



## **Electronic properties of nanostructured surfaces studied by electron spectroscopies**

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### **Abstract:**

Angle-resolved Photoemission Spectroscopy (ARPES) and Scanning Tunneling Spectroscopy (STS) are powerful and complementary techniques to investigate the electronic properties of materials and surfaces. These spectroscopies give information on the band structure by measuring the electron dispersions in reciprocal space by ARPES and on the local density of state in direct space by STS. In this talk the interests and complementarities of ARPES and STS will be discussed and illustrated on two examples of nanostructured surfaces [1,2].

In the first example, we present a study of the electronic properties associated with the reconstruction of a metallic interface: one Ag monolayer on Cu(111). The super-periodicity of the reconstructed surface leads to the opening of gaps in the surface band structure. We show that ARPES and STS measurements allow to determine the electronic potential associated with the surface reconstruction. The method is based on the determination of the Fourier components of the potential: their amplitudes can be obtained directly from the gap amplitudes measured in ARPES whereas their phases are deduced from STS.

The second illustration is devoted to the study of a self-assembly of organic molecules on surfaces : an ordered array of poly(para-phenylene) nanowires produced by surface-catalysed reaction. By scanning tunnelling spectroscopy we follow the quantization of unoccupied molecular states as a function of oligomer length, with Fermi level crossing observed for long chains. ARPES reveals a quasi-1D valence band and STS evidences a direct gap of 1.15 eV. Tight-binding modelling and ab initio density functional theory calculations lead to a full description of the band structure, including the gap size and charge transfer mechanisms, highlighting a strong substrate–molecule interaction that drives the system into a metallic behaviour.

[1] G. Vasseur et al., Phys. Rev. B 89, 121409(R) (2014).

[2] G. Vasseur et al., Nature Comm. 7, 10235 (2016).

Contribution:

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