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TÉMA

Graphene on Ru(0001): A nanostructured surface

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Ultra perfect graphene monolayers, islands and ribbons can be epitaxially grown on different single crystal metal surfaces under Ultra High Vacuum conditions. These graphene layers are spontaneously nanostructured in a periodic array of ripples by the Moiré patterns caused by the difference in lattice parameter with the different substrates.

We characterize its perfection at the atomic scale by means of Scanning Tunneling Microscopy (STM) and determine its electronic structure in the real space by local tunnelling spectroscopy (STS). In-situ STM imaging of graphene monolayers on Ru(0001) reveals periodic corrugations with 12x12 periodicity. The apparent corrugation depends strongly on the bias voltage and can even be inverted above +2.6 V, revealing that, in addition to the geometric corrugation, a much stronger electronic corrugation exists. Moiré patterns have been observed with STM on different systems and their interpretation, in some cases, is not straightforward. The main reason is that in STM images the geometric corrugation and the electronic structure are entangled [1, 2]. Graphene grown on Ru(0001) presents periodic variations in the electronic structure induced by the chemical interaction between the carbon atoms and the ruthenium ones [3]. By means of STS we observe inhomogeneities in the charge distribution along the moiré unit cell [4].

The inhomogeneities in the local surface potential landscape can be explored with nanometer resolution measuring the Field Emission Resonances (FERs). The STM is operated in constant current mode and the expected energy position for the FERs is given by the expression founded by Gundlach some time ago [5]. With that expression it is possible to determine experimentally the local surface potential along the moiré unit cell. For graphene on Ru(0001) we have found a difference of the order of 0.25 eV in the work function values depending on the position on the moiré pattern. The energy position of the first FER presents strong spatial variations due to the hybridization with a Ru(0001) surface resonance [6].

Finally I will discuss briefly the deposition of electron acceptor molecules on this surface.

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