
Effect of thermomechanical treatment on fracture toughness of Mg alloys

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Abstract

This work is focused on the effect of microstructure on the fracture toughness of Mg-9Gd-4Y-1Zn-0.5Zr alloy processed by hot extrusion as well as various heat treatment. Microstructure and mechanical properties of alloys under various heat treatment conditions were observed and analyzed. The fracture toughness of the alloys was measured through nanoindentation. The microstructure of Mg-9Gd-4Y-1Zn-0.5Zr alloy after extrusion deformation is partly recrystallized microstructure, which is typical dynamic recrystallization microstructure containing a small amount of long-period ordered (LPSO) phase distributed along the extrusion direction. The non-recrystallized structure in the alloy is almost completely recrystallized structure after the peak-ageing treatment (T5). The extruded alloy was then solid solution treated before ageing treatment which is denoted as T6 treatment. The peak aging hardness of the alloy after T6 treatment is much higher than that of the T5 treated alloy and the tensile strength of the T6 treated alloy is higher than that of the extruded alloy, which is slightly lower than that of the T5 treated alloy. However, the elongation of the extruded alloy is the highest, followed by the T6 treated alloy and the T5 treated alloy, indicating that the T6 treated alloy has achieved a relatively good combination of strength and plasticity.

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