NOISE CHARACTERISTICS OF Co-γFe_2O_3 PERPENDICULAR MAGNETIC RECORDING HARD DISK

Setsuo YAMAMOTO, Takayuki ANDOU, Hiroki KURISU, Mitsuru MATSUURA, Takanori DOI* and Kohsaku TAMARI*

Faculty of Engineering, Yamaguchi University, Tokiwadai, Ube 755, Japan

* R & D Division, Toda Kogyo Corporation, Meijishinkai, Ohtake 739-06, Japan

Introduction

We have already proposed a new fabrication method of Co-γFe_2O_3 perpendicular magnetic recording thin film hard disks [1,2]. The Co-γFe_2O_3 hard disks exhibit superior high density recording performance and hardness tolerable for contact recording without media overcoat [3,4]. In this study, noise characteristics of the Co-γFe_2O_3 disk was investigated.

Experimental

The Co-γFe_2O_3 disks were prepared by following process: At first, a NiO underlayer, which had ⟨100⟩ orientation, with NaCl-like structure was deposited onto a glass substrate by reactive rf sputtering. Succedingly, a CoO-Fe_3O_4 single layer was reactive sputtered on a NiO underlayer using a CoFe alloy target at a substrate temperature from 200 to 280°C. Finally, annealing was performed at 260-350°C for 0.5-2 hours to obtain Co-γFe_2O_3 layer which has large perpendicular magnetic anisotropy ($K_u \sim 6\times10^5$ erg/cm^2) and high perpendicular coercivity of about 2500 Oe .

Noise characteristics of the Co-γFe_2O_3 disks and several longitudinal disks whose specification was listed in Table 1 were measured using a MIG-type ring head with a gap length of about 0.2 μm in contact recording. The head-disk relative speed was 3m/s. Medium noise, $N_{m,rms}$, was estimated by subtracting the sum of head impedance noise and amplifier noise from the measured noise in the frequency region from 0 to 8MHz.

Results and Discussion

When the Co-γFe_2O_3 layer thickness was varied from 600 to 1300 A, maximum SN ratio was obtained at 900A. Reverse DC erase noise measurement was performed [5]. The longitudinal particulate thinly coated flexible disk (Zip) shows minimum medium noise at intermediate reverse DC erase magneto-motive-force. On the contrary, longitudinal thin film hard disk shows the maximum medium noise at MMF of $0.06AT_{p\text{-}p}$. For the Co-γFe_2O_3 perpendicular disk, the maximum medium noise was measured at reverse DC erase MMF of $0.1AT_{p\text{-}p}$. It was concluded that the Co-γFe_2O_3 perpendicular disk shows a thin film media like noise behavior.

Noise spectra when 84.7kFRPI signal was recorded are shown in figure 1. The Co-γFe_2O_3 perpendicular disk has largest $B_r\delta$ value except for the Zip disk. However, the medium noise level of the Co-γFe_2O_3 perpendicular disk is as low as longitudinal hard disk designed for MR head use.

Figure 2 shows the recording density dependence of SN ratio ($S_{p\text{-}p}/N_{m,rms}$). The Co-

1. Name: Setsuo YAMAMOTO
   Company Name: Faculty of Engineering, Yamaguchi University
   Address: Tokiwadai,Ube 755, Japan
   Telephone: int. access code 81-(836)35-9111 ext.9486
   FAX: int. access code 81-(836)35-9486
   Email: yamamoto@po.cc.yamaguchi-u.ac.jp
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γFe_2O_3 perpendicular disk showed the highest SN ratio than any other longitudinal recording disks now on the market at high densities over 40kFRPI.

Conclusion

It was proved that the Co-γFe_2O_3 perpendicular magnetic disks have remarkable capabilities for ultra-high density recording media, i.e. hardness tolerable for contact recording without overcoat, high density recording performance, and very low noise characteristics.

References

[1] T.Doi and K.Tamari, J. Appl. Phys., 79(8), 4887 (1996).
[2] T.Doi and K.Tamari, J. Magn. Soc. Jpn, 20(2), 73 (1996).
[3] S.Yamamoto, T.Andou, H.Kurisu, M.Matsuura, T.Doi and K.Tamari, J. Appl. Phys., 79(8), 4884 (1996).
[4] S.Yamamoto, T.Andou, H.Kurisu, M.Matsuura, T.Doi and K.Tamari, J. Magn. Soc. Jpn, 20(2), 137 (1996).
[5] H.Aoi, M.Saitoh, N.Nishiyama, R.Tsuchiya and T.Tamura, IEEE Trans. Magn., 22, 895 (1996).

Table 1 Specification of tested magnetic recording disks

Recording media	Hc [Oe]	Br·δ [G·μm]
Co-γFe_2O_3 HD	2500 (⊥)	367 (δ=900Å)
For inductive head used HD	1756 (//)	289
For MR head used HD	1775 (//)	119
Particulate FD (Zip)	1565 (//)	540

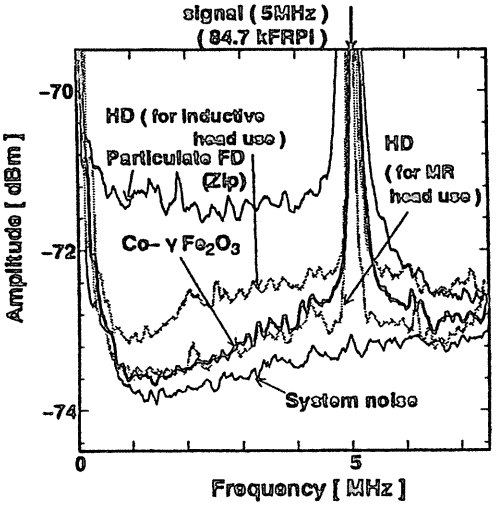

Fig.1 Noise spectra for various recording disks. 84.7kFRPI (5MHz) signal was recorded.

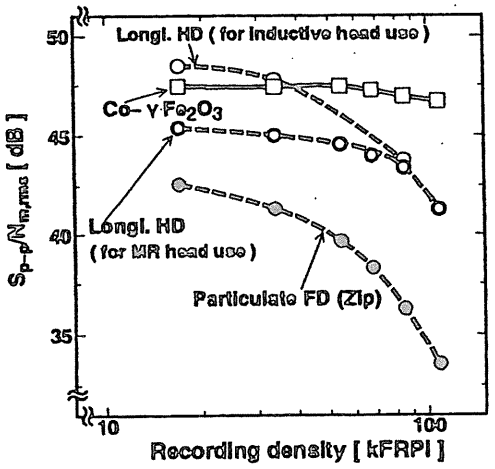

Fig.2 Recording densisty dependence of signal to medium noise ratio.