Study of double dip in the transfer characteristics of graphene based field-effect transistors

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We present measurements on Cr/Au-contacted long-channel (~10 µm) graphene transistors on Si/SiO₂ substrate. We report the observation of hysteresis as well as double dips in the transfer characteristics, that, as far as we know, have never been reported before on GFET with Cr/Au electrodes. Charge trapped in the surrounding dielectric and in particular in silanol groups at the SiO₂ surface is at the origin of hysteresis; on the other hand, the gradient of carrier along the channel caused by electron transfer from the graphene to the Au/Cr contacts and the band shift induced by the back-gate voltage and the SiO₂-trapped charge are proposed to accounts for the double-dip feature.

We show that p-n junctions are spontaneously formed by charge transfer between graphene and electrodes, and a double Dirac point can be achieved when low-resistivity contacts are fabricated. We further clarify the role of charge stored at the SiO₂ interface in the formation of the double dip. Theoretical modeling of experimental data was successfully implemented by taking into account a different doping at contacts with respect to the bulk channel and partial charge pinning at the contacts.

We finally show that a double-dip enhanced hysteresis can conveniently be exploited to build graphene-based memory devices.

References

Figures

Figure caption: (a) Transfer characteristic of a GFET with hysteresis and double dip. (b) Band diagrams of graphene between source and drain and position of the Fermi level at different VGS for different gate voltages. For floating gate, the double cone, close to the contacts, is shifted upward with respect to the one in the bulk channel to account for the p-type graphene due to transfer of electrons from graphene to the Cr/Au leads.