

Boldrini, José Luiz; Dias Vaz, Cristina Lúcia**Existence and regularity of solutions of a phase field model for solidification with convection of pure materials in two dimensions.** (English) [Zbl 1034.76057](#)

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Summary: We study existence and regularity of weak solutions of a phase field type model for pure material solidification in the presence of natural convection. We assume that a non-stationary solidification occurs in a two-dimensional bounded domain. The governing equations are the phase field equation coupled with a nonlinear heat equation and modified Navier-Stokes equations. These equations include buoyancy forces modelled by Boussinesq approximation, and a Carman-Koseny term to model the flow in mushy regions. Since these modified Navier-Stokes equations hold only in the non-solid regions, which are not known a priori, we have a free boundary problem.

MSC:[76T99](#) Multiphase and multicomponent flows[80A22](#) Stefan problems, phase changes, etc.[76R10](#) Free convection[76D03](#) Existence, uniqueness, and regularity theory for incompressible viscous fluids[35Q30](#) Navier-Stokes equations[35R35](#) Free boundary problems for PDEsCited in **6** Documents**Keywords:**

weak solutions; phase transition; natural convection; non-stationary solidification; nonlinear heat equation; modified Navier-Stokes equations; buoyancy; Boussinesq approximation; Carman-Koseny term; mushy regions; free boundary problem

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