

The group of Electronic and Vibrational Nanostructures of the spanish Universidad de Castilla-La Mancha will be adding one postdoctoral researcher (tenure-track)

Research Position: "Electronic nanostructures in thin films (magnetic, superconducting, optics)"
Research Centre: Instituto de Nanociencia, Nanotecnología y Materiales Moleculares –
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SCIENTIF ASPECTS: APPLICATIONS OF NANOSTRUCTURES BY ION SCULPTING

We propose the research of magnetic and electrical transport properties of low dimensional nanostructures created by means of ion beam irradiation at glancing incidence on a thin film or substrate surface, and/or by means of self-assembly of nanoparticles. Following experimental realizations of a previous national project, the applications of glancing ion erosion to develop herewith are twofold: (1st) On ferromagnetic thin films grown by magnetron sputtering, an ion beam irradiation at glancing incidence creates a nanoscale ripple pattern at the surface and thereby an in-plane *uniaxial* magnetic anisotropy, that we are to study especially along the film evolution with the irradiation dose (erosion) until the substrate is reached and quasi-unidimensional magnetic *nanowires* form. (2nd) Eroded magnetic films with uniaxial anisotropy can provide an effective guide for collective channelling of a superconducting vortex lattice, when an amorphous superconducting layer (Mo₃Ge) is grown atop. The morphology, size and magnetostatic state of these nanostructure systems will be related to the magnetic interactions and the electrical transport properties. For these research lines we count with experience in the formation of surface ripple patterns on cobalt films [1,2], in the characterization of vortex dynamics in superconducting films with artificial pinning arrays [3], and for the setup of scanning force techniques to undertake magnetic nanoscale characterization at low temperatures. (3rd) A nanoscale ripple pattern on the surface of silicon or other substrates has proved to make an appropriate *template* for the alignment of a nanoparticle formation in a later glancing deposition [4]. This new method will assist in studies of Sb and Ag self-assembly to explore the growth of nanowires and nanoparticles, whose electrical properties (magneto-conductance, Hall effect) we can study in lithographically etched bars, and correlate with their local probe experiments of electronic and mechanical properties. We will focus in these nanostructure systems as a model of quasi-unidimensional transparent conductor, in case of silver nanowires, and to help understand the conduction regime of antimony coalescent nanoparticles [5-7]. In all cases we intend to achieve a deeper understanding of confinement effects and of the relation between geometrical and structural characteristics on one side and physical properties on the other side. Additionally with this project we are to develop a prototype low-energy linear ion gun that makes a cost-effective, scalable ion source for large area applications.

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KEY WORDS: Ion sculpting, self-assembly, films, nanostructures, magnetism, mechanical properties, electrical transport, probe microscopy

Current projects: Nanoestructuras magnéticas de baja dimensión II (ref. PPII10-0054-1318)