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External-Field-Driven Nanopatterning on Crystalline Substrate Surfaces ASHISH KUMAR, DWAIPAYAN DASGUPTA, DIMITRIOS MAROUDAS, Univ of Mass - Amherst — Current-driven dynamics of single-layer epitaxial islands on fcc crystalline substrates can lead to surface pattern formation with significant implications for nanofabrication. We have developed and validated a fully nonlinear model of driven island evolution on {110}, {100} and {111} substrate surfaces due to diffusional mass transport along the island edge and accounting for edge diffusional anisotropy. We find that the migration speed of a morphologically stable island is inversely proportional to the island size, R, up to a critical size that marks the onset of island morphological transition; further increase in R triggers edge fingering and/or necking or dynamical transitions. We report formation of complex nanopatterns emerging from individual larger-than-critical islands with two different types of initial configuration: a slender, high-aspect-ratio island shape and an equilibrium, rounded morphology. We have developed a linear stability theory that explains the observed morphological instabilities. We characterize the nanopatterns formed and study the dependence of the nanopattern features on the duration of application of the electric field and the misorientation angle between a fast edge diffusion direction and the electric field direction.

Dwaipayan Dasgupta
Univ of Mass - Amherst

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