Setup of a UHV chamber for combined scanning tunneling microscopy and photoemission spectroscopy (XPS and UPS) experiments for the investigation of 2D materials of interest for the energy sustainable transition

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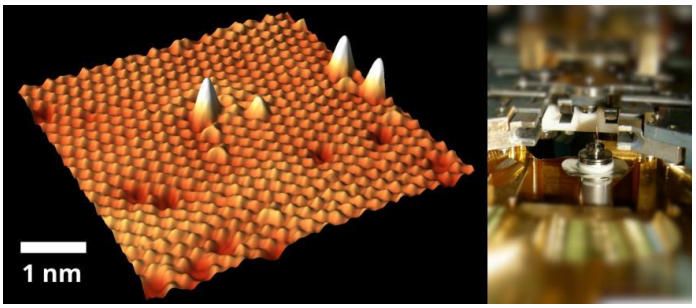

The synthesis of stable tailored 2D nanostructured systems has become of paramount importance in catalysis, energy conversion and sensing applications. For example, the functionalization of low dimensional materials, resulting in an increased chemical reactivity, offers an alternative route to conventional catalytic processes. In the same way, the development of technologies to convert solar energy into chemical energy and electric power can constitute a valid and green alternative to the technology based on fossil fuels.

Within this context, this project aims at integrating scanning tunneling microscopy (STM) and photoemission spectroscopy for in-situ characterization of 2D materials within the same experimental setup. The first part of the activity will be dedicated to the upgrade of the UHV system, with the installation and commissioning of new instrumentation. The second part will focus on the synthesis of stable functionalized 2D nanostructured systems, providing proof of their enhanced physical and chemical properties, by exploiting the new capabilities of the upgraded setup. The experimental activity will be based on the expertise of the hosting research group. In particular, the project can rely, on one hand, on a Variable Temperature STM (150-900 K) to investigate, up to video rate, the morphology of the prepared nanostructures and their reactivity over exposure to selected gases in realistic thermodynamic conditions, and, on the other hand, on a well-established experience in the use of XPS/UPS to provide the chemical sensitivity needed to complement the microscopy data. The experimental results will be supported by ab-initio calculations performed through external collaborations and beamtime application to external synchrotron radiation facilities will be also encouraged and supported.

The ideal PhD candidate is expected to have a Master degree in Physics, Chemistry or Materials Science, previous experience with vacuum technology and surface science techniques, high drive to solve challenges independently, attitude to work in an international research environment with collaboration spirit, and good English skills. Skills in scripting and analysis using programming languages as well as in the building of experimental setups will be added values.

References

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