Nitrogen doped graphene studied by STM/STS and ARPES

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Tuning the electronic properties of low dimensional carbon materials is a current challenge for the development of carbon based technology. Doping by insertion of foreign atoms in the atomic lattice is a promising strategy to reach the control of the electronic structure of carbon materials. Nitrogen atoms are good candidates for chemical doping due to their suitable atomic radius and the additional electron that they contain as compared to carbon. They can adopt different local environments (graphitic-like, pyridinic-like) which can have various effects on the electronic structure [1].

For the particular doping method we use (i.e. exposure of the epitaxially grown graphene to an atomic nitrogen flux), we combine STM imaging and tunnelling spectroscopy [2] with Angled-Resolved Photoemission Spectroscopy (performed at the Cassiopée beamline at the synchrotron Soleil), to correlate the configuration of the nitrogen atoms in the graphene lattice with their observed effect on the band structure and compare it with the result of DFT-based calculations. Typical data are displayed on figure 1 where one can see an STM image, a STS spectrum and an ARPES spectrum of one sample. We also evaluate the number of charge carriers brought by each doping atom and its evolution as a function of the nitrogen concentration. We will point out difficulties in determining those quantities arising when one is dealing with heavily doped samples.

References

[1] B. Zheng, P. Hermet, L Henrard, ACS Nano, **7** (2010) 4165
[2] F. Joucken et al., Phys. Rev. B **85**, (2012) 161408(R)

Figure

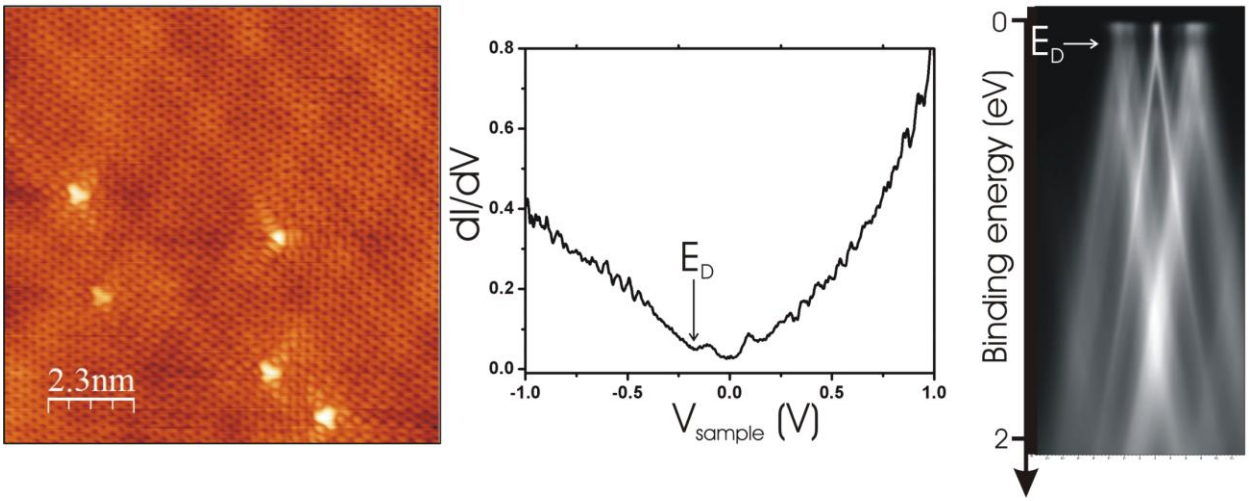

Figure 1- (left to right) STM image, STS spectrum and ARPES spectrum of a lightly nitrogen-doped sample