

Abstract Submitted
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The Steepling of Mushy Layers¹ ANTHONY ANDERSON, GRAE WORSTER, DAMTP, University of Cambridge — The rapid solidification of a binary alloy leads to the formation of a mushy layer, comprised of a dendritic solid phase and a concentrated interstitial fluid phase. When freezing from below, such that the mean density field is statically stable, a phenomenon known as “steepling” has been observed, whereby the mushy layer becomes domed. In experiments, the degree of steepling has been shown to increase with a decreased rate of solidification and the lateral extent of the steeple is comparable to the size of the container. It was reasoned that steepling is the cause of an instability of a planar front induced by convection within a perturbed compositional boundary layer at the top of the mushy layer in an otherwise stable solute field. We explore this possibility using a linear stability analysis of the mush-liquid interface and compare the results to unidirectional solidification experiments using aqueous NaCl solutions.

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