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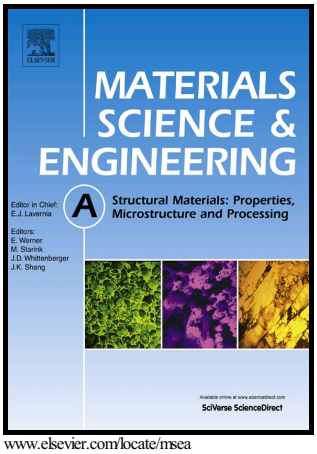

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Mechanical properties of a Hot Deformed Al-Mg_2Si in-situ composite

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Abstract

An as-cast aluminum-matrix composite (AMC) with in-situ formed Mg_2Si phase was subjected to high-temperature annealing, hot rolling, and hot extrusion processes. The modification effect of phosphorous (poisoning effect) was briefly taken into account. It was found that the homogenization heat treatment tremendously influences the eutectic Mg_2Si phase and sharp edges of the primary particles toward slight enhancement of mechanical properties. About 44% increase in ultimate tensile strength and 335% enhancement in total elongation to failure was achieved in the extruded sample, which was ascribed to the changing of the morphology of the primary Mg_2Si particles to more round or spherical shapes, the break-up of the eutectic network, closure of the casting defects, and improvement of the particle-matrix interface. During hot rolling at low reductions in thickness, the break-up of the eutectic structure, fragmentation of the primary particles, and development of a recrystallized microstructure resulted in enhancement of ductility. At high reductions in thickness, however, the retardation of recrystallization resulted in an increase in tensile strength and decrease in ductility with the appearance of small cracks in the heavily rolled sheet. The fracture surface appearances with the consideration of the interfacial decohesion, particle cracking by cleavage facets, and ductile fracture characterized by dimples were also discussed. The tensile toughness was calculated based on approximating the integral using the trapezoidal rule and the extruded composite was shown to have superior properties. Finally, the comparison of mechanical properties between these in-situ