

Hydrodynamic Effect of Slow Phase Transitions in Microgravity

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Slow phase transitions are widespread in microgravity condition, because thermal conduction and diffusion processes, governing phase transition there, often cannot provide enough high intensity of the process. Small Stefan number corresponds to slow phase transition and it is quite natural to apply small parameter method to the problem, using a Stefan number as a small parameter, what was made in previous works of the authors. However due to density difference between origin and created phases there must be fluid flow (quite weak because of slow process), what is the main object of the present work. Correspondent convective flux is smaller than heat conduction one, but its influence must be estimated too. Using the same small parameter method it can be shown that the convective term has first order with respect to Stefan number, therefore it is absent in zero approximation, what gives an opportunity to build an analytical solution in one-dimensional (in space) case and to obtain a numerical solution in two- and three-dimensional cases. Boundary element method is used for numerical solution of boundary-value problem, if it is necessary, and Euler scheme is used for time integration, if analytical integration is impossible.

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