CHARGE-STRAIN ENGINEERING IN GRAPHENE BY NANOPARTICLES

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Abstract

Local control of strain and doping in graphene enables custom variation of the graphene electronic structure at submicron scale. For extremely strained graphene, giant magnetic pseudofields can be generated, which opens possibility to study Dirac fermions in extreme high magnetic field regimes. In order to reach control of spatial distribution of the strain and doping in graphene, we prepared graphene – nanoparticle heterostructures, constituted of isotopically labelled CVD-grown graphene monolayers transferred over substrates decorated with monodisperse nanoparticles acting as sources of the graphene corrugation. The strain and doping were inspected by Raman micro-spectroscopy. Typical fingerprint of the delaminated fraction of the graphene is identified as substantial contribution to the principal Raman active modes of the graphene (G and G'). Correlation analysis of the Raman shift of the G and G' modes clearly resolved the graphene in contact and delaminated from the substrate, respectively. Intensity of the Raman features of the delaminated graphene increases linearly with the amount of wrinkles, determined by advanced processing of atomic force microscopy data. The study thus demonstrates possibility of tailoring the electronic structure of the graphene by implementation of the nanoparticles through the spatially modulated charge-strain distribution. Finally, the magnitude and symmetry of strain related to the magnetic pseudo-fields in graphene is critically examined.

Keywords: Graphene, nanoparticles, Raman sepctroscopy, magnetic pseudofields

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