Modeling Solid-State Wetting and Dewetting

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At the nanoscale, surface diffusion mediated mass transport leads to complex changes in the morphology of solid films and islands under annealing. The analogy with liquid-state wetting is a key to understand these phenomena. We explore two situations where wetting plays a crucial role.

In a first part, we discuss the dewetting dynamics of a thin solid film based on 2D Kinetic Monte Carlo (KMC) simulations and continuum models. We focus on the role of the faceting of the dewetting rim, which changes the asymptotic behavior of the dewetting velocity. In addition, we analyze the instability of the dewetting front, which leads to the formation of fingers.

In a second part, we will present some results on the wetting statics and dynamics of islands (or nanoparticles) on surface topographical structures with a large aspect ratio, such as pillars or trenches using 3D KMC simulations including elastic effects. We also propose to control the wetting transitions using electromigration.

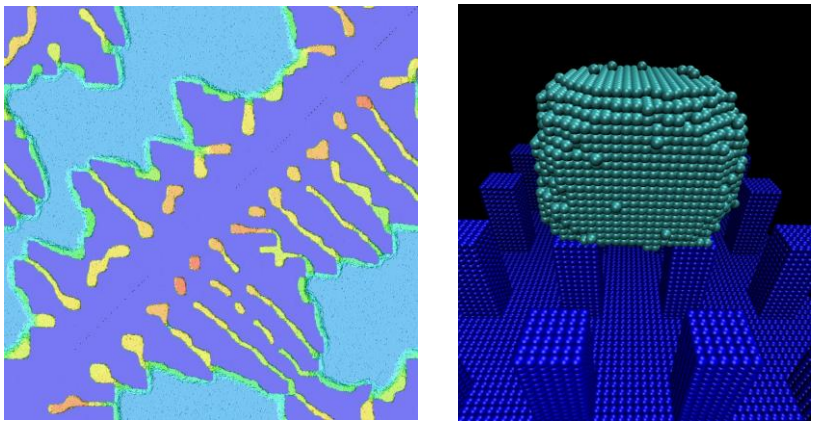

Figure : KMC simulations of solid-state dewetting, and solid-state Lotus effect.

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[5] M. Ignacio, Y. Saito, O. Pierre-Louis, *Csolid-State Wetting on nano-patterned substrates*, Comptes Rendus de Physique, 14 619 (2013).