Abstract Submitted
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Mechanics of Graphene Electronics[1] XUANHE ZHAO, Soft Active Materials Laboratory, Duke University — Graphene, a monolayer of tightly-packed carbon atoms, has demonstrated great academic and industrial promises for integrating superior properties of nanomaterials and nanostructures into novel macroscale devices. Here, we demonstrate a simple method to enable over 200% reversible deformation of continuous large-area graphene sheet (over 1cm x 1cm) on polymer substrates. By patternning large-area graphene on a prestretched polymer layer by 200%, the graphene film develops hierachical patterns including wrinkles with wavelengthes on the order 10$\sim$100 nm and delaminated buckles with wavelengths on the the order of 1μm. If the polymer is stretched again (<100%), the wrinkled region relaxes and the graphene on this region becomes flat. As the stretch further increases (over 100%), the graphene on delaminated buckles slides toward the flat regions, decreasing the amplitude of the buckles. The relaxation of the wrinkles and buckles enables the large deformation of graphene electrode without fracture. We further demonstrate potential applications of the graphene electrodes capable of large deformation. For example, a polymer film can be sandwiched between two graphene electrodes. As a voltage is applied between the two graphene electrodes, the polymer can achieve an actuation strain over 200%.

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