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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 gas sensing, the measured conductance change after the sensor is exposed to target molecules has been traditionally attributed to carrier density change due to charge transfer between the sample and the adsorbed molecule. However, this explanation has many inconsistencies when it is applied to graphene on silica substrate. In this talk, we propose and explore an alternative mechanism. When adsorbed, charged functional groups and polar molecules on the surface of graphene may counteract the effect of charged impurities on the substrate. Because scattering of electrons with these charged impurities has been shown to be a limiting factor in graphene conductivity, this 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 magnitudes for the charge and dipole moment which has maximal screening effect. The dipole screening is generally weaker than the charge screening although the former becomes more effective with higher gate voltage. With increasing amount of adsorbates, the charge impurities eventually become saturated and additional adsorption always leads to decreasing conductivity.

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