Opracowanie algorytmu odtwarzania rozkładu wielkości podłoża zarodkowania heterogenicznego na przykładzie stopu AlZn7
(Development of the algorithm for reconstruction of the substrate size distribution of heterogeneous nucleation on the example of the AlZn7 alloy)

SUMMARY

The aim of this thesis is the modelling of nucleation substrate size distribution and possibility of prediction, based on this distribution, of the grain size of the primary phase. The work is focused on light metal alloys, especially on the aluminum based alloy - AlZn7.

The first part of this thesis (chapter 1) is a literature review. The chapter presents knowledge of the crystallization basics with particular emphasis on the heterogeneous nucleation process. Classification of mathematical models of the heterogeneous nucleation process is presented and the Free Growth Model as the foundation for further research is selected.

Chapter 2 contains the main theses and research objectives. The research objectives include development, implementation and verification of the author's computational algorithm allowing the restore of real statistical distribution of the heterogeneous nucleation substrate dimensions.

The next (practical) part of this work (chapter 3-6) presents a detailed methodology for experimental research and calculations. There is also full description of the developed computational algorithm and software based on this algorithm.

The developed algorithm is based on three kinds of input data, the most important of which are experimental data. This data are experimental values characterizing the alloy, for which the distribution is generated. Maximal undercooling and corresponding grains densities belong to this category. The second kind constitutes thermophysical parameters of an alloy, i.e. volumetric entropy of fusion and the interfacial energy at the boundary liquid-crystallite. The last group of input data consists of the conditions of the calculations control such as the assumed total number of nucleation substrates, interval, the size of the intervals of the sought equation parameters or the number of numerical integration steps.

In this part of the dissertation there is also results' summary of experimental examinations and computational tests carried out on the AlZn7 alloy, together with their statistical elaboration. The obtained nucleation substrates size distribution curves were compared. The minimal characteristics dimension of the substrates obtained in the simulation was also presented and verified. There is also a comparison of author's simulation results with experimental value of volumetric grain density and other nucleation models predictions.

Beata Barbara Gracz

AGH University of Science and Technology
Faculty of Foundry Engineering
Department of Foundry Processes Engineering

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