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Thermodynamic simulation for solidification path in die casting alloy development

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ABSTRACT

Mathematical modelling of various physical processes and simulation thereof have become a necessity for the development of high-quality die casting alloy. The present work focuses on the thermodynamic simulation for solidification path prediction of aluminum based alloys. An advanced simulation tool called Pandat software is used as the tool to do the modelling. The simulation allows important issues to be studied, such as the optimization of the solidification range in the alloy design. The simulation are primarily based on the solidification profiles and the quaternary phase diagram of aluminum alloys, both obtained by analyzing and assessing the thermodynamics database of Pandat software. The proposed model is developed for predicting solidification path in alpha phase and beta phase of the alloy. The modelling on quaternary phase diagram can also be utilized to describe the solubility limit of the components in the alloy system. The results of the numerical thermodynamics simulations of solidification performed on aluminum based alloys are presented and compared with available experimental data. Based on the overall developments, it appears that the proposed approach is a viable basis for the development of an effective computational tool to be used in the simulation of solidification of die casting aluminum alloy.

KEYWORDS: alloy, aluminum, die casting, simulation, solidification, thermodynamics