Poster

Effect of nitrogen irradiation on Co/Pd multilayers with perpendicular anisotropy.

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Developing new media for magnetic storage exhibiting perpendicular anisotropy, instead of the current longitudinal media, is a matter of the utmost importance [1]. The final goal is to produce a nanopatterned media able to overcome the superparamagnetic limit (information is lost due to thermal fluctuations) at room temperature. In this work, it is shown that nitrogen irradiation of thin films with perpendicular anisotropy induces strain and a modification of the magnetic properties without reduction of the film thickness. Therefore, such a technique can be used to induce a magnetic patterning that preserves flatness of the magnetic medium surface [2].

Co/Pd multilayered films 17.4 nm thick with a strong perpendicular anisotropy have been prepared by means of a Circulus triatron sputtering deposition system. The samples have been irradiated after growth at different energies (20-30 KeV) and doses (10^{14}-$2{\cdot}10^{16}$ ions/cm^2). According to simulations, those values are appropriate to implant nitrogen at the precise depth of the Co/Pd multilayers.

Structural modifications have been studied by X-ray diffraction (XRD) and Atomic Force Microscopy (AFM). Modifications of the layer thickness are studied by X-ray Reflectometry (XRR). Implantation effects on magnetic characteristics have been analyzed by means of extraordinary Hall effect, magneto-optical Kerr effect and Magnetic Force Microscopy (MFM).

Fig. (a) shows the evolution of the XRD diffraction pattern: an increase of the lattice parameter upon irradiation can be deduced. Furthermore, from the hysteresis loops displayed in Fig. (b) it can be inferred a strong effect on the perpendicular anisotropy. Figures (c)-(e) show MFM images where it can be observed how the size of the magnetic domains decreases with irradiation. Finally, Fig. (f) is the AFM image of a thin film with a lithographic mask aimed to study the effect of localized implantation on both shape and location of magnetic domains.

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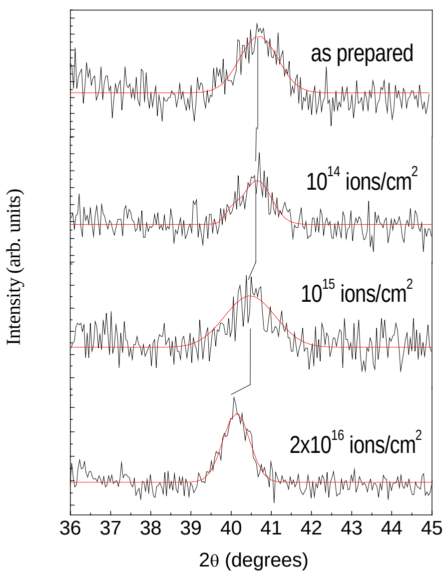
References:

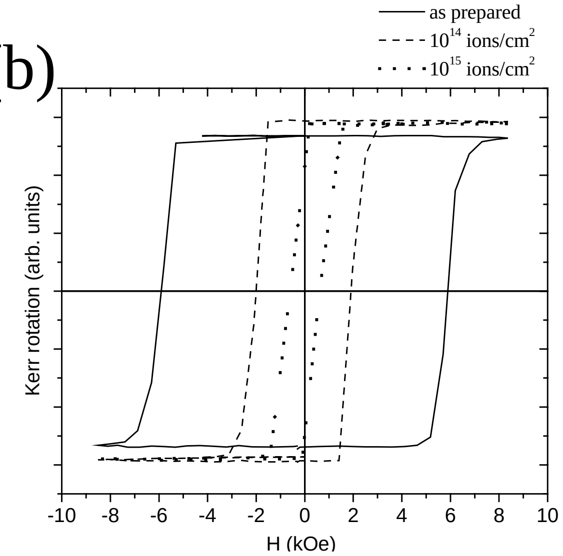
[1] S. P. Li et al., Nature **415** (2002) 601.
[2] C. Chappert et al., Science **280** (1998) 1919.

Figures:

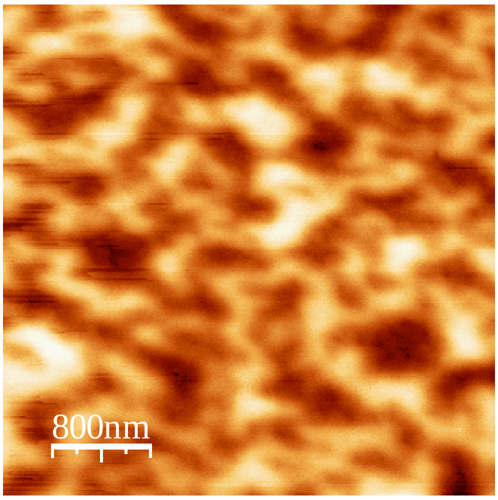
(a)



(b)

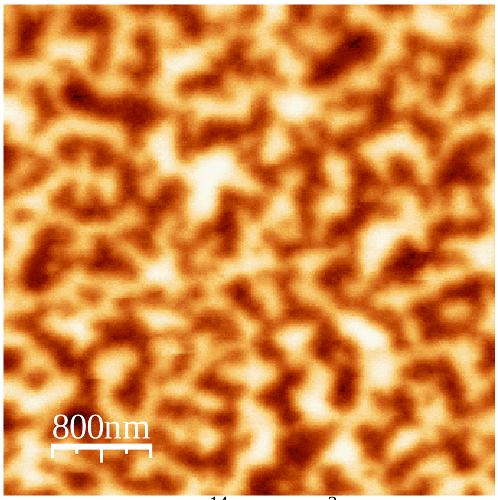


(c)



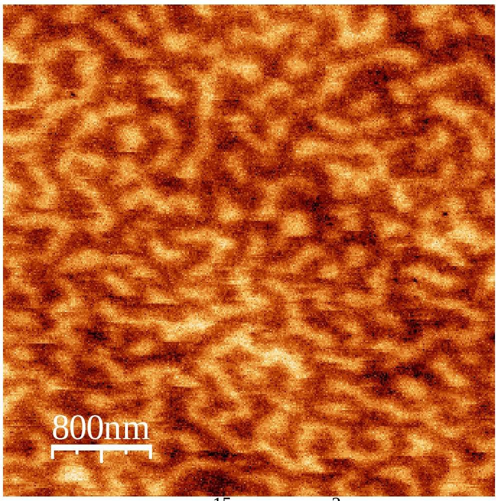
MFM, as prepared

(d)



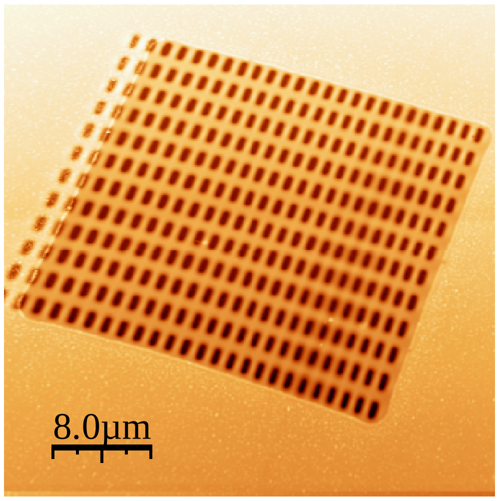
MFM, 10^{14} ions/cm^2

(e)



MFM, 10^{15} ions/cm^2

(f)



AFM of the patterned area