HIGHLY ORDERED Co NANOSTRUCTURES ARRAYS

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Different techniques have been used to obtain ordered magnetic nanostructures some of them based on self-organization process. In particular, our group has long experience in the fabrication of arrays of magnetic nanowires embedded in AAM (Anodic Alumina Membrane) [1] In addition, the AAM have been used to translate the ordering degree into different material following replica-antireplica process [2]. In this work, PMMA (poly (methyl methacrylate)) patterned surfaces has been prepared. The nanostructured samples present hexagonal symmetry following the geometry of the Aluminium substrate used as a precursor. Notice that many works have been reported using the PMMA (poly (methyl methacrylate)) as a base material to perform replications for submicrometric and nanometric structures for a variety of applications [3] [4].

The aim of this work has been to use the PMMA polymer as a substrate for the deposition of magnetic materials creating a nanostructured array of magnetic nanoparticles. The morphology of the PMMA surface is controlled by the geometry of the Al precursor. The Al template used for this purpose suffered an anodization process that induces the hexagonal pattern on its surface, after 24h. In particular, hexagonal arrays of PMMA nanostructures with a lattice parameter of 105nm and 180nm have been fabricated. Magnetic thin films have been deposited by sputtering onto the polymer at different angles.

We have studied the magnetic properties of these samples by using Vibrating Sample Magnetometer (VSM) and Magnetic Force Microscope (MFM). Figure 1 shows the topography and the domain structure of two samples with different lattice parameter. Figure 1 (a) and (b) corresponds to the sample with a lattice parameter of 105nm. In this case, the bright and dark magnetic contrast corresponds to the out-of-plane component of every nanoparticle. The dependence of the domain configuration with the previous magnetic history has also been observed by MFM. The samples with higher lattice parameter (180nm) present weak out-of-plane magnetization component, which oscillates in up and down direction as shown in Fig 1(d).

In the VSM we have measured successive hysteresis cycles varying the angle from in plane (0º) to out of plane (90º) and extracted their coercivities from each one (fig. 2). Theses measurements correspond to the polymer replica with 105 nm of lattice parameter recovered with Co, without a protect layer. In this graphic one can note that the coercivity increases respect with the angle.

In this work we have reported a technique to fabricate magnetic nanostructures on polymeric substrates with controllable magnetic behaviour. This procedure can be reproducible many times without damage the Al template used for it, and this suppose a great advantage in economic terms.

Referencias

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[3] Li M. *et al., Appl. Phys. Lett*., 76, 673-675 (2000).

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Figures:

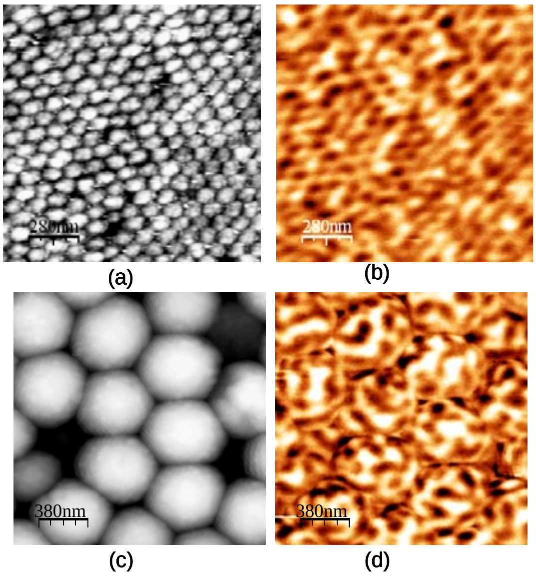

Figure 1: (a) AFM and (b) MFM image of the sample with a lattice parameter of 105nm. The Co thin film thickness is Co 30 nm. (c) AFM and (d) MFM image of the sample with a lattice parameter of 180nm. The Co thin film thickness is Co 30 nm.

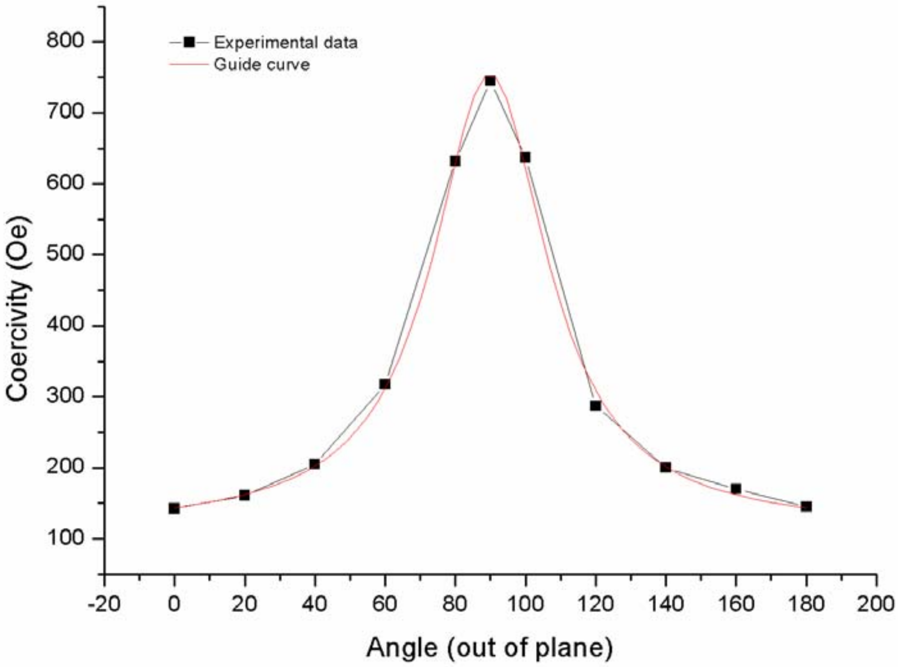

Fig 2 – Coercivity as function of the out of plane angle.