Poster

MAGNETIC BEHAVIOUR OF ARRAYS OF NiFe AND CoFe SUB-MICRON ELLIPSES FABRICATED BY INTERFERENCE LITHOGRAPHY

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Large-area periodic nanomagnet arrays of well-defined sub-micron dimensions have recently attracted remarkable attention because of their applications to patterned recording media, magnetic access random memories (MRAMs) [1] and have also provided model systems to study magnetic interactions and switching behaviour. Most patterned submicron magnetoelectronic devices have been fabricated with e-beam lithography [2,3], a serial process unsuitable for large-area patterning. In recent years interference lithography (IL) has developed as a rapid and economical method to generate large-area (~ cm^2) arrays with periods of a few hundreds nanometers [4-6], using grid templates created by two consecutive IL exposures [7]. The main advantage of the IL as a fabrication tool over classical lithography is its relative simplicity and cleanliness. The precise control of the hole dimensions enables the fabrication of nanomagnets with a variety of sizes suitable to study the correlation between magnetic behaviour and particle geometry.

In this work we report on a simple additive process, using an interference system built around a 325 nm He-Cd TEM_{00} laser, a spatial filter and a Lloyd's-mirror. We have fabricated submicron ellipses arrays of $Ni_{80}Fe_{20}$ and $Co_{70}Fe_{30}$ with similar aspect ratio (6.4-6.6) and different geometry (hexagonal vs square) over large areas by interference lithography (IL). The method uses a negative-tone-resist (TSMR-iN027)/anti-reflection-coating (WIDE-8B) bylayer and the coating of the templates is made with a non-conformal ion beam sputtering system, followed by a lift-off with 1-methyl-2-pyrrolidinone at 120º C. The samples have been characterized at room temperature by magneto-optical Kerr effect measurements. It has been found that the magnetic properties of the nanomagnets are governed by shape anisotropy, showing these arrays a two-fold and a four-fold anisotropy induced by the pattern architecture.

References:

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Figures:

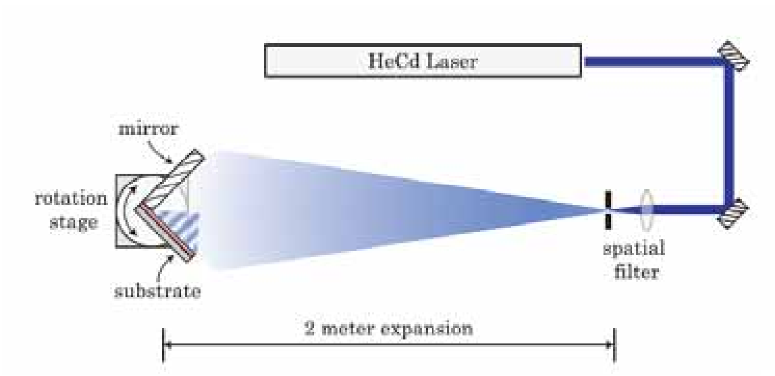

Figure 1. Experimental system.

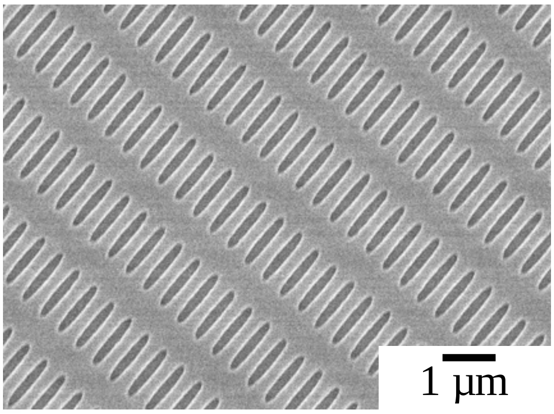

Figure 2. SEM image of the template with hexagonal symmetry.

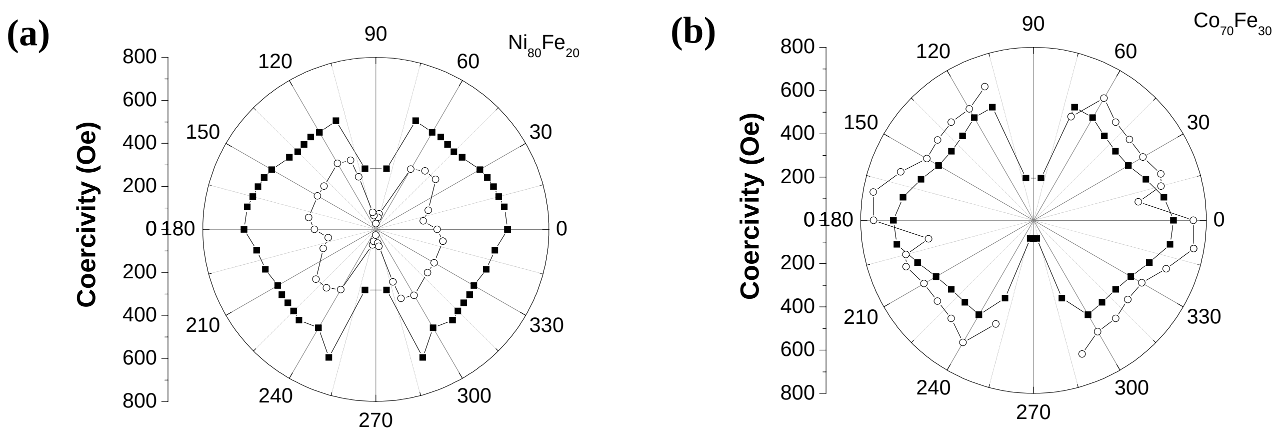

Figure 3. Coercivity angular dependence of $Ni_{80}Fe_{20}$ (a) and $Co_{70}Fe_{30}$ (b). In each sample, the open circles correspond to an square symmetry and the filled squares to an hexagonal symmetry.