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**Nicholas Gewecke\*** ([gewecke@math.utk.edu](mailto:gewecke@math.utk.edu)), Department of Mathematics, University of Tennessee, Knoxville, TN 37996, and **Tim Schulze**. *The Rapid Advance and Slow Retreat of a Mushy Zone*. Preliminary report.

Mushy zones are regions of intermixed liquid and solid which most often result from instability due to the build-up of solute during the solidification of multispecies materials. In a typical experiment, a uniformly mixed solution is placed onto a cold boundary, inducing the growth of a thin solid layer, capped by an initially expanding mushy zone. Later, the growth slows as the solution is largely depleted of the material forming the dendrites. If the diffusion of the solute is ignored, there is a steady state mushy zone, representative of what is observed over typical laboratory time scales, but even a small amount of diffusion dramatically alters the eventual steady state to a planar solid surface in equilibrium with a uniform solution. The longer time scale of this retreating mushy zone may be of interest in geological settings and highlights some mathematical details that may lurk in simulations of castings. Specifically, if one assumes local thermodynamic equilibrium, the equation governing the evolution of the solid fraction is inherently hyperbolic, so the boundary condition to impose, along with the boundary on which to impose it, becomes a subtle issue. (Received August 23, 2009)