Recent advances on Cahn-Hilliard models with dynamic boundary conditions

Dr. Patrik Knopf (Universität Regensburg)

The Cahn-Hilliard equation is the most common model to describe phase separation processes in a mixture of two materials. Moreover, it is further used to describe different phenomena where the distribution and/or motion of two (or more) immiscible materials is considered.

Standard Cahn-Hilliard models are usually endowed with homogeneous Neumann boundary conditions for both the phase-field variable and the chemical potential. However, these boundary conditions yield certain limitations:

1.) The diffuse interface separating the materials is enforced to intersect the boundary at a perfect angle of ninety degrees, which is unrealistic in many applications.

2.) No transfer of material between bulk and boundary is allowed and thus, absorption process cannot be described.

For these reasons dynamic boundary conditions for the Cahn-Hilliard equation have been introduced. We take a closer look at dynamic boundary conditions that also exhibit a Cahn-Hilliard type structure. In particular, we discuss recent insights on the sharp-interface limit of the underlying bulk-surface free energy functional as well as recent results on related models for two-phase flows.