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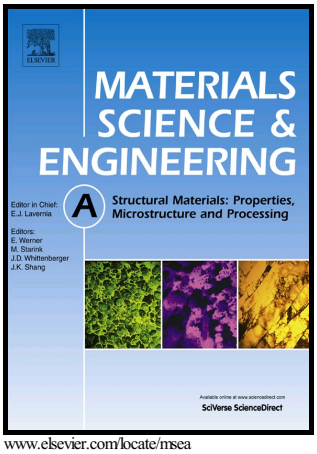

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Effect of intermetallic phases and recrystallization on the corrosion and fracture behavior of an Al-Zn-Mg-Cu-Zr-Yb-Cr alloy

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Abstract

The effects of alloying elements on the characteristics of intermetallic phases and recrystallization in Zr, Yb, Cr-containing Al-Zn-Mg-Cu alloys have been investigated. The results show that the inhibiting recrystallization and subgrain growth behaviour mainly could be attributed to the fine, dense, secondary, coherent Cr-containing Al_3(Yb, Zr) dispersoids with core-shell structures. The volume fraction of primary and secondary $Al_{18}Mg_3Cr_2$ phases decreased and then increased with increasing Cr content from 0.09 wt.% to 0.22 wt.% in the Al-Zn-Mg-Cu-Zr-Yb-Cr alloys. Cr content has little effect on the recrystallization resistance and strengthening effect. Recrystallization of the Al-Zn-Mg-Cu-Zr-Yb-Cr alloys can be attributed to the particle stimulated nucleation (PSN) owing to the presence of primary micro-scale Al_2CuMg and $Al_{18}Mg_3Cr_2$ particles, resulting in a decline in the fracture toughness, tensile properties and corrosion resistance. In the Al-Zn-Mg-Cu-Zr-Yb-Cr alloys, fracture and local corrosion preferentially initiate from these primary micro-scale particles, and then propagate along the high-angle recrystallized grain boundaries or original grain boundaries with continuous, coarser grain boundary precipitates and broadening precipitate-free zone at its periphery. Compared with $Al_{18}Mg_3Cr_2$ discrete particles, the Al_2CuMg constituent particles are more susceptible to be corroded.

Keywords: aluminium alloys; intermetallics; fracture; grain boundaries; recrystallization