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Screening of substrate charged impurities as mechanism of conductance change in graphene gas sensing[1] SANG-ZI LIANG, Pennsylvania State University, GUGANG CHEN, AVETIK HARUTYUNYAN, Honda Research Institute USA Inc., JORGE SOFO, Pennsylvania State University — In graphene sensing of gaseous NO, NO_2, and NH_3, the measured conductance change after the sensor is exposed to the molecules has been traditionally attributed to carrier density change due to charge transfer between the sample and the adsorbed molecule. However, this explanation ignores the effect of the adsorbates on the electron mobility, and analysis of the electron affinity/ionization potential does not favor charge transfer. In this talk, we propose and explore an alternative mechanism. When adsorbed, charged and dipolar functional on the surface of graphene may counteract and screen charged impurities on the substrate. Because scattering of electrons with these charged impurities has been shown to be a limiting factor in graphene conductivity, the screening leads to significant changes in the transport behavior. A model for the conductivity is established using the random phase approximation dielectric function of graphene and the first-order Born approximation for scattering. The model predicts maximal screening magnitudes for the charge and dipole moment. The dipole screening is generally weaker than the charge screening although the former becomes more effective with higher gate voltage.

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