Thermodynamic Database Based Modelling of Precipitation Kinetics for Aluminium Alloy Development

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ABSTRACT

About 10 years ago, a statistical model named ClaNG has been developed to simulate Classical Nucleation and Growth of precipitates in many wrought aluminium alloys. The model is based on a thermodynamic database containing 8 elements (AlCrCuFeMgMnSiTi) and is capable of describing the simultaneous nucleation, growth and coarsening of all known stable precipitates in multi-component systems for arbitrary heat treatments. Recently the model has been improved in various ways, for instance by a new growth law. The precipitation kinetics of the wrought alloy AA5182 during homogenization was investigated experimentally to calibrate this new model. The prediction quality of the calibrated model was validated with the precipitation kinetics in a different alloy: AA3104. The simulation results show good agreement with the experimental results. Subject to final project approval, this model ClaNG is going to be used for the development of new alloys with both high electric resistivity and high creep resistance over long periods of time. This requires a high strengthening contribution by stable precipitates and low solute contents. At the same time, it must be possible to produce this alloy economically. After extension of its thermodynamic database by promising candidates of additional elements and their stable phases in aluminium alloys, the precipitation model ClaNG will be used to find and optimize the production conditions while ensuring long term stability at the application temperature.