Control of magnetic anisotropy by Ion-Beam-Mixing method under external magnetic field

J.-H. Yune, H.B. Kim*, C.N. Whang

Department of Physics, Yonsei University, 134Shinchon-dong, Sudaemun-ku, Seoul, Korea

*Corresponding author: e-mail: hyobae@yonsei.ac.kr

Researches of increasing magnetic recoding density have performed steadily, and offered various ways. In this study, we tried increasing recoding density and minimizing interaction among bit cells by controlling magnetic anisotropy with using Ion Beam Mixing(IBM) technique. By applying magnetic field horizontally to the sample, we can control the direction of magnetic anisotropy. It is shown that magnetic anisotropy was created to the direction of the external applied magnetic field.

The [Pt(45 Å)/Co(35 Å)]8/Pt(50 Å)/Si(100) multilayered films were grown by e-beam evaporation. Ion beam mixing was perfoemed by Ar+ ions with an energy of 80keV. Doses were varied from 1×10^{14} /cm^2 to 5×10^{16} /cm^2 and applied magnetic field was approximately 2900 Gauss. The magnetic remanences and coercivities were measured by MOKE, and X-Ray Diffraction(XRD) for the sample phase variation.

The rates of remanence at easy axis are almost same with the increase of the dose, but the change of the semi-easy axis is notable(Figure 1). And the semi-easy axis(has behaviour of the easy axis at the hard axis) remained at low dosage. In case of coercivities, it also shows same tendency. This may because of the result of existing $CoPt_3$ phase. As increasing dosage of ions, the amount of Pt(111) decreases, CoPt(111) increases at the same. The semi-easy axis appeared at low doses ($\leq 1\times10^{15}$ /cm^2) in remanences and coercivities; this was shown in XRD data that it was created by $CoPt_3$ phase. At higher dosage ($\geq 3\times10^{15}$ /cm^2), the semi-easy axis is disappeared, and the sample has a biaxial anisotropy completely.

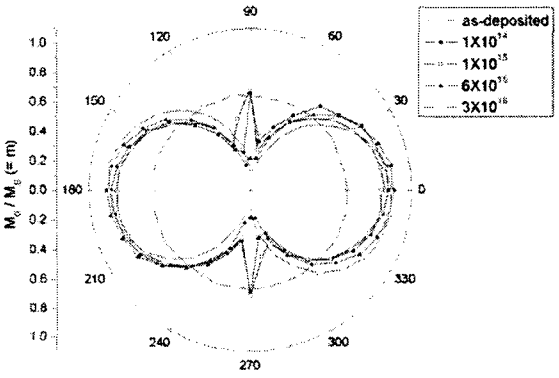

Figure 1. The remanent magnetization ratios of the ion beam mixed samples with various dosage to azimuthal angle.

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