TITLE

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Abstract

Using the phase field crystal model (PFC-model), analysis of arbitrary slow and fast dynamics of solid-liquid interface in solidification / melting processes is presented. In examples of triangle, cubic and hexagonal crystals as well as homogeneous liquid, dynamical regimes of lattices invading metastable liquid (in case of solidification) and liquid propagating into the metastable crystal (in case of melting) are described in terms of evolving amplitudes of the atomic density. Dynamical equations for propagating amplitudes in body centered (BCC), face centered (FCC) and hexagonal close packed (HCP) crystals are derived in two-mode approximation. Universal form of the amplitude's equation is obtained for the three dimensional dynamics whose traveling wave solution is presented for different types of crystal lattices and crystallographic directions. Dynamics of amplitude's propagation for different lattices and PFC-mode's approximations is qualitatively compared. The traveling wave velocity is quantitatively compared with data of molecular dynamics simulations obtained for solidification and melting of the aluminium FCC-lattice.

Keywords: stochastic particle distribution, discontinuous media, finite element method, selective laser melting, numerical simulation, unsteady heat transfer
2010 MSC: 00-01, 99-00

1. Introduction

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2. Content

Content, [1, 2]

3. Conclusions

Conclusions

4. Acknowledgments

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References

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