Electronic and Chemical nano-imaging of 2D materials beyond graphene

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Recently, remarkable progress has been achieved in modern microscopies. However, even if they have attained exceptional lateral resolution, the problem of providing powerful spectroscopic characterization at the nano- and mesoscopic-scale still remains. This gap is particularly filled by an innovative and powerful technique named k-space nanoscope or NanoARPES (Nano Angle Resolved Photoelectron Spectroscopy). This cutting-edge nanoscope is able to determine the momentum and spatial resolved electronic structure, disclosing the implications of heterogeneities and confinement on the valence band electronic states typically present close to the Fermi level, see Fig. 1. The k-momentum space nanoscope can be effectively combined with chemical imaging based on core level scanning photoemission and X-ray absorption able to detect even very tiny different chemical environments.

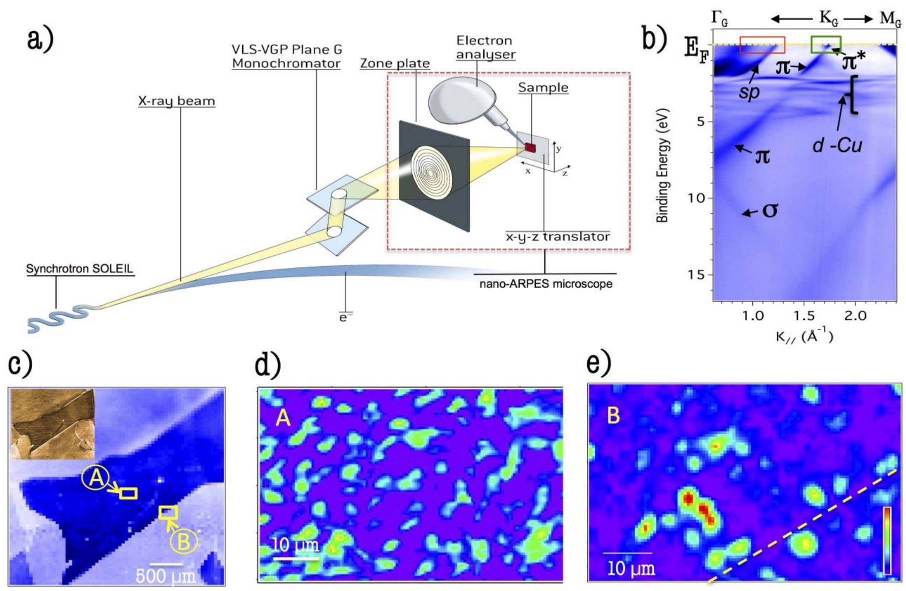

Figure 1. Mixed real- and reciprocal-space images of a polycrystalline graphene film, grown on copper foils. (a) scheme of the nano-ARPES apparatus (b) ARPES data inside one of a large copper grain of the sample. (c) real-space image of the copper states intensity. *Panels (d) and (e) show graphene grain distribution at the ''A'' and ''B'' yellow rectangles*

In the present talk, the more relevant innovations in the field of chemical and electronic imaging of 2D materials will be disclosed, highlighting the basic principles, associated instrumental and appealing scientific cases. In particular, nanoARPES findings describing the electronic band structure of mono-atomic exfoliated graphene on SiO2 substrates, epitaxial and polycrystalline monolayer graphene films grown on copper and SiC [2] will be presented and Graphene/MoS2 heterostrustures. Electronic and chemical mapping with high energy, momentum and lateral resolution have provided relevant features like gap-size, doping, effective mass, Fermi velocity and electron-phonon coupling, among other properties for diverse 2D materials [3-6].

References

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