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Chemical and electronic imaging of energy and electronics materials important for basic science and industrial applications

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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. The k-space nanoscope can be effectively combined with chemical imaging based on high energy resolution core level scanning photoemission and X-ray absorption able to detect even very tiny different chemical environments.

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In this presentation, 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, our findings describing the electronic properties of mono-atomic exfoliated graphene films as well as mono- and poly-crystalline monolayer of graphene grown on copper and SiC [2] will be presented. Outstanding Graphene/hBN and Graphene/MoS2 heterostrustures will be also described together with our latest results from electronic and chemical mapping of other complex 2D materials, beyond graphene [3-5]. Finally, special mention will be devoted the spin-charge separation in metallic MoSe2 grain boundary [6].

References

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Author: Prof. ASENSIO, Maria C. (Synchrotron SOLEIL & Université Paris-Saclay)

Presenter: Prof. ASENSIO, Maria C. (Synchrotron SOLEIL & Université Paris-Saclay)

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