Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Surface nanopatterning using electric-field-driven assembly of single-layer epitaxial islands ASHISH KUMAR, DWAIPAYAN DASGUPTA, DIMITRIOS MAROUDAS, University of Massachusetts Amherst — We report a systematic simulation study of an approach to surface nanopatterning based on electric-field-driven assembly of single-layer epitaxial islands on face-centered cubic crystalline substrates. We have developed and validated a fully nonlinear driven island evolution model with diffusional mass transport limited to the island edges and accounting for edge diffusional anisotropy and island coalescence and break-up. For islands on $\langle 110 \rangle$-, $\langle 100 \rangle$-, and $\langle 111 \rangle$-oriented substrate surfaces, we report formation of complex nanopatterns starting from two different types of initial configurations: a single island with larger-than-critical size and an assembly of relatively small islands, which undergo a sequence of coalescence and break-up events. For both initial configurations, we study the dependence of the nanopattern features on the duration of application of the electric field, the strength of edge diffusional anisotropy, and the misorientation angle between a fast edge diffusion direction and the applied electric field direction. For assemblies of islands, we also study the resulting nanopattern dependence on the intrinsic geometrical parameters of the assembly. We report entire classes of complex patterns formed as the above parameters are varied.

Dwaipayan Dasgupta
University of Massachusetts Amherst

Date submitted: 13 Nov 2014 Electronic form version 1.4