Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Electromigration-driven dynamics of single-layer epitaxial islands on substrates DWAIPAYAN DASGUPTA, GEORGIOS I. SFYRIS, DIMITRIOS MAROUDAS, University of Massachusetts, Amherst — Electromigration-driven dynamics of single-layer epitaxial islands on substrates can lead to surface pattern formation that may have significant impact on nanofabrication. We develop a fully nonlinear model for the driven morphological evolution of single-layer homoepitaxial islands and coherently strained heteroepitaxial islands on crystalline elastic substrates with diffusional mass transport limited to the island periphery. We carry out dynamical simulations of the driven dynamics of such islands and validate the model by comparisons of the simulation results for individual islands with published experimental results. We find that the island migration speed varies linearly with 1/R, where R is the island size, up to a critical size that marks the onset of island morphological transition; further increase in R triggers other morphological or dynamical transitions. We also find an exponential dependence of the island mobility on the misfit strain. We also study the driven dynamics of island pairs with the island sizes and the island center-to-center line misalignment with respect to the electric-field direction being the key parameters. This parametric study identifies several classes of pattern forming dynamical phenomena mediated by island coalescence and break-up.

Dwaipayan Dasgupta
University of Massachusetts, Amherst

Date submitted: 08 Nov 2012 Electronic form version 1.4