Field: Physics

Doctoral School: SMD-Science de la Matière

Title: Study of the molecular networks formation on conductive and insulating surfaces

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Area: Nanoscience

This subject is related to the study of the mechanisms of chemical reactions taking place on a surface and not in solution. When molecules are deposited on a substrate, they may be more or less strongly bonded to the substrate but are still weakly bonded to one another. The aim here is to fabricate wires or extended networks of molecules which are covalently linked together, which will enable studying the phenomena of electronic transfer in these layers. This so-called surface synthesis method [1-4] made possible, for example, to create nanoribbons of graphene on several substrates and this, with control at the atomic scale. The advantage of this type of synthesis is that it is possible to create large networks of molecules that could not be transferred onto substrates, to do so in an ultra-clean (UHV) environment and with a much wider temperature range than in solution. It is thus possible to fabricate in a controlled manner new structures which could not be synthesized in solution. These molecular layers have a great interest for devices based on organic electronics such as OLEDs type screens. An example of the formation of such networks is shown in FIG. 1 which compares the structures of coordination complexes obtained before the reaction (FIG. 1 a and b) and that resulting from surface synthesis (FIG. 1c).

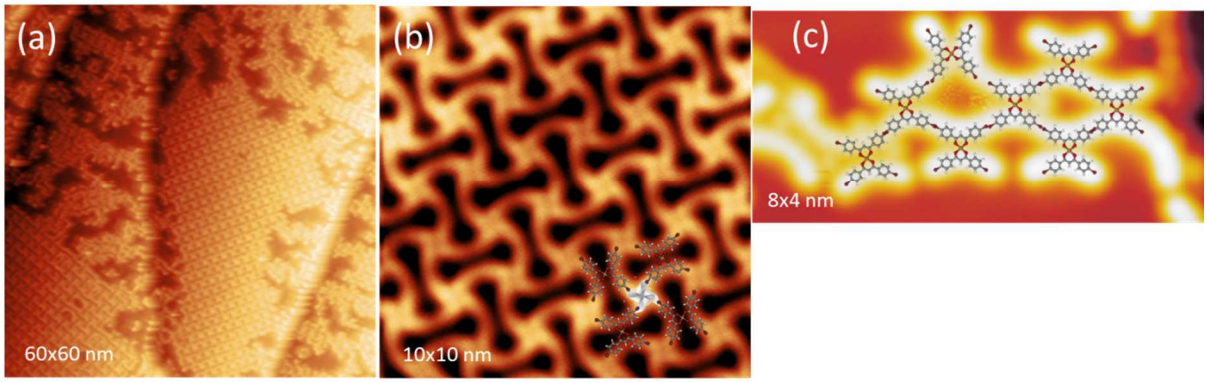

Fig 1: (a and b) Self-assembled molecular layer on an Au (111) surface and network of molecules covalently bonded between each other on the same substrate.

This research work will be carried out by local probe microscopies (STM and non-contact AFM) which not only allow to study the structure of molecular networks and reaction paths but also the resulting electronic and magnetic properties. In order to have access to the electronic transfer properties, a thin

insulating layer must be introduced under the molecular network in order to isolate it from the metal used as substrate. So far, few studies have been done on insulator [5-8]. The first part of the study will therefore be conducted on a conductive metallic substrate and the second on ultra-thin films of oxide grown on metal surfaces.

Collaborations: The candidate will be likely to collaborate with the Nanoscience Institute of Aragon in Zaragoza (Spain) and the STM Group of the National University of Taiwan (NTHU) in Hsinchu (Taiwan).

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