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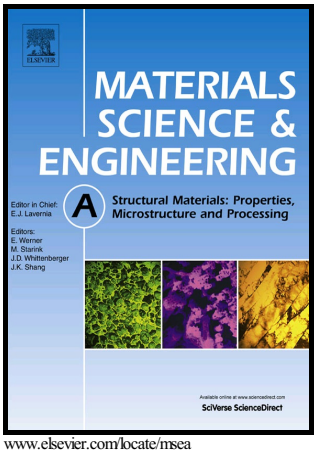

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Competitive twinning behavior in magnesium and its impact on recrystallization and texture formation

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Abstract

Rolled pure Mg and Mg-1wt.% Gd alloy were subjected to room temperature in-plane compression along the rolling direction, followed by isochronal annealing treatments for 1 hour. The results of deformation texture and microstructure showed substantial differences due to rare earth alloying. In spite of imposed c-axis extension during deformation, the Mg-1Gd alloy retained the initial texture with the majority of basal poles concentrated near the longitudinal direction of the used channel-die tool. Electron back scatter diffraction analysis of the deformation microstructure revealed a predominance of $\{10\bar{1}1\}$ compression and $\{10\bar{1}1\}$-$\{10\bar{1}2\}$ double twins relative to coexisting $\{10\bar{1}2\}$ tension twins. This behavior was significantly contrasting in comparison with that of pure Mg, wherein first and second generation $\{10\bar{1}2\}$ tension twins were observed in profuse quantities. Continuous dynamic recrystallization took place inside compression and double twins by means of slip assisted subgrain rotation about the [0001] axis giving rise to a sharp prismatic fiber of recrystallized orientations. This fiber was transformed into a randomized texture pattern during subsequent static recrystallization and grain growth due to a different discontinuous recrystallization mechanism. This resulted in a significant annealing texture weakening and an increase of the overall Schmid factor for basal slip.

Keywords: Texture, dynamic recovery, recrystallization, magnesium, rare-earths

1. Introduction

Deformation of hexagonal close packed (HCP) crystals takes place by activation of dislocation slip and mechanical twinning, and is characterized by a strong directional anisotropy. Deformation twinning is a very important feature of HCP plasticity due to its strong impact on