Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Theory of current-induced surface roughness reduction in conducting thin films DWAIPAYAN DASGUPTA, University of Tennessee Knoxville, LIN DU, DIMITRIOS MAROUDAS, University of Massachusetts Amherst — Thin film surface roughness is responsible for various materials reliability problems in microelectronics and nanofabrication technologies. Aiming at a fundamental understanding of surface dynamical phenomena toward developing surface roughness reduction strategies, we report results of a systematic modeling study that establish the electrical surface treatment of conducting thin films as a viable physical processing strategy for surface roughness reduction. We develop a continuum model of surface morphological evolution that accounts for the residual stress in the deposited conductor film, surface diffusional anisotropy and film texture, the film's wetting of the layer that is deposited on, and surface electromigration. Supported by linear stability theory, self-consistent dynamical simulations based on the model demonstrate that the action over several hours of a sufficiently strong and properly directed electric field on a conducting thin film can reduce its surface roughness and lead to a smooth planar film surface. The modeling predictions are in agreement with experimental measurements on copper thin films deposited on silicon nitride layers.

Lin Du
University of Massachusetts Amherst

Date submitted: 11 Nov 2016 Electronic form version 1.4