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In-situ Investigation of Electrical-Mechanical Coupling in graphene-based devices MINGYUAN HUANG, California Institute of Technology, TOD PASCAL, HYUNGJUN KIM, WILLIAM GODDARD III, JULIA GREER, California Institute of Technology — Graphene, a truly two-dimensional gapless semiconducting material, recently deemed strongest ever measured, can sustain very high (up to 25%) in-plane tensile elastic strains. Several recent theoretical-only studies on strained graphene predict that strain can shift the Dirac cones, reduce the Fermi velocity, introduce a pseudo-magnetic field, and be used to engineer the electronic structure. However, no direct experiments on electrical measurements of highly strained graphene have yet been reported. Here, we present the results of *in-situ* investigation of electrical-mechanical coupling in graphene-based devices. In our experiment, *in-situ* nanoindentation was performed on suspended graphene transistors to introduce homogeneous tensile strain up to 3%, while electrical measurements were carried out simultaneously. We find that the electrical resistance shows only a marginal change under strain, and the electronic transport measurement confirms that there is no opening of the band gap for graphene under moderate uniform strain. We also report first-principles informed molecular dynamics simulation that lead to Young modulus consistent with our experiments and show no opening of a band gap.

Mingyuan Huang
California Institute of Technology

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