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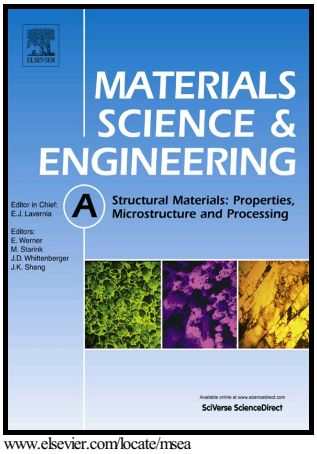

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The Effect of Solution Treatment Time on the Tensile Deformation Characteristics of Naturally-Aged A383 Alloy Die Castings

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Abstract

A383 aluminum alloy high pressure die castings were solution treated at 490°C for six durations 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 previously (G. Eisaabadi et al. Mater. Sci. Eng. A, 722, pp. 1-7, 2018.) In the current study, the tensile deformation characteristics of A383 alloy castings were determined by analyzing work hardening rate versus true stress in Kocks-Mecking plots. Results showed that (i) there was a sudden drop in work hardening rate immediately prior to fracture in all specimens, (ii) some specimens exhibited Portevin-Le Chatelier (PLC) effect, (iii) the stress where the PLC effect started increased with yield strength, (iv) the unitless Kocks-Mecking parameter, K. decreased with increasing solution treatment time, and there was a strong relationship between K and elongation (v) the main benefit of prolonged solution treatment of cast aluminum alloys is healing of structural defects, namely oxide bifilms. These results are discussed in detail in the paper.

Keywords: Heat treatment; work hardening; Kocks-Mecking; PLC effect; structural quality

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