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The Solidification of an Ideal Ternary Alloy in a Mushy Layer[1]
DANIEL ANDERSON, George Mason University and NIST, GEOFFREY MCFADDEN, SAM CORIELL, NIST, BRUCE MURRAY, Binghamton University and NIST — We examine a model for the solidification of a ternary alloy in a mushy layer. Our model is of an isolated mushy layer, mathematically decoupled from any other liquid, mushy or solid layers. The effects of species transport are included along with heat transport in order to investigate the possibility of double-diffusive and other modes of convection in this system. In the ternary mushy layer system the liquidus constraint, which relates temperature to the concentrations of the two diffusing species, allows an additional degree of freedom not present in models for solidification of binary alloys in mushy layers. We investigate the properties of non-convecting base state solutions for this ternary system and then present linear stability results that reveal convective modes of instability. The base state and linear stability results are compared with previous work on binary and ternary alloy mushy layer solidification.

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Daniel Anderson
George Mason University and NIST

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