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Effect of adsorbed monolayers on the conductance of single-walled carbon nanotubes[1] BORIS DZYUBENKO, HAO-CHUN LEE, OSCAR VILCHES, DAVID COBDEN, Department of Physics, University of Washington —
We have studied the effects of adsorbing noble gases He, Ne, Ar, Kr, Xe, and diatomic gases O2, N2 and CO, on the electrical properties of individual suspended single-walled nanotubes, as a function of pressure and temperature. The quantity of gas adsorbed can be determined from the shift in the mechanical resonance frequency of the nanotube. We find that the conductance can be sensitive to small changes in density for all gases and can be measured on a timescale of milliseconds. This opens ways for studying the dynamics of adsorbed atoms/molecules on the surface of a nanotube. For some devices the conductance varies non-monotonically with coverage as a monolayer builds up. The conductance change results at least in part from a very small charge transfer between the adsorbates and nanotube. Measurements below the 2D critical point show sharp features and fluctuations in some devices but not in others. The reason for this is not currently understood. In the nonlinear regime we observe features in the I-V characteristics which occur because electrical currents cause phase transitions on the surface of a nanotube and may lead to stationary nonequilibrium states.

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