## EFFECT OF Cr UNDERLAYER ON OBLIQUELY SPUTTERED Co ON PET SUBSTRATE

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Oblique deposition of magnetic films is often used for magnetic recording tape. The well-known materials are Co and CoNi deposited by reactive evaporation with $O_2$ directly on polymer substrate [1]. However, for the next generation of high density media the desirable magnetic properties have not been achieved by this method. In our previous work, oblique sputtering of Co on PET substrate resulted in a relative low $H_c$, which is mainly originated from shape anisotropy, as the films only consist of *fcc* Co phase [2,3]. In this paper, properties of *sputtered* Co on Cr underlayer at incident angle of 70° will be reported. Microstructure and magnetic analyses of the Co layer reveal a strong influence of the Cr underlayer. With Cr underlayer the Co films consist mainly of *hcp* crystalline structure. As expected this development of *hcp* Co phase gives rise to an abrupt change in magnetic properties. The in-plane coercivity increases from 20 kA/m to over 200 kA/m when the thickness of Cr layer varies from 0 to 180nm with a constant thickness (16 nm) of the Co layer. The film microstructure has been investigated by TEM and AFM. As a result of oblique incident condition, titled columns have been observed in the case of thick Co and Cr layers as shown in Fig.2. Moreover, the large magnetocrystalline anisotropy of *hcp* phase prevails over the shape anisotropy of the columns. Although this results in a preferential orientation of easy axis in the transverse direction (Fig.3), we can still control the easy axis orientation in the longitudinal direction of the tape by changing the sputtering geometry. Detailed results of our experiments will be reported elsewhere.

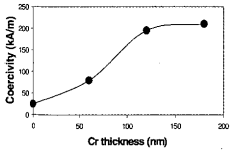


Fig. 1. Cr thickness dependence of $H_c$ for Co sputtered films of 16nm thick.

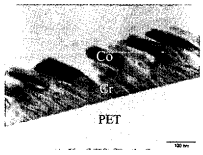


Fig. 2. TEM cross-section of 120nm Co grown on 120nm Cr underlayer sputtered film.

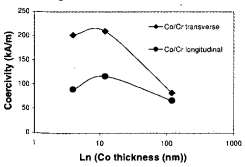


Fig. 3. $H_c$ as a function of Co thickness (4-120nm) in the transverse and longitudinal directions (with respect to the incident plane). Cr thickness is 120nm for all sputtered films.

References:

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[2] A. Lisfi and J.C. Lodder, Phys. Rev. B **63**, 174441 (2001)
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## Recording Characteristics of Thin Metal Evaporated Media in a Helical-Scan Tape System With a Spin-Valve Head

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A high recording density using a spin-valve head with Co-CoO metal evaporated (ME) tapes, with low noise due to the oxygen input, has been reported [1,2]. We report here the recording characteristics of ME tapes with various Mr (remanent magnetization) t (thickness) in order to determine whether the tapes are suitable for use with the spin-valve head. We confirmed high recording density in a helical-scan tape drive system.

A series of Co-CoO ME tapes were prepared by varying Mrt from 14 to 4.5 mA by controlling the oxygen flow rate. The thickness of their magnetic layer was 33nm. The media noise and carrier-to-media noise ($C/N_{media}$) ratio of the tapes at a wavelength of 0.4μm are plotted in Fig.1. The track width and the shield-to-shield distance of the spin-valve head were 0.8μm and 0.18μm, respectively. As shown in Fig.1, the media noise level was reduced with the decrease in Mrt, whereas the $C/N_{media}$ ratio was maximized at around 10mA. Based on these results, we determined the optimum range of Mrt in Co-CoO ME tapes and also investigated the effect of the combination of Mr and t in Mrt on the recording characteristics. Figure 2 shows the envelope of the reproduced signal output at a liner density of 106kFRPI in the helical-scan tape system using a spin-valve head with a track width of 0.8μm.

[1] T. Ozue *et al*, Digests of TMRC2001, Minneapolis E3(2001)
[2] S. Onodera *et al*, Digests of TMRC1999, San Diego F1(1999)

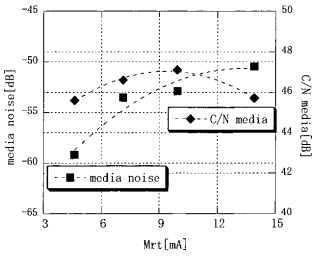


Fig.1 Mrt dependence of media noise and $C/N_{media}$ at wavelength of 0.4μm

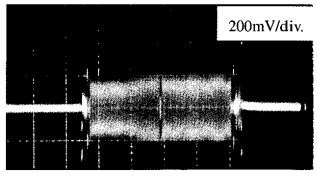


Fig.2 Envelope of output of spin-valve head in the helical-scan tape drive system

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