

Isothermal and non-isothermal precipitation kinetics in Al–Mg–Si-(Ag) alloy

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Abstract: In the present work, isothermal and non-isothermal precipitation kinetics in a 6063 aluminium alloy containing a small silver (Ag) addition have been investigated using Vickers microhardness and Differential Scanning Calorimetry (DSC) measurements respectively. Isothermal kinetics analysis showed that θ'' phase precipitation obeyed the Johnson-Mehl-Avrami (JMA) model. The DSC analysis revealed that Ag addition modified the precipitation sequence in the investigated 6063 aluminium alloy through the formation of an additional metastable pre- θ'' phase. An approach based on the additivity concept has been applied to the heating DSC diagrams to investigate the θ'' phase precipitation. The obtained Avrami exponent values from this approach led to suggest that the θ'' phase precipitation proceeded through two processes during continuous heating. The Avrami exponent value obtained at the final stage of the transformation was consistent with that obtained from the isothermal analysis, whereas the corresponding activation energy was higher than the one calculated from the isothermal analysis and Kissinger's method. It was also established that the precipitation kinetics of the θ'' phase was enhanced by the formation of the precursor phase pre- θ'' .

Keywords : 6063 aluminium alloy, Ag addition, Precipitation kinetics, JMA model, Additivity concept