Quantitative phase-field simulations for microsegregation during solidification in multicomponent alloys

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Control of microsegregation is an important issue in material production processes. Analyses and prediction of microsegregation in practical alloys generally require multicomponent diffusion to be precisely described during the formation of dendrite structures, which is not trivial task. The phase-field model is a powerful tool to describe microstructural pattern formation during alloy solidification. Its capability of affording qualitative understanding of phenomena is generally acknowledged. Importantly, the quantitative phase-field model which is formulated based on the thin-interface limit analysis enables us to carry out quantitatively accurate computations of solidification microstructure. The quantitative phase-field model for multicomponent alloys was recently developed by our group. In this talk, the performance of this quantitative phase-field model is first presented and its application to analyses on microsegregation during the dendrite growth is demonstrated.

Keywords: Quantitative phase-field model, dendrite, microsegregation, multicomponent alloy