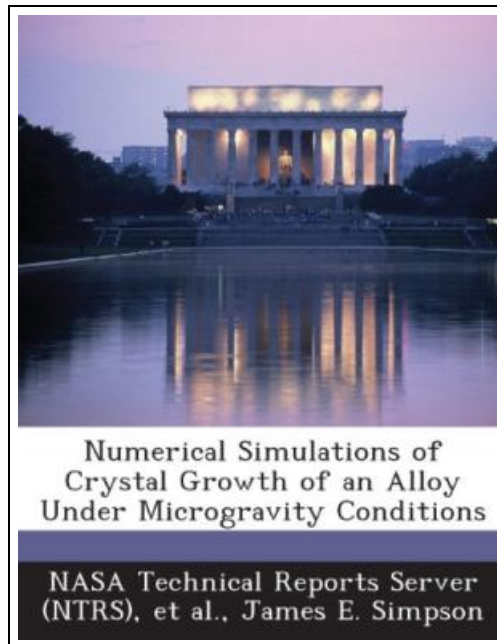


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NUMERICAL SIMULATIONS OF CRYSTAL GROWTH OF AN ALLOY UNDER MICROGRAVITY CONDITIONS



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Bibliogov, United States, 2013. Paperback. Book Condition: New. 246 x 189 mm. Language: English . Brand New Book ***** Print on Demand *****.The directional solidification of a dilute binary alloy (Bi-1.0 at. Sn) is investigated. Results are obtained at a gravity level of $1g$. Computations are performed in two dimensions with a fixed, non-uniform grid. The simulation involves a solution of the species concentration equation (modified to account for solute rejection at the interface) and energy equation (modified to account for phase-change) for both the solid and liquid phases, in addition to the constitutive equations for describing convective flow in the melt. The effects of conductive heat transfer in the ampoule and in a capillary tube in the sample are included. To gauge the effects of including this growth capillary tube in the apparatus, simulations both with and without the capillary tube are presented and compared. Fully transient simulations have been performed; no simplifying steady-state approximations are used, however, the influence of solute on the melting temperature at the interface is not included. Both thermal and solutal convective cells are seen to form. Convective velocities are significantly damped inside the capillary, causing less segregation due to convection. As solidification proceeds beyond the capillary tube, longitudinal segregation arises as a result of the change in cross-sectional area of solidifying material. The magnitudes of the velocities in this cell increase significantly once the solid/liquid front passes beyond the end of the capillary tube; this causes a corresponding increase in the level of radial solute segregation in the solidified material.



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