Photoemission electron spectromicroscopy of complex interfaces: probing 2D materials and the support underneath

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The process of photoemission is at the basis of many spectroscopies employed in atomic and molecular physics, surface chemistry and, more in general, materials sciences. In the last two decades, imaging applications of photoemission spectroscopy have flourished at third generation synchrotron light sources, benefiting both from the high photon flux density and steady advances in the instrumentation. On the one hand, the lateral resolution of both full-field and scanning photoemission microscopes has been pushed well below the micron, nearing nowadays the nanometre. On the other, thanks to micro- or nano-focussing of the x-ray beam, angle-resolved photoemission spectroscopy (ARPES) has enabled us to access the local electronic structure of individual, micrometre-sized crystal grains, obtained by exfoliation, cleavage or grown by CDI. Today, photoemission spectro-microscopes have become indispensable tools to study graphene, as well as the emerging class of layered two dimensional (2D) materials. Elettra, the synchrotron radiation facility in Trieste, operates several x-ray photoemission spectro-microscopes. In this talk, I will give an overview on the *in situ* and *in operando* capabilities of these instruments, which often find application in the study of heterostructures formed by different 2D materials [1-3]. Selected case-studies will be presented, illustrating the usefulness of photoemission in studying interfacial processes. The emphasis will be placed on the application of x-ray photoemission electron microscopy (XPEEM), which, used in combination with low energy electron microscopy (LEEM), provides unique means to characterize the chemical, electronic and magnetic structure of both simple and complex layered materials [4-7].

References

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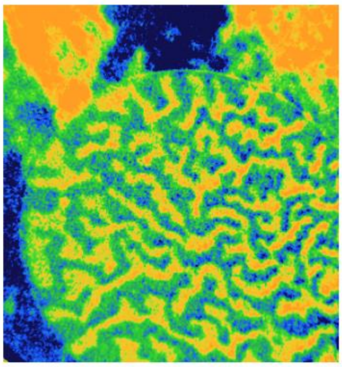

Figure 1: Magnetic state of ultra-thin cobalt. The disk-shaped structure is covered by a lithographically printed graphene monolayer, which induces out-of-plane magnetic anisotropy in cobalt. This is manifested by domains arranged in a meander-type pattern. Adapted from [7].