Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Mesoscopic Modeling of Nanostructured Strained Films: Single-Component vs. Alloy Systems ZHI-FENG HUANG, Wayne State University, KEN ELDER, Oakland University — The instability and nanostructure formation in strained solid films are examined through a mesoscopic approach that we developed recently to incorporate both the film crystalline structure and standard continuum theory. It is based on the phase field crystal (PFC) model and particularly the corresponding amplitude equation analysis of the slowly varying film surface profile, for both single-component and binary alloy films. A universal scaling relation for strained island size is identified, showing a crossover from the continuum elasticity result at the weak strain limit to a behavior governed by the "perfect" lattice relaxation condition [1]. We also analyze the coupling between the film composition distribution and the evolution of film morphology and nanostructures in alloy systems. Our results indicate the breakdown of conventional continuum approaches even at relatively large scales due to the discrete nature of the film crystalline structure.

[1] Z.-F. Huang and K. R. Elder, Phys. Rev. Lett. 101, 158701 (2008).

ZhiFeng Huang
Wayne State University

Date submitted: 20 Nov 2008 Electronic form version 1.4