He^+ ion bombardment induced effects on magnetic properties of Ni-Fe/Au/Co/Au films

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It was recently demonstrated that the magnetic properties of magnetic layered structures can be locally modified in a controlled manner by ion bombardment. We show that magnetic patterning induced by ion bombardment is possible in NiFe/Au/Co/Au thin film systems. It is known that such films present the perpendicular and the easy plane magnetic anisotropy for Co and NiFe layers, respectively [1]. To check the influence of ion bombardment on the perpendicular anisotropy of the Co layer and on interlayer coupling between ferromagnetic layers, two different samples were prepared: (A) $Ni_{80}Fe_{20}$-2nm/Au-3nm/Co-wedge/Au-3nm and (B) $Ni_{80}Fe_{20}$-2nm/Au-wedge/Co-0.6nm/Au-3nm. The samples were bombarded by He^+ (10 keV) ions with constant doses (varied in the range $10^{13} \le D \le 10^{15}$ He^+/cm^2) limited to stripes (1 mm in width) located along the thickness gradient of the Co or Au layers, for sample (A) or (B), respectively. The magneto-optical studies based on the polar Kerr effect was used to determine the modification of the magnetic properties caused by the ion bombardment for a range of thickness of the Co and Au.

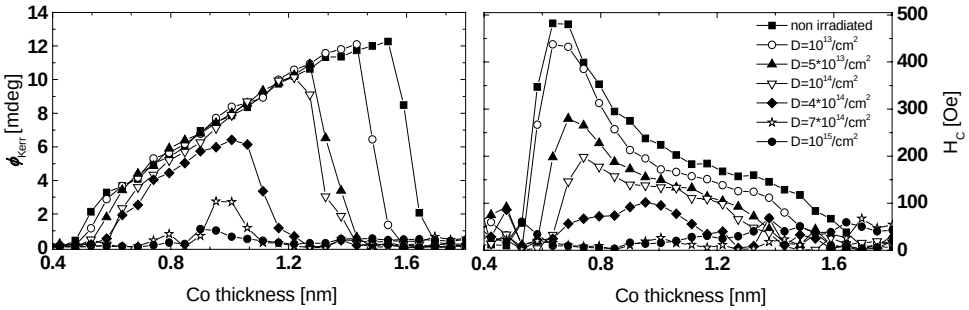

Fig. 1. The angle of Kerr rotation Φ_{Kerr} at remanence (a) and the coercive field H_c (b) as a function of Co layer thickness and ion dose D determined for sample (A) from magnetooptical measurements in polar configuration.

The following changes in magnetic properties were observed with increasing D: (i) the decrease of Co thickness range corresponding to the perpendicular anisotropy (Fig. 1a), (ii) the decrease of coercive field (H_c) (Fig. 1b), (iii) the increase of ferromagnetic coupling between ferromagnetic layers. The demonstrated ability of tailoring both the perpendicular anisotropy and the interlayer coupling in investigated films may result in a better control of magnetic patterning *via* ion bombardment.

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