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Phase transition of adsorbed noble gas on suspended graphene ZAIYAO FEI, HAO-CHUN LEE, BORIS DZYUBENKO, SANFENG WU, DAVID COBDEN, Department of physics, University of Washington — Suspended graphene sheets are simultaneously 2D nanomechanical resonators, hosts to massless Dirac electrons, and 2D substrates for adsorption. Adsorption is expected to modulate the mechanical and elctrical properties in a number of ways. We therefore aim to investigate the effects of equilibrium adsorbates on the vibrational resonances and on the conductance. Beginning with noble gases on non-suspended graphene exfoliated on SiO2, for argon we have seen a gradual change in the conductance as a function of vapor pressure at temperatures below the 2D critical point (54 K), indicating gradual formation of a monolayer over a wide chemical potential range (although we have also seen signs of a sharp monolayer phase transition in a least one sample). The mechanism of conductance modulation is a topic of interest. The large broadening of the expected 2D vapor-liquid step is likely to be due to inhomogeneous binding caused by charge disorder, roughness, and other properties of the SiO2 substrate. We are developing pristine suspended graphene devices to eliminate these complications.

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