

Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Locally fluctuating elasticity of vulcanized solids XIAOMING MAO, PAUL GOLDBART, University of Illinois at Urbana-Champaign, XIANGJUN XING, Syracuse University, ANNETTE ZIPPELIUS, Universitaet Goettingen — The elastic properties of vulcanized solids, such as rubbery polymeric media, are characterized not only by their small mean shear moduli but also by the random spatial fluctuations of their local elasticity. These fluctuations originate in the randomness locked in, e.g., to a polymer network during the cross-linking process. We examine these fluctuations in the local elasticity of random solids via vulcanization theory, i.e., the replica field theory that describes cross-linking- driven random solidification transitions and their emergent rigidity. To do this we identify the Goldstone excitations of the random solid state as local shear deformations, and interpret their effective free energy in terms of a phenomenological model of inhomogeneous, non-local rubber elasticity. Thus, we arrive at predictions for the statistical properties of the fluctuating elasticity of vulcanized solids.

Xiaoming Mao
University of Illinois at Urbana-Champaign

Date submitted: 04 Jan 2006

Electronic form version 1.4