EGU22-12437
https://doi.org/10.5194/egusphere-egu22-12437
EGU General Assembly 2022

Normal growth versus Cahn-Hilliard models for kinetics of the first-order phase transformations in binary mixtures under pressure gradients

Yury Podladchikov[1,2] and **Ivan Utkin**[2,3]
[1]University of Lausanne, Institute of Earth Sciences, Lausanne, Switzerland (yury.podladchikov@unil.ch)
[2]Faculty of Mechanics and Mathematics, Moscow State University, Moscow, Russia
[3]ETH Zurich, Switzerland

The simplest kinetic normal growth model assumes linear dependence of the transformation rate (or the velocity of the phase boundary) on overstepping of equilibrium conditions (or the degree of metastability). Under pressure gradients within the phases, the equilibrium state requires zero spatial gradient of difference of the chemical potentials of the two chemical components. This can be achieved by diffusional redistribution of the fraction of two components. At the phase boundary, equilibrium requires the equality of both chemical potentials. Accordingly, at the phase boundary, the linear kinetic model may assume the first component exchange between the phases to be proportional to the chemical potential difference of this component and the phase boundary velocity to be proportional to the chemical potential difference of the second complementary component. The phenomenological proportionality constants are needed to quantify the "mobility" of the phase boundary and intensity mass exchange between phases. These phenomenological material parameters can either be taken from an experiment or derived from a Cahn-Hilliard-type model. Cahn-Hilliard-type model resolving the fine structure of advancing phase boundary *'can derive, rather than postulate, a kinetic relation governing the mobility of the phase boundary and check the validity of the "normal growth" approximation'* (Truskinovsky, 1994).

Truskinovsky, L. About the “normal growth” approximation in the dynamical theory of phase transitions. *Continuum Mech. Thermodyn* **6,** 185–208 (1994). https://doi.org/10.1007/BF01135253