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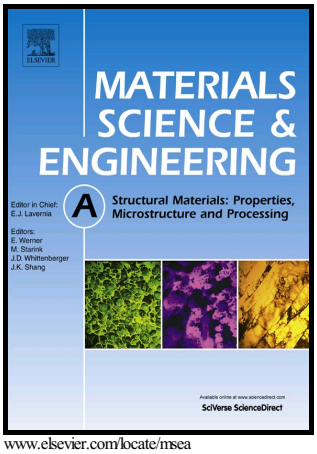

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Microstructure evolution and mechanical properties of quasicrystal-reinforced Mg-Zn-Y alloy subjected to ultrasonic vibration

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Abstract: Although the icosahedral quasicrystal phase found in Mg-Zn-Y alloys has some outstanding characteristics, the coarse α-Mg dendrites and the agglomeration of the secondary phases in as-cast microstructure restrict the improvements in the mechanical properties. In this study, the semisolid slurry of Mg-6Zn-1.4Y alloy was obtained with ultrasonic vibration (UV) treatment and then formed by rheo-squeeze casting (RSC) process. The effects of UV on the microstructure evolution and mechanical properties were systematically investigated. With UV, primary α-Mg grains and the agglomerated Mg-Zn-Y compounds were significantly refined. Notably, a large mass of fine and granular quasicrystal I-phase particles precipitate in the grains at the later stage of solidification. The RSC alloy subjected to 6 W/mL UV exhibited the optimal mechanical properties, with the yield strength of 129 MPa, the ultimate tensile strength of 231 MPa and the elongation of 18.5%. Compared with the samples without UV, they are increased by 18.3%, 14.9% and 55.5%, respectively.

Keywords: Mg-Zn-Y alloy; icosahedral quasicrystal phase; ultrasonic vibration; tensile properties

1. Introduction

Mg-Zn-Y alloys reinforced by a thermally stable icosahedral quasicrystal phase (I-phase) have attracted tremendous attention in recent years due to their high strength at room and elevated temperatures [1-3]. The stable icosahedral quasicrystal phase was first reported in Mg-Zn-Y alloys by