C－2－5 Stability of Small Bits Written in Amorphous GdCo Thin Films

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The amorphous GdCo thin films are a promising bit storage material for the thermomagnetic writing and magnetooptic reading application. However, it has been reported that the instability of small bits written in them is the major drawback of this material.[1] Experiments on the bit stability were performed. As a result, a simple, but effective, procedure for preparing stable films has been established.

Amorphous GdCo films with 0.2 μm thick were prepared onto glass substrates by means of a diode rf sputtering technique. A 3-cm-diam disk of GdCo alloy (73 at.% Co) was used for a target which had been made by an arc-melting method from the Gd-Co mixtures. Experimental results for four typical films will be presented.

The sputtering conditions and the stability of written bits are shown in Table 1. The bits were written at the point where the room temperature was just above the compensation temperature by means of thermomagnetic effect. A laser beam pulse of 10 μs in time duration and about 2 μm in diameter was impinged onto the air-film interface and magnetic bias field of +90 Oe was applied in order to assist the thermomagnetic writing. Bits of 1 μm in diameter were written by controlling the laser beam power. A critical field Ho in Table 1 shows the value of the magnitude of the external field at which the written bits collapsed when reducing it gradually from +90 Oe after the bits had been written.

Since the concentration ratio of Gd and Co can be varied by changing the sputtering current, it is expected that films (A) and (B) are homogeneous, while films (C) and (D) are inhomogeneous along the film thickness. This could be confirmed by the magneto-optical hysteresis loops[2] (Fig.1) and the temperature dependences of coercive forces (Hc) and the reciprocal of coercive forces (Fig.2).

It is concluded that the bits written in the amorphous GdCo thin films which are inhomogeneous along the film thickness are stable.

The laser beam power which was necessary to write a bit was almost equal for the four films, and there was no difference in the readout signal level of polar Kerr effect. Thus any deterioration for the thermomagnetic and magnetooptic application could not be found in these films.

(References)

1) B.R.Brown, Appl.Opt. 13, 761 (1974).

2) S. Esho, Jpn.J.Appl.Phys. 15-S, 93 (1976).

Table 1 Sputtering conditions and stability of 1-μm-diam bits under changes of external magnetic field and temperature

film	sputtering current	stability	
		under changes of external magnetic field	under changes of temperature
(A)	constant	unstable (Ho=+40 Oe)	unstable (R.T.±10°C)
(B)	constant	unstable (*)	unstable (R.T.±10°C)
(C)	changing continuously 118 to 113 mA	stable (Ho=-280 Oe)	stable (-40°C~+60°C)
(D)	piling two layers 108 mA: 0.1 μm 123 mA: 0.1 μm	stable (Ho<-350 Oe)	stable (-40°C~+60°C)

(*) Small bits below 3 μm in diameter could not be written in this film.

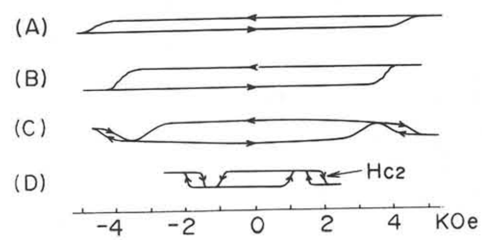

Fig.1. Typical hysteresis loops of films (A), (B), (C), and (D).

Fig.2. Temperature dependence of coercive forces (Hc) and the reciprocal of coercive forces (Hc^{-1}) of films (a) (B) and (b) (D).