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Effect of Rotation Rate on Chemical Segregation during Phase Change

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Abstract : Numerical parametric study is conducted to study the effects of ampoule rotation on the flows and the dopant segregation in vertical Bridgman (VB) crystal growth. Calculations were performed in unsteady state. The extended Darcy model, which includes the time derivative and Coriolis terms, has been employed in the momentum equation. It was found that the convection, and dopant segregation can be affected significantly by ampoule rotation, and the effect is similar to that by an axial magnetic field. Ampoule rotation decreases the intensity of convection and stretches the flow cell axially. When the convection is weak, the flow can be suppressed almost completely by moderate ampoule rotation and the dopant segregation becomes diffusion-controlled. For stronger convection, the elongated flow cell by ampoule rotation may bring dopant mixing into the bulk melt reducing axial segregation at the early stage of the growth. However, if the cellular flow cannot be suppressed completely, ampoule rotation may induce larger radial segregation due to poor mixing.

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