Efficient *n*-type Doping in Epitaxial Graphene through Strong Lateral Orbital Coupling of Ti Adsorbate

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Abstract

Recently, many different types of doping methods for epitaxial graphene have been demonstrated through atom substitution and adsorption. Then, here we observe by angle-resolved photoemission spectroscopy (ARPES) a coupling-induced Dirac cone renormalization when depositing small amounts of Ti onto epitaxial graphene on SiC. We obtain a remarkably high doping efficiency and a readily tunable carrier velocity simply by changing the amount of deposited Ti. First-principles theoretical calculations show that a strong lateral (non-vertical) orbital coupling leads to an efficient doping of graphene by hybridizing the $2p_z$ orbital of graphene and the 3*d* orbitals of the Ti adsorbate, which attached on graphene without creating any trap/scattering states. This Ti-induced hybridization is adsorbate-specific and has major consequences for efficient doping as well as applications towards adsorbate-induced modification of carrier transport in graphene.

Keywords **- Graphene, lateral coupling, titanium, angle-resolved photoemission spectroscopy (ARPES), density-functional theory (DFT)**