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Mechanical properties and Hall-Petch relationship of the extruded Mg-Zn-Y alloys with different volume fractions of icosahedral phase

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Abstract

The effect of the volume fraction (0.6-8.4%) of the icosahedral phase (*I*-phase) on the microstructure, texture and mechanical properties of extruded Mg-Zn-Y alloys was examined. During extrusion, the eutectic and divorced eutectic *I*-phase in the cast microstructures was broken into small particles, and the particles were dispersed along the extrusion direction, forming particle bands. The broken *I*-phase particles promoted grain refinement via a particle-stimulated nucleation mechanism and led to basal texture weakening through dynamic recrystallization. The work hardening rate increased with an increase in the volume fraction of *I*-phase. However, the strength decreased with an increase in the volume fraction of *I*-phase due to the texture softening effect. To incorporate the texture softening effect into the Hall-Petch relation, a modified Hall-Petch equation, which simultaneously considers the effects of grain size and texture, was developed using the Schmid factors for basal slip. The