MAGNETO OPTICAL PROPERTIES AND REVERSAL MECHANISMS IN LARGE AREA ARRAYS OF PERPENDICULARLY MAGNETIZED NANODOTS

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The magnetic properties of large area arrays of nanodots fabricated by Laser Interference Lithography (LIL) are investigated, with special emphasis in the understanding of the measured switching field distribution (SFD). Understanding the SFD is very relevant technologically for the optimization of the bit writing process for the use of these materials in the new generation of storage media. In order to do so, it is very important to obtain a very good account of the reversal mechanisms of the continuous film, and then investigate the effect that patterning has on the structure and magnetic properties of the patterned dots.

Two kinds of material systems will be presented: thin film Co Pt multilayers {26x(0.5nmCo/0.5nmPt) and 26x(0.5nmCo/1nmPt)}, both exhibiting a strong anisotropy perpendicular to the film plane, sufficient to render the magnetization perpendicular to the film plane in the demagnetized state. The hysteresis loops, measured magneto optically, for both continuous thin films are markedly different. Doubling the Pt thickness of the CoPt multilayer modifies drastically the magnetic behaviour of the continuous film, obtaining a much sharper reversal. This behaviour can be explained and correlated with results from micromagnetic simulations.

Patterning by LIL allows us to fabricate 300nm and 600 nm periodic arrays of nanodots (typical sizes ~ 100-200nm) over areas well above 1cm^2. The magnetization processes are again measured magneto optically, an example is shown in Fig.2 for 600 nm periodic structures, and correlated with MFM measurements (Fig.1). Both the MFM data, and magneto optical measurements in the diffracted beams will be presented that support the scenario where the magnetization is homogeneous within the dot, i.e., there are no magnetic domain walls during reversal. Patterning seems to improve the SFD in the dot array whose original film had quite a broad reversal (see Fig.2) which might be indicative of a better defined anisotropy (due to the dot shape). This is not so, and it will be shown by comparing different results and simulations for dot arrays fabricated with the two archetypical systems, 26x(0.5nmCo/0.5nmPt) and 26x(0.5nmCo/1nmPt), including the effect that patterning has in the superstructure as seen by X-ray and the Polar Kerr Magneto Optical spectroscopy and possible magnetic interaction effects.

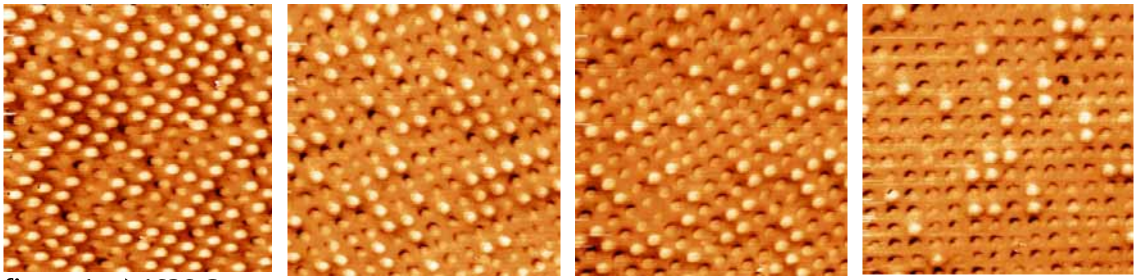

figure 1: a) 1636 Oe **b) 1881 Oe** **c) 2028 Oe** **d) 2235 Oe**

MFM images at different fields showing the magnetization reversal of individual dots. Images are 10x10 μm^2. The film is 26x(0.5nmCo/0.5nmPt) and the fabricated dot array has 600nm period.

H-field (Oe)	Magnetized dots (%)
1636	63.7
1881	40.1
2028	31.6
2235	14.6

Table 1: applied fields and percentage of magnetized dots

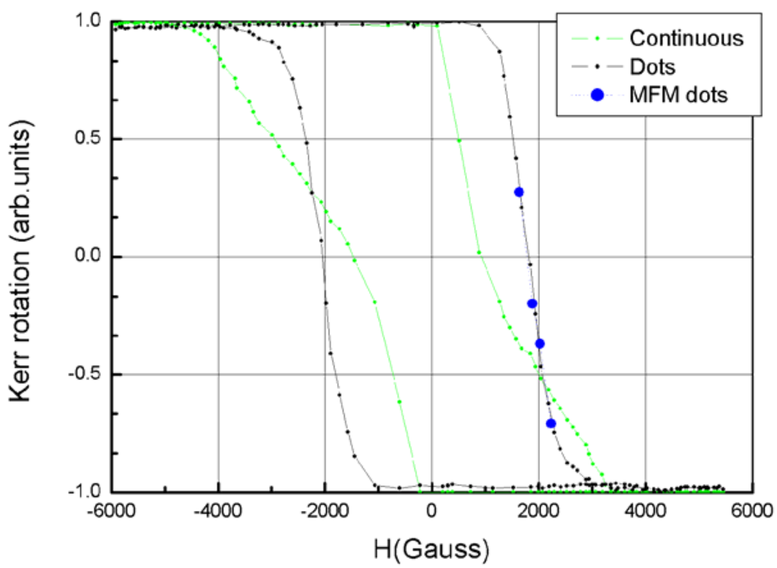

Fig.2 Magneto optical hysteresis loops for the continuous 26x(0.5nmCo/0.5nmPt) film, the patterned 600nm period dots and the magnetization values obtained from the MFM measurements on the dots.

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