

Magnetization reversal process in Permalloy battlements

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Patterned Permalloy (Py) submicrometric stripes were fabricated by interference lithography (IL) and magnetically characterized by vibrating sample magnetometry (VSM) [1, 2]. Photoresist templates generated by IL were used to deposit a Ti hard mask on a 100 nm thick Py layer. Then Ar⁺ ion etching transferred the Ti mask onto the Py layer (Figure 1). Line periodicity was set at 1.9 microns with an inter stripe distance of 700 nm. Four Py etching depths ($d_{Py} = 10, 15, 25$ and 50 nm) were determined by atomic force microscopy (AFM) imaging (Figure 2).

Magnetic hysteresis loops for different angles between the external field and the stripe axis were obtained at room temperature by VSM. Samples with low depth profile ($d_{Py} = 10$ and 15 nm) show a progressive evolution from the easy axis to the hard axis of the ferromagnet. However deeper etching ($d_{Py} = 25$ nm) reveals inverted hysteresis loops at specific angle conditions. The decreasing branch of the hysteresis loop crosses the magnetic field axis at positive values whilst the increasing branch shows a negative coercivity. For the deepest etching ($d_{Py} = 50$ nm) two phases were observed in the hysteresis loops revealing a different approach to saturation for the stripes and the continuous part.

Work supported by Basque Country Government grant Nanoiker11 and MICINN grants MAT2010-20798, FIS2008-06249.

References

[1] Q. Xie, M.H.Hong, H.L. Tan, G.X. Chen, L.P. Shi, T.C. Chong, J. Alloy Compd. **449** (2008) 261.

[2] S. Moralejo, F.J. Castaño, C. Redondo, R. Ji, K. Nielsch, C.A. Ross, F. Castaño, J. Magn. Magn. Mater. **316** (2007) e44.

Figures

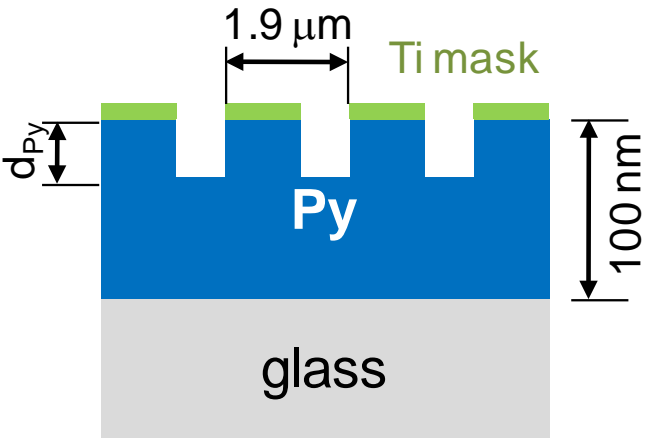


Figure 1. Cross section sketch of patterned samples

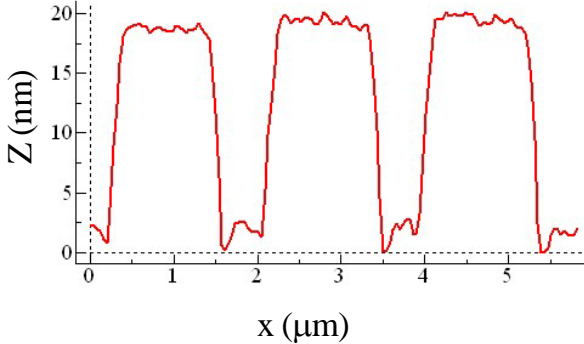
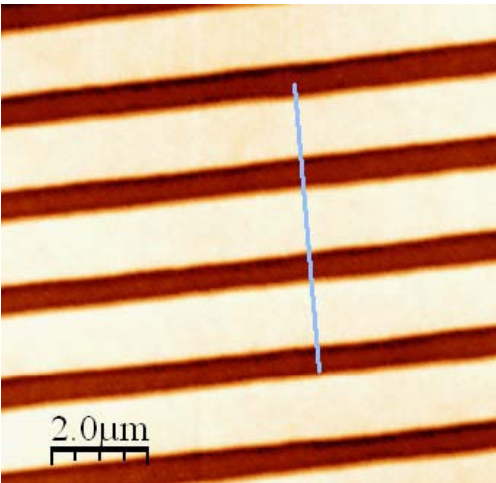


Figure 2. AFM top view image (upper panel) and height profile through the gray line (lower panel) of a patterned sample