Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Surface Morphological Response of Stressed Elastic Solids under Electromigration Conditions VIVEK TOMAR, RAUF GUNGOR, DIMITRIOS MAROUDAS, University of Massachusetts, Amherst — We present a theoretical analysis of the surface morphological response of electrically conducting, stressed elastic crystalline solids under the simultaneous action of an electric field that drives surface electromigration. The analysis is based on a fully nonlinear model of driven surface morphological evolution and combines linear stability theory with self-consistent dynamical numerical simulations. We report results of the surface morphological response of a uniaxially stressed solid as a function of electric field strength, surface crystallographic orientation, and temperature. We find that a properly directed and sufficiently strong electric field can stabilize the surface morphology of the stressed solid against crack-like surface instabilities, as well as surface rippling instabilities, and determine the required critical electric-field strength over a broad temperature range and for various surface crystallographic orientations. We also demonstrate the superior morphological response of <111>-oriented surfaces of face-centered cubic metals.

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Date submitted: 25 Nov 2008 Electronic form version 1.4