Electronic transport properties of graphene doped by gallium

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Abstract

In this work we present the effect of low dose gallium (Ga) deposition (< 4 ML) performed in UHV (10^{-7} Pa) on the electronic doping and charge carrier scattering in graphene grown by chemical vapor deposition (CVD). In-situ graphene transport measurements performed with a graphene field-effect transistor (FET) structure show that at low Ga coverages a graphene layer tends to be strongly n-doped with an efficiency of 0.64 electrons per one Ga atom, while the further deposition and Ga cluster formation results in removing electrons from graphene (less n-doping). The experimental results are supported by the density functional theory (DFT) calculations and explained as a consequence of distinct interaction between graphene and Ga atoms in case of individual atoms, layers, or clusters.

References

[1] Mach *et. al.*, manuscript
[2] Losurdo *et. al.*, ACS Nano, 2014 (3), 3031

Figures

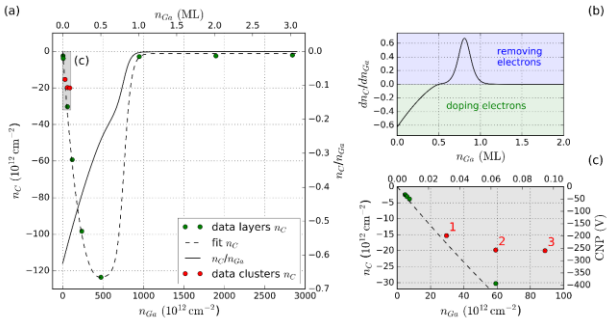

Figure 1: Calculated concentration of charge carriers (electrons) in graphene as a function of Ga concentration. The green dots are the results of DFT calculation and were fitted by the black dashed curve. The average number of charge carriers per one Ga atom is expressed by the black solid curve. (b) The change of the number of charge carriers per every additional Ga atom was obtained by differentiation of the fitting black dashed curve, and the green and blue, respectively. (c) The detail of the chart in (a) (marked by the grey rectangle) where the red dots are the results of DFT calculation for an individual atom (1), and clusters consisting of two (2), and three (3) Ga atoms.