Prediction of the Precipitation Kinetics in the Recycled Aluminum Alloy with ClaNG Model

Zhenshan.Liu
Institut für Metallkunde und Metallphysik, RWTH Aachen, Germany

ABSTRACT

With the increase of energy cost and environmental concern, more and more aluminum issued from recycling activities instead of that produced from the reduction of alumina by electrolyze, is used as raw materials for the production of cast and wrought products. Compared with the primary aluminum with a controlled low amount of impurities, recycled aluminum contains an amount of solute elements sometimes higher than that desired. The change of alloy composition leads to a change of precipitation behavior during the industrial processing of aluminum products. The change of precipitate nature, density and size consequently modifies the properties of the end product either by direct impact on mechanical and corrosion properties or by indirect interfering with other microstructural phenomena such as, recovery or recrystallization. Therefore, the simulation model of precipitation kinetics ClaNG (Classical Nucleation and Growth) was developed to predict the properties of the product being processed in relevant amount of time, further more to keep the change of production properties within a controlled range. The ClaNG model is based on the classical theories of Döring& Becker for nucleation and Zener for growth and coarsening. Coupled with the ChemApp application of GTT, all the decisions in the model are performed according to the calculation of the thermodynamic equilibrium. With the input information, e.g., alloy composition, primary phases and other physical parameters, the evolution of the size and density of the precipitates during different industry processes could be predicted. The predictions provided by the ClaNG model are in excellent agreement with the experiment results of alloys AA3014 (AlMn), AA5182 (AlMg) and AA6016 (AlMgSi).