Surface phase separation and flow in models of multicomponent vessicles

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Abstract

We introduce and investigate numerically a thermodynamically consistent simple model of a vesicle in which the interfacial surface contains multiple constitutive components (e.g. amphiphilic molecules). The model describes the nonlinear coupling among the flow, drop/vesicle morphology and the evolution of the surface phases. We consider a version of the Helfrich model for fluid- like vesicle membranes. To solve the highly nonlinear, coupled system a new numerical method is developed. This method combines the immersed interface method to solve the flow equations, and the Laplace-Young jump conditions, with the level-set method to represent and evolve the interface and a non-stiff Eulerian algorithm to update the mass concentration on the drop interface. Results are presented for vesicles where an initially unstable mixture of the surface mass separates into distinct phases which affect both the shape and dynamics.