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**Effect of heat treatment on tensile properties, impact toughness and
plane-strain fracture toughness of sand-cast Mg-6Gd-3Y-0.5Zr
magnesium alloy**

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Abstract

The tensile properties, impact toughness and plane-strain fracture toughness of sand-cast Mg-6Gd-3Y-0.5Zr magnesium alloy were studied in different thermal conditions, including as-cast, as-quenched and isothermal aging states. The results show that optimum heat treatment is solutionized at 490°C for 12 h, and then aged at 212°C for 100 h. Tensile test exhibits that as-quenched GW63 alloy shows high elongation but low tensile strength, nevertheless, aged alloy shows higher strength but worse ductility. Impact values of GW63 alloy are 34.6, 50.9 and 20.3 J/cm² in the as-cast, as-quenched and aged states, respectively. Room temperature impact toughness is more closely related to material ductility than strength for the studied alloy. The plane-strain fracture toughness values of the as-cast, as-quenched and aged alloy are 16.2, 17.7 and 19.5 MPa·m^{1/2}, respectively, i.e., the improvement of 20.4% has been achieved by aging precipitation strengthening in contrast with slight improvement of 9.3% by solid solution strengthening. In addition, fractured characteristics after impact and fracture toughness tests were also investigated by fracture analysis.

Keywords: Mg-Gd-Y-Zr; Heat treatment; Impact toughness; Fracture toughness; Cast magnesium alloy

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