Motion of droplets driven by curvature and potential

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Ohta–Kawasaki introduced a free energy functional describing micro phase separation of diblock copolymers. Starting with the pioneering work of Nishiura–Ohnishi, where the Ohta–Kawasaki theory is formulated on a bounded domain as a singularly perturbed problem and the limiting sharp interface problem as $\varepsilon \to 0$ is identified, there has been a bulk of analytical work.

We study the motion of a small droplet driven by the curvature and the potential in a bounded domain. This free boundary problem can be regarded as a gradient flow of Ohta–Kawasaki energy which consists of the surface energy and the potential energy.

In the regime that one component has small volume fraction such that micro phase separation results in an ensemble of small spheres of one component, the effective equations describing the dynamics called mean-field models are derived starting from the free boundary problem describing the micro phase separation of diblock copolymer melts restricted to spheres (particles). In this homogenization limit, one then sees that the evolution is dominated by coarsening and subsequent stabilization of the radii of the spheres. In this talk, we consider a motion of small droplet according to the gradient flow equation, we show that the problem has a time global solution and the center of the droplet moves along a solution of some reduced equation in a small volume fraction limit. This is a joint work with Xiaofeng Ren.