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Sharp Interface Numerical Simulations of Interactions of Growing Dendrites with Solid Particles YI YANG, J.W. GARVIN, H.S. UDAYKUMAR, The University of Iowa — Dendrite-particle interaction is important to processes such as metal-matrix composites (MMCs) manufacturing. Numerical simulation of particle-dendrite interaction is carried out using a sharp interface level-set based numerical method which affords easy interface tracking. A local mesh refinement technique is also developed to further facilitate the close observation of the evolving dendrite before and after contact with the particle. The simulation of the interaction between a particle and a dendrite grown from pure material shows that for a particle to melt thermal conductivity ratio $\lambda = \frac{k_p}{k_l} < 1$ (typical for MMCs), the dendrite does not approach the particle close enough to activate particle pushing. Instead, the dendrite chooses to go around the particle and eventually the particle is engulfed by sidebranches. Thus the entrapment mode is the likely outcome. The simulation of interaction of a particle with a dendrite grown from a binary alloy is also carried out.

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