CONDUCTIVE SCANNING FORCE MICROSCOPY ON LINEAR-CHAIN ORGANIC FILMS.

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The electrical properties of self-assembled monolayers (SAMs) of organic molecules on metal surfaces have gained particular interest due to their potential applications in nanometer-scaled electronics systems [1]. Understanding the transport mechanism through these thin molecular films as well as the dependence of the conductivity on the molecular length and structure, the applied load and the enviromental conditions are key issues for future applications.

Alkanethiol molecules ($CH_3(CH2)_{n-1}SH$; Cn) constitute one of the model systems most extensively studied, due to their capability to form well-ordered self-assembled monolayers on noble and semi-noble metals. In particular, on Au(111) surfaces, alkanethiols self-assemble into large, structurally well defined domains [2]. The full-coverage phase corresponds to a monolayer of closely packed molecules in a hexagonal arrangement, with the chains tilted around 30-35º from the surface normal. But, for a wide range of coverage below the monolayer completion, the organization of alkanethiols leads to islands presenting different molecular structures. Under non-equilibrium conditions and depending on the balance between existing interactions, differently ordered configurations (from near-flat to upright phases) can be prepared and films with different tilt angles and consequently different thickness are obtained [3].

In this work, and by means of conductive Scanning Force Microscopy (SFM), we have faced the combined study of the structural and electrical properties of hexadecanethiol (C16) islands on Au(111). The high spatial resolution of the local probe has been used to determine the molecular order and frictional properties of the thiol islands, while 3D operation modes allow us to study the dependence of the I/V behaviour as the tip approaches on selected locations of the island (Figure 1). Current maps illustrating the isolating nature have also been obtained as shown in Figure 2.

References:

[1] M. A. Reed, J. Chen, A. M. Rawlett, D. W. Price, and J. M. Tour, Appl. Phys. Lett.,78 (2001) 3735

[2] A. Ulman, Chem. Rev. 96 (1996) 1533

[3] E. Barrena, C. Ocal, M. Salmeron, J. Chem. Phys. 113 (2000) 2413

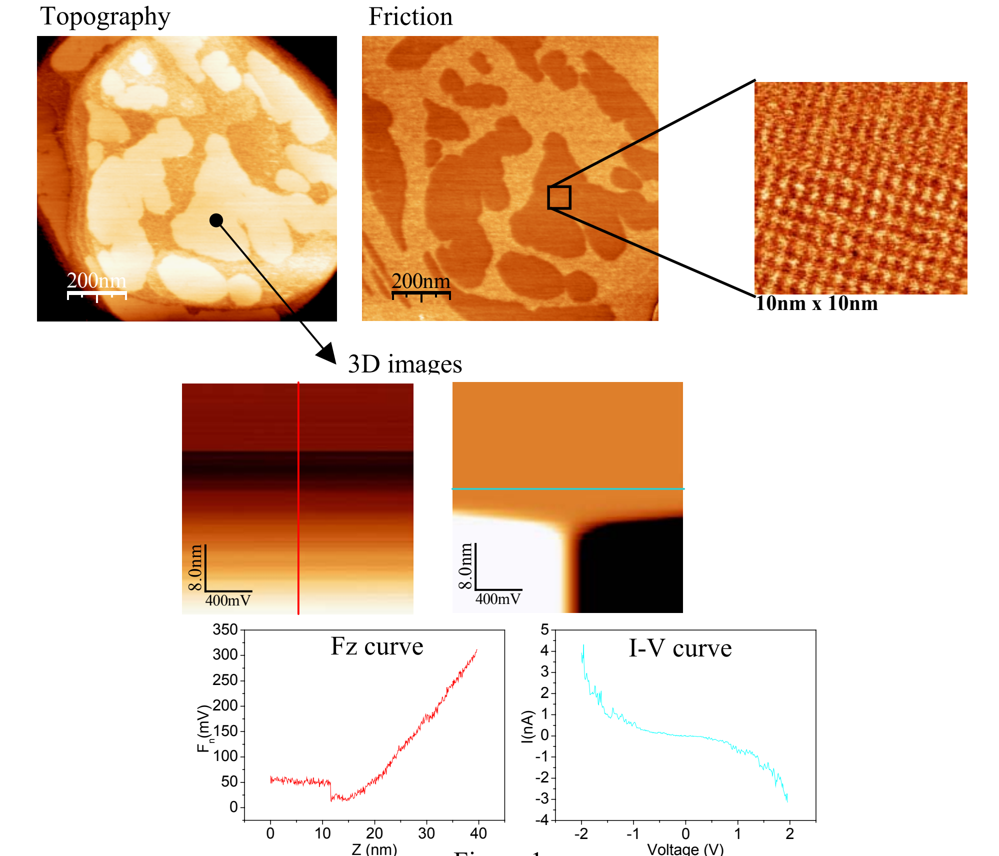

Figure 1

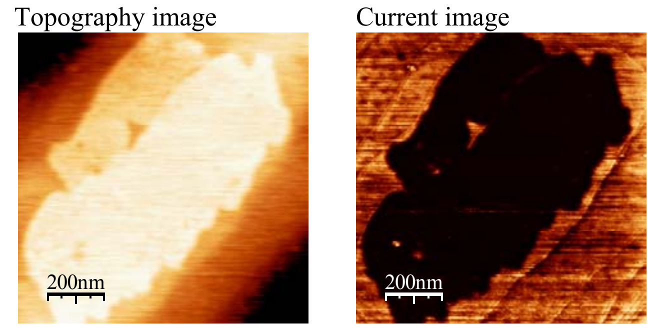

Figure 2