Abstract Submitted
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Wrinkling instability in graphene supported on nanoparticle-patterned SiO_2 WILLIAM CULLEN, MAHITO YAMAMOTO, Center for Nanophysics and Advanced Materials, University of Maryland, College Park, MD 20742-4111, OLIVIER PIERRE-LOUIS, LPMCN, Universite Lyon 1, France, THEODORE EINSTEIN, MICHAEL FUHRER, Center for Nanophysics and Advanced Materials, University of Maryland, College Park, MD 20742-4111 — Atomically-thin graphene is arguably the thinnest possible mechanical membrane: graphene's effective thickness (the thickness of an isotropic continuum slab which would have the same elastic and bending stiffness) is significantly less than 1 Å, indicating that graphene can distort out-of-plane to conform to sub-nanometer features. Here we study the elastic response of graphene supported on a SiO_2 substrate covered with SiO_2 nanoparticles. At a low density of nanoparticles, graphene is largely pinned to the substrate due to adhesive interaction. However, with increasing nanoparticle density, graphene's elasticity dominates adhesion and strain is relieved by the formation of wrinkles which connect peaks introduced by the supporting nanoparticles. At a critical density, the wrinkles percolate, resulting in a wrinkle network. We develop a simple elastic model allowing for adhesion which accurately predicts the critical spacing between nanoparticles for wrinkle formation. This work has been supported by the University of Maryland NSF-MRSEC under Grant No. DMR 05-20471 with supplemental funding from NRI, and NSF-DMR 08-04976.

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