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The Effect of Solution Treatment Time on the Microstructure and Ductility of Naturally-Aged A383 Alloy Die Castings

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Abstract

A383 aluminum alloy high pressure die castings were solution treated at 490°C for six duration ranging between 15 and 180 minutes, subsequently quenched in water and naturally aged for 4 days. The effect of solution treatment time on the evolution of microstructure and tensile properties were determined. As expected, Si particles became larger and rounder with increasing solution treatment time. In all cases, the size and aspect ratio of the Si particles followed the lognormal distribution. Moreover, the coarsening of Si particles during solution treatment was found to follow the Lifshitz –Slyozov-Wagner model. A new equation was developed for the evolution of the aspect ratio during solution treatment of Al-Si-Mg alloys. Analysis of tensile properties showed that elongation and quality index increased steadily with increasing Si particle size, a result that is in contrast with the widely accepted notion that large Si particles impairs the ductility of cast Al-Si-Mg alloys. The positive correlation between Si particle size and quality index was interpreted to be due to partial healing of oxide bifilms entrained in the castings.

Keywords: Heat treatment; Homogenization; ADC12 alloy; aspect ratio; coarsening.

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