Abstract Submitted
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Wrinkling instability in nanoparticle-supported graphene: implications for strain engineering[1] WILLIAM CULLEN, MAHITO YAMAMOTO, University of Maryland, OLIVIER PIERRE-LOUIS, LPMCN, Universite Claude Bernard Lyon 1, France, JIA HUANG, MICHAEL FUHRER, THEODORE EINSTEIN, University of Maryland — We have carried out a systematic study of the wrinkling instability of graphene membranes supported on SiO_2 substrates with randomly placed silica nanoparticles. At small nanoparticle density, monolayer graphene adheres to the substrate and is highly conformal over the nanoparticles. With increasing nanoparticle density, and decreasing nanoparticle separation to ~100 nm, graphene's elastic response dominates substrate adhesion, and elastic stretching energy is reduced by the formation of wrinkles which connect protrusions. Above a critical nanoparticle density, the wrinkles form a percolating network through the sample. As the graphene membrane is made thicker, delamination from the substrate is observed. Since the wrinkling instability acts to remove inhomogeneous in-plane elastic strains through out-of-plane buckling, our results can be used to place limits on the possible in-plane strain magnitudes that may be created in graphene to realized strain-engineered electronic structures.[2]

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[2]M. Yamamoto et al., "Princess and the Pea at the nanoscale: Wrinkling and unbinding of graphene on nanoparticles," arXiv:1201.5667 (2012).

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