On a convective Cahn-Hilliard system with dynamic boundary conditions

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We consider a general class of convective Cahn-Hilliard systems with dynamic boundary conditions. In contrast to classical Neumann boundary conditions, the dynamic boundary conditions of Cahn–Hilliard type allow for dynamic changes of the contact angle between the diffuse interface and the boundary, a convection-induced motion of the contact line as well as absorption of material by the boundary. The coupling conditions for bulk and surface quantities involve parameters $K, L \in [0, \infty]$, whose choice declares whether these conditions are of Dirichlet, Robin or Neumann type.

In this talk, I present some recent results on the well-posedness of this system. For regular potentials, the existence of weak solutions in the case $K, L \in (0, \infty)$ are proven by means of a Faedo-Galerkin approach, whereas for all other cases, the existence is shown by means of the asymptotic limits, where K and L are sent to zero or to infinity, respectively. Eventually, we establish higher regularity for the phase-fields, and we prove (weak-strong) uniqueness of weak solutions under additional assumptions on the mobility functions. Finally, we prove analogous results in the case of singular potentials. For the analysis in this case, we regularise singular potentials by a Yosida approximation, which allows us to apply the results for regular potentials, and eventually pass to the limit in this approximation scheme.

This is based on joint work with Patrik Knopf (Universität Regensburg).