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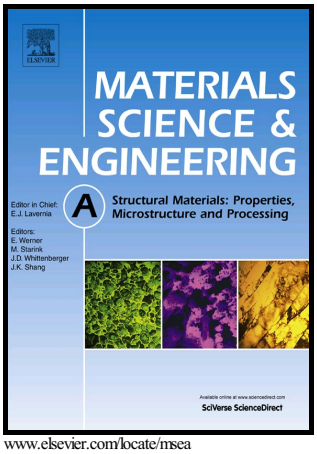

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A comparative study of the role of Ag in microstructures and mechanical properties of Mg-Gd and Mg-Y alloys

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Abstract

Mg-Gd and Mg-Y are two fundamental Mg alloy systems. Four alloys with a equi-concentration of total alloying elements: Mg-2.8Gd-0.1Zr (at. %), Mg-2.4Gd-0.4Ag-0.1Zr (at. %), Mg-2.8Y-0.1Zr (at. %) and Mg-2.4Y-0.4Ag-0.1Zr (at. %) were designed. The role of Ag in the Mg-Gd and Mg-Y alloys were comparatively studied. The Ag addition enhances the age-hardening response of the Mg-2.4Gd-0.4Ag-0.1Zr due to a combined strengthening effect of the prismatic β′ and basal γ′′ precipitates. In contrast, the Mg-2.4Y-0.4Ag-0.1Zr exhibits a weakened age-hardening response in comparison with the Mg-2.8Y-0.1Zr, which is due to the formation of the basal γ′′ precipitates at the expense of the prismatic β′ precipitates. The Ag addition also promotes the formation of precipitation free zones (PFZs) along grain boundaries in both Mg-2.4Gd-0.4Ag-0.1Zr and Mg-2.4Y-0.4Ag-0.1Zr. The grain boundary PFZ is supposed to relax stress concentration to some extent during plastic deformation, which is beneficial to ductility. In summary, the Ag addition not only improves the tensile yield strength (YS) and ultimate tensile strength (UTS), but also improves the elongation of