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**Nonlinear Analysis of Secondary Ripple Formation on Surfaces of Stressed Crystalline Solids** LIN DU, DWAIPAYAN DASGUPTA, DIMITRIOS MAROUDAS, University of Massachusetts Amherst — The competition between surface energy and elastic strain energy in surfaces of stressed crystalline solids is responsible for Asaro-Tiller/Grinfeld (surface cracking) morphological instabilities. Using linear stability theory (LST), we have predicted that properly directed and sufficiently strong electric fields and thermal gradients can inhibit such instabilities; we validate the LST predictions based on self-consistent dynamical simulations according to a fully nonlinear surface evolution model. The simulations also reveal that long-wavelength perturbations from the planar surface morphology can trigger a tip-splitting instability, which causes formation of a pattern of secondary ripples that is beyond the scope of LST. Based on weakly nonlinear analysis, we have developed a theory that can explain the occurrence of such rippling instabilities and predict the number of ripples that form on the surface as a function of perturbation wavelength. The theory predicts the critical wavelength for the onset of secondary ripple formation and the external field strength requirement for planar surface stabilization. The conclusions of the theory are validated by comparisons with the results of the self-consistent numerical simulations.

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