Phase field modelling of a slow process – Pattern formation during growth of Ge_xSi_{1-x} crystals

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Some interesting applications require a cellular structure in semi-conductor single crystals like e.g. Ge_xSi_{1-x}. In contrary to metallurgy the growth velocity is very small (some mm/h) and the cellular structures are of the order of some ten μm. Therefore, some changes to the standard phase-field models have been made. In particular, we use the isothermal phase-field model for binary alloys proposed by Kim, Kim, and Suzuki [1] and modify the computation of the surface energy term. The phase-field equation is solved by a finite-difference scheme, the diffusion-advection and the Navier-Stokes equations are solved using lattice Boltzmann methods [2, 3].

1D calculations have been performed to test the general stability of the phase-field method concerning the concentration within the diffuse interface. Results of 2D calculations for the pattern formation in GeSi single crystals for different temperature gradients, diffusion coefficients and melt velocities will be presented.

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References

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