MAR13-2012-020416

Abstract for an Invited Paper
for the MAR13 Meeting of
the American Physical Society

Coarsening of patterns from scale free instabilities in soft solids

EVAN HOHLFELD, University of Massachusetts, Amherst

Soft materials such as rubbery solids have hidden, scale-free instabilities that are undetectable by linearized analysis, yet which have no energy barrier for onset. Examples include the nucleation of sharply creased surface folds resembling the sulci on the brain and the nucleation and growth of cavities. These instabilities can be understood as quasi-phase transitions: they have well defined binodal points, form via a nucleation and growth process, and have finite energies of transformation; however, there is no clear phase boundary dividing the "nucleated phase" from the surrounding elastomer. First anticipated by Weierstrass more than 100 years ago, our understanding of these instabilities—so called "Weierstrass needles"—is now rapidly developing as an increasing number of physical examples are being identified. Recent experimental and theoretical work has continued to deepen the analogy between a Weierstrass needle and a more traditional phase transition. Along this line, I will present new results showing how the coarsening of a crease pattern can be understood as a form of Ostwald ripening. I will also discuss classes of systems which might support other examples of Weierstrass needles.