Chemical Potential of Inhomogeneous Single Layer of Graphene

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We developed an alternative exfoliation method which enables us to receive high quality of graphene layers (single, double, etc...) over insulating substrates. We have studied graphene performance on high k dielectrics, and obtained high gate geometrical capacitance, high tansconductance, and high mobilities. In such devices the energy associated with the quantum capacitance becomes significant fraction of the total energy, and thus we could measure directly the chemical potential of single layer of graphene. In the regime where inhomogeneous charge densities are found, electrons and holes coexist, and the standard two carriers Hall Effect analysis fails to be adequate. Using direct measurements of the chemical potential as function of temperature we could extract the charge density of electrons and holes in the homogenous and inhomogeneous regime as well. It turns out that the temperature dependence of electron and hole densities is the dominant source for the temperature behavior of the graphene conductivity as well.