Electronic properties of graphene on Ir(111) upon Pd intercalation

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Graphene (Gr) is a well-known two-dimensional material showing outstanding electron mobility thanks to its linear electronic dispersion in the vicinity of the Fermi level (Dirac Cones). Interfacing Gr with other materials is a promising way to tailor its band structure [1] for potential applications. In this respect, several studies of Gr on different metallic substrates have shown a variety of changes in the electronic properties depending on the hybridization strength [2]. In addition to that, a superpotential with a nano-metric periodicity, can develop, due to the Gr/substrate lattice mismatch (moiré pattern) [3] which results in the opening of “minigaps” at the edges of the moiré Brillouin zone [4]. The Gr band structure can be further modified by the intercalation of foreign species in between Gr and its substrate. In the case of metal intercalation on a metallic substrate, often the intercalated material takes the substrate lattice parameter. Due to the new chemical properties of the Gr underlying layer, the Dirac Cone electronic dispersion can be modified producing for example energy shift, electron velocity renormalization and a change in the amplitude of the moiré induced superpotential [5].

Here we present our study of the electronic and structural properties of one monolayer Pd intercalated between Gr and Ir(111) made by scanning tunnelling microscopy (STM) and angle-resolved photoemission spectroscopy (ARPES). While Gr on Ir is quasi-free-standing showing a low corrugated moiré pattern (Fig. a) and a “minigap” value of 250 meV [4] (Fig. b), when laying on a Pd layer, the Gr corrugation increases by a factor of 3 (Fig. c). The linear dispersion of the Dirac Cone is preserved with an enhancement of the “minigap” to 450 meV (Fig. d). These effects can be explained by a strongest Gr-Pd interaction which increases the amplitude of the moiré induced superpotential while keeping the electronic linear dispersion of the Dirac Cones.

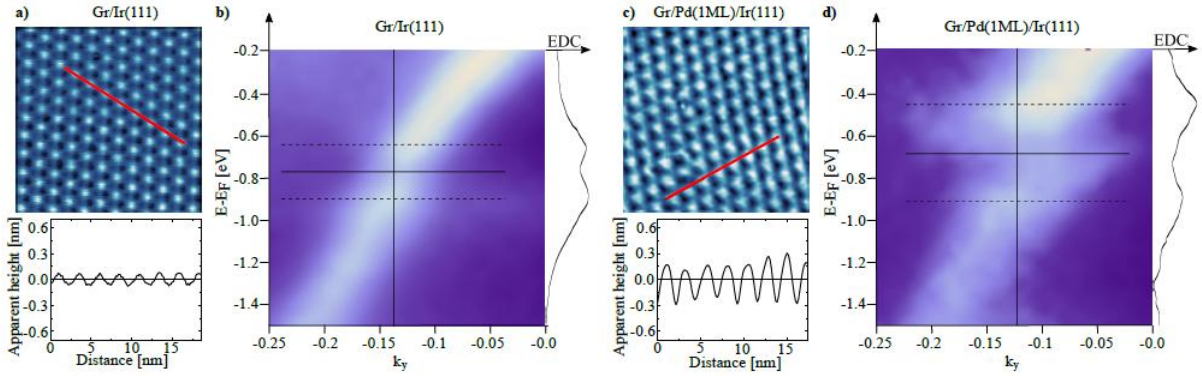

Figure: a) STM image of Gr/Ir(111) and apparent height profile along the red line. b) ARPES measurement of the minigap of Gr/Ir(111) along the pΓK direction, EDC along the black line. c) STM image of Gr/Pd(1ML)/Ir(111) and apparent height profile along the red line. d) ARPES measurement of the minigap of Gr/Pd(1ML)/Ir(111) along the pΓK direction,EDC along the black line.

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