Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Nonlinear Driven Response of a Phase-Field Crystal in a Periodic Pinning Potential CRISTIAN ACHIM, TKK, Finland, JORGE RAMOS, INPE, Brazil, MIKKO KARTTUNEN, University of Western Ontario, Canada, KEN ELDER, Oakland University, ENZO GRANATO, INPE, Brazil, TAPIO ALA-NISSILA, TKK, Finland, SEE-CHEN YING, Brown University — We study numerically the phase diagram and the response under a driving force of the phase field crystal model for pinned lattice systems in one and two dimensions. The model describes the lattice system as a continuous density field in the presence of a periodic pinning potential, allowing for both elastic and plastic deformations of the lattice. We first present results for phase diagrams of the model in the absence of a driving force. The nonlinear response to a driving force on an initially pinned commensurate phase is then studied via overdamped dynamic equations of motion for different values of mismatch and pinning strengths. For large pinning strength the driven depinning transitions are continuous, and the sliding velocity varies with the force from the threshold with power- law exponents in agreement with analytical predictions. Transverse depinning transitions in the moving state are also found in two dimensions. Surprisingly, for sufficiently weak pinning potential we find a discontinuous depinning transition with hysteresis even in one dimension under overdamped dynamics. We also characterize structural changes of the system in some detail close to the depinning transition.

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Date submitted: 21 Nov 2008 Electronic form version 1.4