

# A novel structural-based approach to model the age hardening behaviour of aluminium alloys

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Received 21 November 2005

Published 8 June 2006

Online at [stacks.iop.org/MSMSE/14/905](http://stacks.iop.org/MSMSE/14/905)

## Abstract

A new approach based on an artificial neural networks (ANN) model was used to model the ageing behaviour of an Al–Mg–Si alloy. A systematic combination of hardness measurements, transmission electron microscopy (TEM), image analysis and the ANN method was used to correlate the key precipitate parameters with the age-hardening response. The ageing behaviour of AA6022 during isothermal heating was characterized by hardness measurements and the structural evolution was studied by TEM. To distinguish the precipitate morphology at each stage of ageing, an image analysis algorithm capable of capturing orientation gradient, nearest neighbour distances, number density, shapes and size of precipitates was developed. A parametric study was performed to identify the significance of each precipitate parameter, and then the most important parameters were used to train the ANN model. The model combines the most important precipitate parameters including volume fraction, shape, size and distance between precipitates. It was found that the model is able to successfully predict the age hardening behaviour of AA6022 in both deformed and undeformed conditions.