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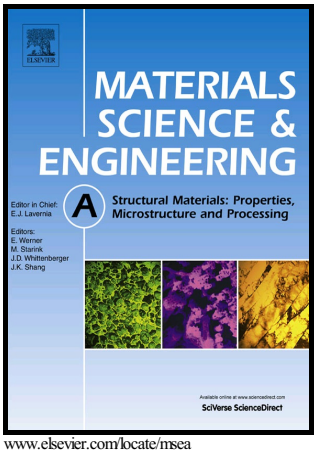

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Influence of pre-ageing on the stretch formability of Al-Mg-Si automotive sheet alloys

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Abstract

In 6xxx aluminium alloys for automotive panel applications, pre-ageing is normally employed to reduce the negative effect of natural ageing on the paint-bake response of the materials. Pre-ageing can also influence the stretch formability, although the mechanism is still unclear. In this paper, the effect of a pre-ageing treatment on the stretch formability of 6xxx alloys for the levels of Mg/Si ratio ranging from 2.5 to 0.4 was studied by using tensile testing, forming limit diagram (FLD) tests, and three dimensional atom probe (3DAP) investigations. In particular, the 3DAP results were used to explain the work hardening behavior of samples. The results showed that pre-ageing deteriorates the stretch formability of all the 6xxx alloy samples studied, regardless of the magnitude of the Mg/Si ratio, due to a reduction in both the work hardening and the strain-rate hardening capabilities. Furthermore, it was demonstrated that the paint-baked hardness is inversely correlated with the plane strain stretch formability of the alloys.

Keywords: Pre-ageing; Stretch formability; 6xxx aluminium alloys

1. Introduction

Among the aluminium alloys that are used for automotive body panels, the heat treatable 6xxx alloys are the primary choice for outer panel applications since these alloys exhibit a

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