Electronic properties of sharp junctions in nitrogen doped graphene

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Tuning the physical properties of graphene is one of the current challenges in the field of 2D materials. Soon after the first isolation of graphene, its chemical doping has been investigated with particular attention in nitrogen doping which is an n-type dopant [1,2]. To bring graphene to a new level, one bottleneck is to control the spatial distribution of dopants in order to realize band engineering at the nanometer scale. Here, we show that a nanopatterning of nitrogen dopants in graphene can be achieved by using monolayer islands of adsorbed molecules as a resist during the doping procedure. The resulting formation of domains with different nitrogen concentrations allows obtaining nn' and pn junctions in graphene. This method leads to the formation of a large collection of domains on a sample, allowing to address the junctions at the atomic scale by scanning tunneling microscopy (STM). Using STM and scanning tunneling spectroscopy, the electronic properties of the junctions have been measured. In particular, the evolution of the Dirac point along the junction makes it possible to measure the width of the space charge zone (Figure 1) which appears to be smaller than the Fermi wavelength [4].

References

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Figures

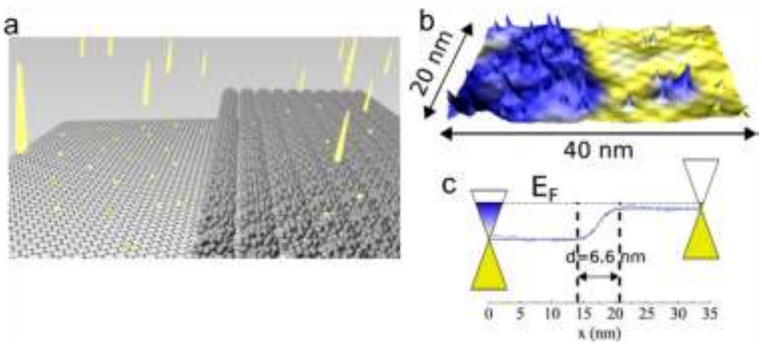

Figure 1: (a) 3D representation of a monolayer resist used to achieve nanodomains of different concentration of nitrogen dopants in graphene. (b) STM topography color code with a differential conductance map showing the variation of the Dirac point on a junction between two domains of different nitrogen concentration in graphene. (c) Linescan of the conductance map used in (b) showing the variation of the Dirac point across the junction.