Geophysical Research Abstracts, Vol. 9, 08947, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-08947

Anisotropic model of spinodal decomposition: application to exsolution in alkali feldspar

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The problem of spinodal decomposition is considered theoretically and the results are applied to description of exsolution of alkali feldspar. Here, the second phase precipitates often have clearly non-isometric, elongated shape. We relate this phenomenon to the orientation dependence of the free energy on the concentration gradient. Correspondingly, the mathematical formulation is based on a non-isotropic Cahn-Hilliard equation (CHE). The latter is systematically derived from the expansion of the slow varying free energy using a proper generalization of the original method of Cahn and Hilliard. It is shown that all non-isotropic terms can be described by one second-order tensor, that affects only the bilaplace part of the CHE. After the final equation is established it is solved numerically using finite-element technique. In addition to anisotropy, both cooling and inhomogeneity effects are considered in numerical models. The results suggest a qualitative explanation of alkali feldspar exsolution by spinodal decomposition and successive coarsening.