STM and NC-AFM investigations of Graphene on Metal Surfaces

V. Simic-Milosevic, Y. Dedkov, A. Kaiser, S. Schmitt, S. Bahr, O. Schaff, A. Thissen

SPECS Surface Nano Analysis GmbH, Voltastrasse. 5, 13355 Berlin, Germany.
Violeta.Simic-Milosevic@specs

Abstract Summary: We present recently obtained results in graphene-based systems as measured with STM and NC-AFM techniques. We highlight the latest state-of-the-art developments in these two techniques and show how these techniques are applied in the latest graphene research as well in other experimental systems.

The SPM Aarhus 150 is an ideal instrument for investigating lattice mismatched surfaces, with a focus in the present talk of SPM measurements on the graphene/Ir(111) system [1]. Microscopy experiments were performed in constant current / constant frequency shift (CC/CFS) and constant height (CH) modes, exploiting a combination of the STM and NC-AFM capabilities of the system. We found that in STM imaging the electronic contribution is prevailing compared to the topographic one and the inversion of the contrast can be assigned to the particular features in the electronic structure of graphene on Ir(111). Contrast changes observed in constant height AFM measurements [1] are analyzed on the basis of the energy, force, and frequency shift curves, obtained in DFT calculations, reflecting the interaction of the W-tip with the surface and are attributed to the difference in the height and the different interaction strength for high-symmetry cites within the moirè unit cell of graphene on Ir(111).The presented findings are of general importance for the understanding of the properties of the lattice-mismatched graphene/metal systems especially with regard to possible applications as templates for molecules or clusters.

References

[1] E. N. Voloshina *et al*., Nature Sci. Rep. **3**, 1072 (2013).

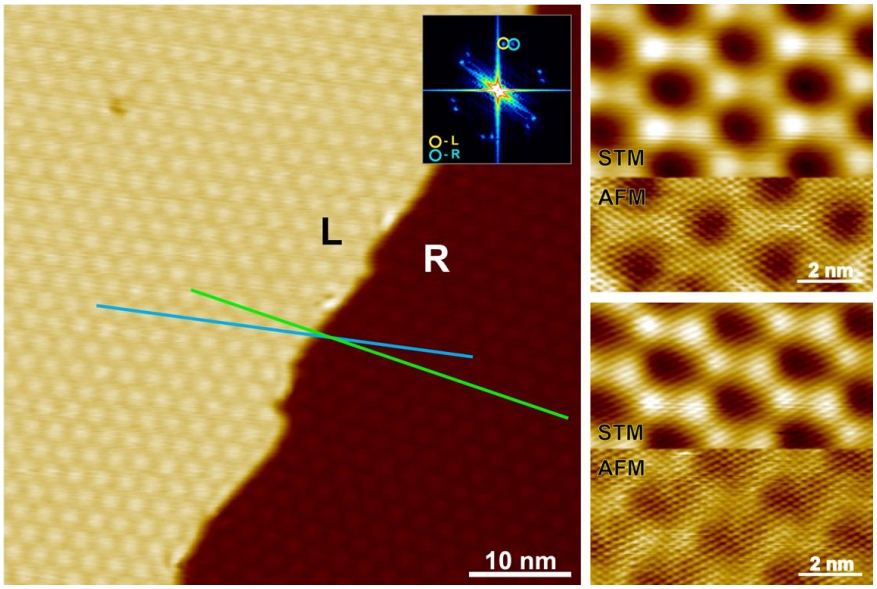

Fig. 1. Gr/Ir(111) moirés (left) are contrasted with STM/NC-AFM measurements, with feedback switched ‘on-the-fly’ (right) at tunnelling voltages of +0.46 (top-right) and -0.2 V (bottom-right). The top of each image demonstrates the effect of feedback via tunnelling current and the bottom feedback in NC-AFM modeshows STM, the bottom Δf (AFM).