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High Magnetization Exchange Coupled TM-TbCo/RE-TbCo Double Layer

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High saturation magnetization (Ms) media are desired to yield large flux density for high resolution giant magnetoresistive head (GMR) readout in Heat Assisted Magnetic Recording (HAMR). To ensure adequate stability of small size domains, the media for HAMR should possess enough coercivity (Hc). In general, the single layer used for conventional magneto-optical (MO) recording films can not satisfy these requirements since net Ms of the films are small. In this work, we study of interface wall energy and the behaviour of the magnetization of each layer in exchange coupled doubled-layered (ECDL) films with different RE-rich thickness to increase the Ms and Hc value for GMR head readout.

Figure 1 shows the M-H loop of the $Tb_{17}Co_{83}$ and $Tb_{30}Co_{70}$ films at room temperature. The Mr values of two single layer $Tb_{17}Co_{83}$ (90 nm) and $Tb_{30}Co_{70}$ (90 nm) films are approximately 200 and 160 emu/cm^3, respectively. These small Mr values make detection by GMR head difficult. Therefore the $Tb_{17}Co_{83}/Tb_{30}Co_{70}$ ECDL films with different $Tb_{30}Co_{70}$ thickness (20, 50, 90 nm) are made in an attempt to increase the Ms value by exchange coupling. Figure 2 shows the M-H loops of the $Tb_{17}Co_{83}/Tb_{30}Co_{70}$ films with different $Tb_{30}Co_{70}$ film thickness. As the thickness of $Tb_{30}Co_{70}$ film decrease from 90 to 50 nm, the perpendicular coercivity ($Hc_{\perp}$) increasesfrom 1.8 to 4 kOe. The enhanced coercivity of ECDL films is due to the formation of domain wall at the interface of the ECDL films. The interface wall energy of 50 nm $Tb_{30}Co_{70}$ ECDL film is about 16 erg/cm^2 which is larger than that of 90 nm $Tb_{30}Co_{70}$ ECDL film (9.7 erg/cm^2), so, the $Hc_{\perp}$ value of 50 nm $Tb_{30}Co_{70}$ ECDL film is higher than that of 90 nm $Tb_{30}Co_{70}$ ECDL film. On the other hand, as the $Tb_{30}Co_{70}$ decreases from 90 to 20 nm, the Ms value increases from 220 to 430 emu/cm^3. Due to the larger magnetic moment of Co than that of Tb at room temperature, the resulting Ms value increases with increasing Co content.[1]

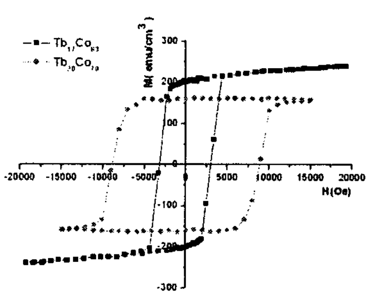

Fig. 1. M-H loop of the $Tb_{30}Co_{70}$ and $Tb_{17}Co_{83}$ film.

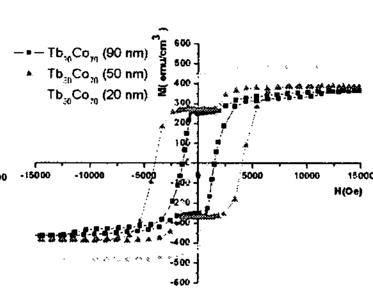

Fig. 2. M-H loop of the $Tb_{17}Co_{83}/Tb_{30}Co_{70}$ filmwith different $Tb_{30}Co_{70}$ thickness.

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TC06

Effect of Sm Content on the Magnetic Properties of the SmCo thin Film

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A high-density recordingmedium is an essential requirement for the various applications. In order to sustain such demand, magnetic films with high coercivity, high squareness and large magnetic anisotropy are required. SmCo alloy film is one of the candidates.[1] In this work, the relationship between the magnetic properties and Sm content in SmCo film are investigated.

Sm_xCo_{100-x}(50nm) films (x = 10.9~37.4) were deposited on nature oxidized Si wafer at room temperature by dc co-sputtering of Sm and Co targets and sandwiched with SiN_x(20nm) to prevent oxidation.

Fig. 1 shows the variations among saturation magnetization Ms, remanence Mr, and Sm content of the SmCo film. The film thickness is 50 nm. The Ms value decreases with increasing Sm content is due to the difference between anti-parallel magnetic moment of Sm and Co is decreased as Sm content is increased.[2] It can be seen that all SmCo films have in-plane anisotropy.

The maximum in-plane coercivity occurs at Sm = 24.8 at%. This is oweing to it contains more $SmCo_5$ phase which has large magnetic crystalline anisotropy, as shown in Fig. 2.

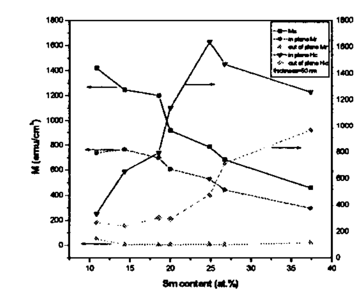

Fig. 1. Variations of the in-plane Mr, out-of-plane Mr, in-plane Hc, out-of-plane Hc, Ms, with Sm content in the SmCo films.

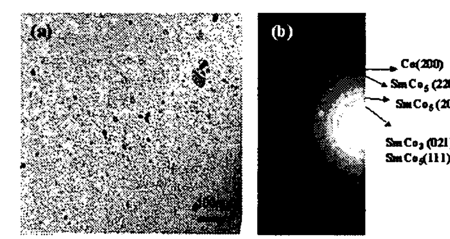

Fig. 2. TEM images of the $Sm_{24.8}Co_{75.2}$ film (a) bright-field image (b) electron diffraction pattern.

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