510th ASRC Seminar

Date: 15:00 ～16:15, 17 April

Location: Meeting room 103, ASRC Building

Speaker: Dr. M Ricardo Ibarra
(Institute of Nanoscience of Aragon, University of Zaragoza)

Title: Superconductivity and magnetism at the nanoscale

Superconducting and magnetic nanostructures can be achieved by the deposition from an organometallic gas precursor assisted deposition by either electrons (FEBID) or ions (FIBID) Focused Beam Induced Deposition.
Co magnetic nanowires of high purity (95%) were produced using FEBID technique [1] and the magnetic characterization of L-shaped Co nanowires revealed that the domain-wall propagation field is lower than the domain-wall nucleation fields (*conduit behaviour*)[2]. 3D magnetic nanostructures magnetic has been obtained (3). This constitutes a promising feature which could have implication in magnetic logic, sensing and storage applications. W nanostructures using FIBID showed relevant superconductor properties. We have found transition critical temperatures around T_c=5K and archetypical BCS behavior [4] that do not change with the size reduction. New effect related with melting of vortex lattices present under application of a magnetic field, were observed in these new nanostructures [5]. A new field induced dissipation-free state has been observed in very narrow nanowires fabricated using FIBID showing the relevance of the surface superconductivity [6].

[1] Serrano-Ramón L. et al….*Ultrasmall Functional Ferromagnetic Nanostructures Grown by Focused Electron-Beam-Induced Deposition* ACS NANO 5 (2011) 7781-7787 DOI: 10.1021/nn201517r
[2] A. Fernández-Pacheco et al, *Domain wall conduit behavior in cobalt nanowires grown by Focused-Electron-Beam Induced Deposition,* Appl. Phys. Lett. 94 (2009) 192509
[3] A. Fernandez Pacheco et al.. "*Three dimensional magnetic nanowires grown by focused electron-beam induced deposition*", www.nature.com/scientific report, DOI: 10.1038/srep01492. (2013).
[4] J. M. De Teresa et al., *Transport properties of superconducting amorphous W-based nanowires fabricated by focused-ion-beam-induced-deposition for applications in Nanotechnology*, Mater. Res. Soc. Symp. Proc. 1180-CC04-09 (2009)
[5] I. Guillamón et al., *Direct observation of melting in a two-dimensional superconducting vortex lattice*, Nature Physics 5 (2009) 651
[6] R. Córdoba, et al. *"Magnetic field-induced dissipation-free state in superconducting nanostructures"*. Nature Communications, vol. 4, 1437. 2013

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