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Focused electron beam induced deposition of magnetic nanostructures[1]

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Nanopatterning strategies of magnetic materials normally rely on standard techniques such as electron-beam lithography using electron-sensitive resists. Focused electron beam induced deposition (FEBID) is currently being investigated as an alternative single-step route to produce functional magnetic nanostructures. Thus, Co-based [1] and Fe-based [2] precursors have been recently investigated for the growth of magnetic nanostructures by FEBID. In the present contribution, I will give an overview of the existing literature on magnetic nanostructures by FEBID and I will focus on the growth of Co nanostructures by FEBID using $Co_2(CO)_8$ as precursor gas. The Co content in the nanostructures can reach 95% [3]. Magnetotransport experiments indicate that full metallic behaviour is displayed with relatively low residual resistivity and standard anisotropic magnetoresistance (0.8%) [3]. The coercive field of nanowires with changing aspect ratio has been determined in nanowires with width down to 150 nm by means of Magneto-optical Kerr Effect [4] and the magnetization reversal has been imaged by means of Magnetic Force Microscopy, Scanning Transmission X-ray Microscopy as well as Lorentz Microscopy experiments. Nano-Hall probes have been grown with remarkable minimum detectable magnetic flux. Noticeably, it has been found that the domain-wall propagation field is lower than the domain-wall nucleation field in L-shaped nanowires, with potential applications in magnetic logic, sensing and storage [5]. The spin polarization of these Co nanodeposits has been determined through Andreev-Reflection experiments in ferromagnetic-superconducting nanocontacts and amounts to 35% [6]. Recent results obtained in Fe-based nanostructures by FEBID using $Fe_2(CO)_9$ precursor will be also presented [7].

[1] I. Utke et al., Appl. Phys. Lett. 80 (2002) 4792-4794
[2] M. Takeguchi et al., Nanotechnology 16 (2005) 1321-1325
[3] A. Fernández-Pacheco et al, J. Phys. D: Appl. Phys. 42 (2009) 055005
[4] A. Fernández-Pacheco et al, Nanotechnology 20 (2009) 475704
[5] A. Fernández-Pacheco et al, Appl. Phys. Lett. 94 (2009) 192509
[6] S. Sangiao et al, Solid State Communications, in press
[7] R. Lavrijsen et al, Nanotechnology, submitted

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