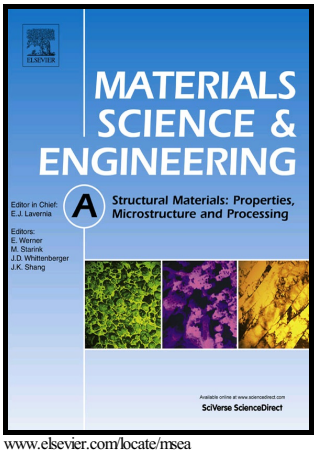

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Formation of 60°⟨01$\bar{1}$0⟩ boundaries between {10$\bar{1}$2} twin variants in deformation of a magnesium alloy

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Abstract:

Interrupted tensile testing along the normal direction of a rolled AZ31 magnesium plate was conducted at various strain levels from 6% to 15.5%. Prior to deformation the specimens were annealed for grains to coarsen such that multiple twin variants in one grain can be activated and interaction between variants can be better resolved. The grain structure and texture evolution were then examined via electron backscatter diffraction. The results reveal that multiple primary $\{10\bar{1}2\}_P$ twin variants inside individual grains grow and impinge, forming profuse boundaries of 60°⟨01$\bar{1}$0⟩ orientation relationship. These boundaries are close to $\{11\bar{2}2\}\langle 11\bar{2}\bar{3}\rangle$ twin relationship, however, they are not formed by twin nucleation and are only a product of interaction between the primary twins. The morphology of these special boundaries are highly irregular. Atomistic simulations were performed to understand such interaction, and the results show that such 60°⟨01$\bar{1}$0⟩ boundaries have limited mobility. Thus, a primary twin variant is able to grow at the expense of other primary twin variants. Our experimental results also show that $\{10\bar{1}2\}$ twinning is active throughout the