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Numerical Simulations of Solidification in a Convecting Supercooled Melt YING XU, Department of Mechanical Engineering, University of Kentucky, J.M. MCDONOUGH, K.A. TAGAVI — We present a 2-D phase-field model with convection induced by a flow field applied to freezing into a supercooled melt of pure substance, nickle. Four-fold anisotropy is introduced to the interfacial energy. Renormalization group theory is applied to the phase-field model with convection to produce an efficient computational procedure for treating multiscales in both time and space. Numerical procedures and details of numerical parameters employed are provided, and convergence of the numerical method is demonstrated by conducting grid-function convergence tests. Dendrite structures, temperature fields, pressure fields, streamlines and velocity vector fields are presented at several different times during the dendrite growth process. Comparisons of dendrites and temperature fields with and without convection indicate that the flow field has a significant effect on the growth rate of the dendrites; in particular, it inhibits growth. In addition, the flow field influences the dendritic structural morphologies and thickness of the interface. Moreover, the dendrites behave as a solid body in the flow leading to stagnation points and other interesting flow features.

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