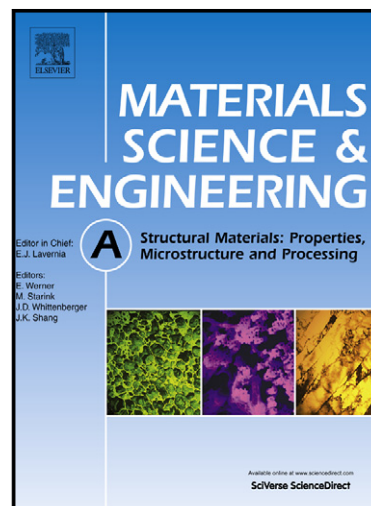


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Microstructure dependent fatigue crack growth in Al–Mg–Sc alloy

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Abstract

The fatigue crack growth behavior of Al–Mg–Sc alloy was investigated by tensile testing and fatigue testing. Different annealing treatments were applied to the alloy. Microstructure characterization of the alloy was carried out by means of transmission electron microscopy (TEM), scanning electron microscopy (SEM) and optical microscopy (OM). The size of $\text{Al}_3(\text{Sc}_{1-x}\text{Zr}_x)$ particle was calculated by software. The fatigue crack growth (FCG) rate (da/dN) was discussed with stress intensity factor range (ΔK) in the Paris's region. The Paris exponent m and constants C were used to calculate the fatigue life. The fatigue process and crack closure effects were discussed with the yield strength and tensile strength of Al–Mg–Sc alloy. Results show that the microstructure, tensile strength and fatigue crack growth rate were greatly dependent on the annealing temperature, and the high resistance of Al–Mg–Sc alloy were mainly due to the combination microstructures of sub-grains, dislocations and these $\text{Al}_3(\text{Sc}_{1-x}\text{Zr}_x)$ precipitates.

Keywords: Aluminum alloys; Annealing; Microstructure; Precipitation; Fatigue crack growth

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