Abstract Submitted
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**Growth of mushy layers with temperature modulations**[1] GUANG-YU DING, CHAO WU, JIN-QIANG ZHONG, Tongji University, Shanghai, China — Directional solidification of aqueous solutions produces a solid-melt coexisting zone whose growth rate can be predicted by the mushy-layer theory. We present measurements of mushy-layer growth when solidifying aqueous ammonium chloride with the cooling temperature modulated periodically $T_B(t) = T_0 + Acos(\omega t)$. The mush-liquid interface $h(t)$ evolves as the square root of time for a constant $T_B$, but exhibits periodical humps in the present of modulations. The growth rate $\dot{h}(t)$ is best approximate to $\dot{h}(t) = \dot{h}_0 e^{-\gamma\omega t/2\pi} cos(\omega t + \pi + \phi(t))$, with a decay rate $\gamma = 0.82 \pm 0.05$ independent on the modulation amplitude $A$ and frequency $\omega$, and a phase-shift $\phi(t)$ increasingly lag behind $T_B$ as a function of time. We discuss a mushy-layer growth model based on the Neumann solution of the Stefan problem with periodical boundary conditions, and show that the numerical results are in agreement with the experimental observations.

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