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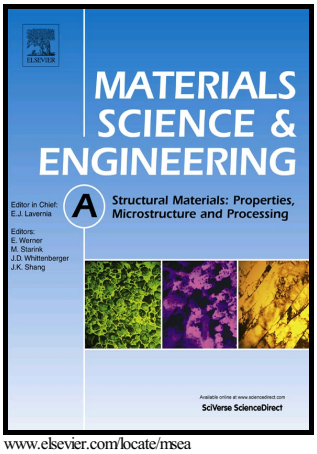

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ACCEPTED MANUSCRIPT

Evolution of microstructure and mechanical properties of an as-cast Mg-8.2Gd-3.8Y-1.0Zn-0.4Zr alloy processed by high pressure torsion

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Abstract:

The novel Mg-8.2Gd-3.8Y-1.0Zn-0.4Zr alloy with high content of rare earth elements has been processed successfully by high pressure torsion (HPT) starting from an as-cast condition. HPT processing was conducted at room temperature for a range of turns from 1/8 to 16, and the evolutions of microstructure and microhardness were investigated. The average grain size decreases from ~85 μm in the as-cast condition to ~55 nm when the equivalent strain reaches ~6.0, and remains almost constant on further strain increase. Meanwhile, the coarse netlike $Mg_3(Gd,Y)$ second phase structures are gradually broken into fine dispersed particles and the dislocation density increases. The microhardness of the alloy increases with increasing strain, and when the equivalent strain reaches ~6.0, the microhardness reaches a saturated value of about 115 HV, which is higher than that obtained by conventional extrusion / rolling of this alloy. The full range of possible mechanisms of hardening are analysed and this reveals that hardening is primarily due to the pronounced grain refinement, which

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