Modeling and Simulation for Solid-State De-wetting Problems

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In this talk, I will present the sharp interface models with anistropic surface energy and a phase field model for simulating solid-state dewetting and the morphological evolution of patterned islands on a substrate. The sharp interface model tracks the moving interface explicitly and it is very easy to be handled in two dimensions via arc-length parametrization. The phase field model is governed by the Cahn-Hilliard equation with isotropic surface tension and variable scalar mobility and it easily deals with the complex boundary conditions and/or complicated geometry arising in the solid-state dewetting problem. Since the phase field model does not explicitly track the moving surface, it naturally captures the topological changes that occur during film/island morphology evolution. Efficient and accurate numerical methods for both sharp interface models and phase field models are proposed. They are applied to study numerically different setups of solid-state dewetting including short and long island films, pinch-off, hole dynamics, semi-infinite film, etc. Our results agree with experimental results very well.

This is a joint work with Wei Jiang, David J. Srolovitz, Carl V. Thompson and Yan Wang.