METALORGANIC NANOSTRUCTURES: 2D- EXTENDED STRUCTURES

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ABSTRACT:

Nanotechnology is being developed as a new and very promising field of science. Very different kinds of nanomaterials are studied nowadays all around the world, looking for new materials which combine properties and applications. For example, hybrid materials obtained by a combination of inorganic and organic units, present properties and applications derived from their mixed nature [1] resulting metalorganic nanostructures, with different electronic properties than the original organic molecules.

In this work, we present a summary of nanostructuring phenomena using self-organizing strategies for structuring materials in the nanoscale range. We have studied by STM the structures resulting from the combination of iron atoms and organic molecules of PTCDA on a gold substrate. These metalorganic compounds presumably combine the properties of its components,. By choosing the growth conditions (substrate temperature and adsorbates quantities) we can control the structural order and form different stable nanostructures. Previously reported nanostructures [2], organic nanodots and molecular chains, result from linking PTCDA molecules with iron atoms, and present a modified electronic structure different than the one observed for the organic material. Next structure is the "ladder-like", resulting from two chains connected by perpendicular PTCDA molecules like the rungs of a ladder. These ladder structures can be extended over the entire surface. Figure 1 shows a STM image corresponding to a 0.9ML growth of this metalorganic 2D- structure. The image shows several domains of this "extended-ladder" structure, where the PTCDA molecules are clearly distinguished. This structure is stabilized by the iron, as it is never observed without the iron. The model for this structure suggests one iron atom per PTCDA molecule.

We have checked the stability of this structure by exposing it to oxygen atmosphere and annealing it at 420K, and no substantial changes have been observed. Finally, we have extended the growth for more than the monolayer, 1.4ML, where order at the second layer has been observed.

References:

[1] For a review on hybrid materials see for example the special issue: *Journal of Materials. Chemistry* **15** (2005).
[2] J. Méndez, R. Caillard, R. Otero, N. Nicoara, and J.A. Martín-Gago, *Advanced Materials* **18** (2005) 2048-2052.

Figures:

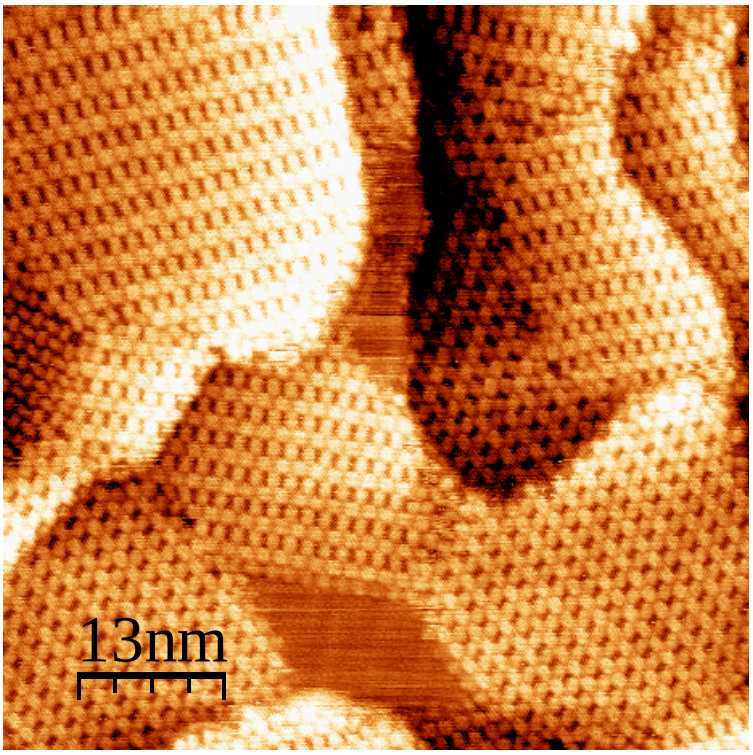

Figure 1. STM image of a gold substrate covered with 2D- metalorganic structures combining PTCDA organic molecules and iron atoms. It is remarkable that this structure is not observed in pure PTCDA growth.