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# Al-Mg-Si alloys with high fractions of intermetallic particles - recrystallization and sheet material properties

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## Abstract

The need to reduce greenhouse gas emissions is driving the recycling of all metallic materials, and aluminium alloys in particular. In this context, there is a need to understand alloys with relatively high levels of previously undesirable tramp elements, which increase the phase fractions of the primary and secondary phases. Recently it was shown that Al-Mg-Si alloys, containing up to 2.9 wt.% of Mn+Fe, can achieve a finely grained structure and well-dispersed particles through refined thermomechanical processing. Surprisingly, this results in exceptionally favourable mechanical properties, including increased strength, elongation, and work hardening.

This study investigates the complex interplay between different primary and secondary particle distributions and their effect on recrystallisation. It also examines the resulting microstructure and texture variations in Al-Mg-Si alloys with different Si, Fe and Mn contents. The research is based on interrupted annealing experiments and uses SEM-based characterization techniques to monitor and evaluate the recrystallisation process.

It is known that Fe- and Mn-rich primary phases significantly influence the final microstructures by: (i) facilitating particle-stimulated nucleation (PSN) and (ii) constraining grain growth via Zener pinning. Concurrently, Mn-containing dispersoid phases introduce an additional layer of complexity by (iii) retarding nucleation. Obviously, this affects not only the microstructures but also the final annealed textures. In typical particle-rich alloys, a rotated cube texture tends to develop as a result of particle-stimulated nucleation. However, when the matrix contains a lower Si content, unexpectedly the cube texture again becomes dominant. Consequently, the aim of the study is identifying the underlying factors responsible for the development of markedly different textures as a function of Si content within the materials.

**Keywords:** PSN, Recrystallization, Recycling

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