Decoupling of graphene by KBr intercalation on Cu(111)

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The catalytic growth on transition metal surfaces provides a clean and controllable route to obtain defect free, monocrystalline graphene. On the other hand, graphene's optical and electronic properties are diminished by the interaction with the metal substrate. One way to overcome this obstacle is the intercalation of atoms and molecules decoupling the graphene and restoring its electronic structure [1]. The decoupling of molecules by alkali halide thin films is a common method, utilized to study single molecules in scanning probe experiments [2]. We applied non-contact atomic force microscopy to study the structural and electric properties of graphene both on clean Cu(111) and after the adsorption of KBr or NaCl [3]. By means of Kelvin probe force microscopy (KPFM) a change in graphene's work function has been observed after the deposition of KBr, indicating a restoration of the electronic properties of graphene. Figure 1 shows graphene islands directly coupled to the Cu(111) surface (left) and after deposition of KBr (right). The work function of the graphene island changed clearly after KBr deposition while no effect was observed for NaCl. In addition, X-Ray photoelectron spectroscopy (XPS) showed a change in the chemical surrounding for potassium and bromine in the presence of graphene. The most striking observation, however, is a clear evidence of a **Coulomb blockade effect** observed in bias spectroscopy measurements at room temperature of the decoupled graphene layers. The results have been compared with density functional theory (DFT) calculations supporting our experimental findings.

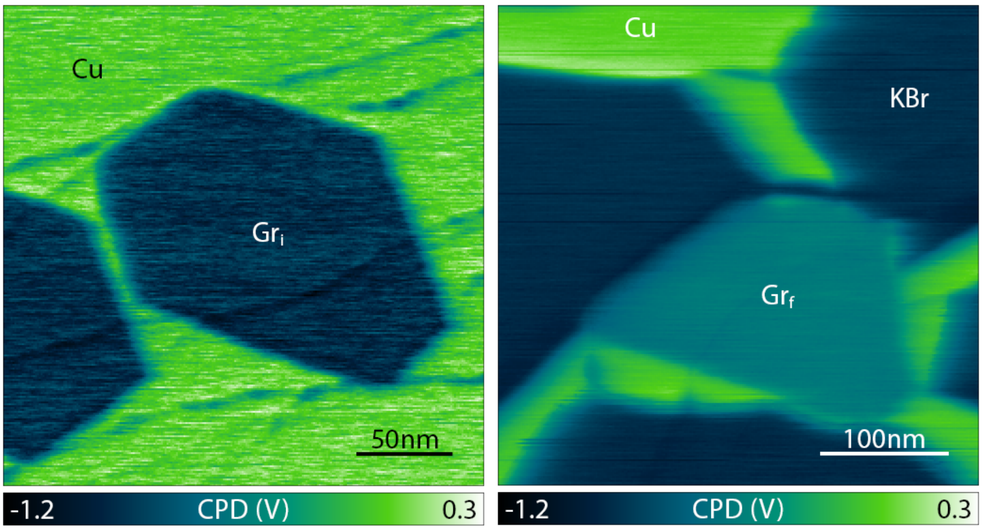

Fig. 1: Change in the work function of graphene upon KBr deposition. On bare copper the CPD of graphene (Gr$_i$) was 850 mV (left), in presence of KBr the CPD of graphene (Gr$_f$) was 450 mV (right) in respect to copper.

References:

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