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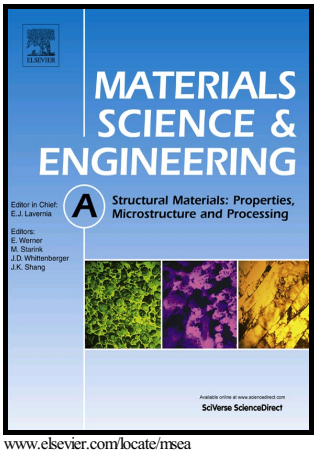

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The effect of volume fraction and dispersion of icosahedral phase particles on the strength and work hardening of Mg-Zn-Y alloys

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Abstract

The cast microstructure of a Mg-13Zn-1.55Y alloy (ZW132) with a high volume fraction of *I*-phase (7.4 %) was refined considerably by severe plastic deformation via high-ratio differential speed rolling (HRDSR). Ultrafine grains (0.7-1.3 μm) with high angle boundary fractions of 0.48–0.50 were obtained after HRDSR with speed ratios of 2 or 3. The alloy processed at a speed ratio of 3 exhibited high strength and high ductility, with a yield stress of 332 MPa and a tensile elongation of 16.3 %. The ductility of the rolled ZW alloy was controlled by the work hardening rate, which increased as the amount of *I*-phase, the degree of refinement of the eutectic *I*-phase pockets, the degree of dispersion of the broken *I*-phase particles over the matrix, and the size of the resultant grains increased. A model that considers the contribution of these factors to the work hardening rate was proposed. Grain-size