

Perspectives on the use of focused electron/ion beams for application in Spintronics

¹J. M. De Teresa*, ^{1,2}A. Fernández-Pacheco, ²R. Córdoba, ²J.V. Obona, ^{1,2}L. Morellon, ²J. Sesé, ^{1,2}S. Sangiao, ¹N. Marcano, ^{1,2}M.R. Ibarra

¹ Instituto de Ciencia de Materiales de Aragón, Universidad de Zaragoza-CSIC, Facultad de Ciencias, Zaragoza, 50009, Spain

² Instituto de Nanociencia de Aragón, Universidad de Zaragoza, Zaragoza, 50009, Spain

* deteresa@unizar.es

In this contribution we will discuss recent results obtained in our group regarding the application of focused electron/ion beams to the fabrication of nanostructures relevant for Spintronics. In this study we use a dual beam (electron/Ga-ion) equipment.

First, the focus will be given to the creation of atomic-sized magnetic metallic constrictions by means of low-energy focused-ion-beam (FIB) Ga etching [1]. In magnetic nanconstrictions, the conduction is ballistic and exciting magnetotransport phenomena have been anticipated and rarely measured. Our research aims to create stable constrictions for ex-situ applications.

Afterwards, the focus will be given to the growth of nanoscale superconducting and magnetic materials by means of focused-electron/ion-beam-induced deposition (FEBID and FIBID respectively). The physical properties and perspectives of W-based amorphous superconducting nanodeposits grown with FIBID will be presented. In particular, STM studies in collaboration with the group of S. Vieira and H. Suderow (UAM, Madrid) reveal outstanding nanoscale superconducting properties of this material [2]. Next, we will show the results obtained in the growth of Co nanowires by means of FEBID. The magnetic and magnetotransport properties of such Co nanodeposits have been found to be of high-quality, opening great perspectives for application in Spintronics [3]. In particular, MOKE experiments in collaboration with the group of R. Cowburn (Imperial College, London) demonstrate domain-wall conduit in L-shaped nanowires.

Finally, the potential of FEBID and FIBID nanodeposits to perform nanometric contacts to nanowires and other nanostructures will be discussed. Magnetotransport measurements of a single Bi nanowire, grown by L. Pérez and M. Plaza (UCM, Madrid) by electrodeposition, will be presented [4].

References

- [1] A. Fernández-Pacheco, J.M. De Teresa, R. Córdoba, M.R. Ibarra, *Nanotechnology* 19, 415302 (2008); J.V. Obona, J.M. De Teresa, R. Córdoba, A. Fernández-Pacheco, M.R. Ibarra, *submitted*.
- [2] I. Guillamón, H. Suderow, S. Vieira, A. Fernández-Pacheco, J. Sesé, R. Córdoba, J.M. De Teresa, M.R. Ibarra, *New Journal of Physics* 10, 093005 (2008); I. Guillamón, H. Suderow, S. Vieira, A. Fernández-Pacheco, J. Sesé, R. Córdoba, J.M. De Teresa, M.R. Ibarra, *submitted*.
- [3] A. Fernández-Pacheco, J.M. De Teresa, R. Córdoba, and M.R. Ibarra, *submitted*; A. Fernández-Pacheco, J.M. De Teresa, R. Córdoba, M.R. Ibarra, D. Petit, D. E. Read, L. O'Brien, E. R. Lewis, R. P. Cowburn, *submitted*.
- [4] N. Marcano, S. Sangiao, J. M. De Teresa, L. Morellón, M. R. Ibarra, M. Plaza, L. Pérez, *submitted*.