MATHEMATICAL MODEL FOR MICROSEGREGATION OF Al-Cu5wt.%-Mg1wt.% ALLOYS

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Abstract

In this paper, model for microsegregation of ternary Al-Cu5wt.%-Mg1wt.% alloys with considering of diffusion in primary phase is presented. Results of numerical analysis are compared with appropriate experiments. The model calculates composition profiles of Cu and Mg in primary phase and takes into account diffusion in solid phase due to the compositional gradients. Titanium is added as grain refiner and it is very effective in reducing the grain size. Mathematical model for microsegregation is composed from two sets of equations: First, which describe generic ternary phase diagram of Al-Cu-Mg alloy, and second which represent conservation laws for mixture enthalpy and compositions of Cu and Mg. Only Al rich corner is taken into account with two binary valleys, which ends in eutectic point at 507^{o}C. Along those two valleys Al_2Cu (phase) and Al_2CuMg (S phase) precipitate as secondary or ternary phase, depending which one is reached first. Previous modelling work has shown that excellent results can be obtained for the phases formed during solidification, as well as their composition and temperature range of formation, by using thermodynamic modelling. Thermodynamic modelling techniques have now advanced sufficiently so that they can be used as a powerful tool in understanding both stable and metastable phase formation in multi-component Al-Cu-Mg-Ti alloys.

Keywords: aluminium-copper-magnesium alloys, ternary phase diagram