

# VIBRATION FOR CONTROLLING OF TEMPERATURE AND DOPANT DISTRIBUTIONS IN MELT

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Numerical investigations of the influence of controlled vibrations on mixing, heat and mass transfer are presented. Crystal growth applications for ground-based and microgravity conditions were considered.

Mathematical simulation is performed on the solutions of basis unsteady Navier-Stokes equations for incompressible fluid flows. The finite element code ASTRA is used for modeling. The researches of influence of vibrations were carried out for vibrations with small amplitude and frequency up to 100 Hertz

The results of parametric calculations for various values of similarity numbers of Prandtl, Reynolds, Grashof and Marangoni are presented including the case of microgravity conditions. The influence of major factors such as thermo-gravitational and thermo-capillary conditions, vibration, rotation on the heat/mass transfer and melt flow was investigated.

The averaged vibrational flow (AVF) was investigated by averaging the instant velocity fields found in direct numerical integration of the Navier-Stokes problem. The results illustrate the influence of the form and arrangement of vibrator and the crucible as well as the vibration amplitude-frequency on the hydrodynamics, temperature and mass distributions. The influence of vibrational Reynolds number (amplitude and frequency of vibrations) on AVF was investigated. Numerical results show possibility of controlling of the direction of AVF by variation of vibrational Reynolds number.

Numerical results are shown that the vibrations can be used to controlling by the thicknesses of dynamic, thermal and concentration boundary layers, the kinetics of crystal growth and the dopant distribution in crystal. The vibrations can change the history of characteristics of convection in the melt and the dopant segregation at the solid-liquid interface.

Influence of the vibration on the shape of melt-crystal interface is also investigated. Possibilities of changing of the curvature of the solid-liquid interface by variation of frequency - amplitude parameters (vibrational Reynolds number) for making more flat shape of interface are shown.

The investigations showed that the vibrations can be used as a simple applied and effective tool for controlling of the hydrodynamics, heat and mass transfer, dopant

distribution and crystal growth kinetics which to improve the conditions of crystal growth.