AR04

Influence of External Magnetic Field on the Magnetization Structure of Perpendicular Magnetic Recording Media

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Introduction Stability of recorded information under an influence of external magnetic field is an important factor in developing perpendicular recording media with high reliability, and has been investigated by using computer simulation, spin-stands, and magnetic force microscopes (MFMs) [1,2]. In the present study, variations of recorded magnetization structure of a high density perpendicular recording medium are investigated by using a high-resolution MFM to study the recorded bit shape change when exposed to external magnetic field. A useful technique is developed to observe the magnetization structure of a same sample area even after repeated ex-situ magnetic field treatments.

Experimental Procedure A commercial perpendicular HDD with 185 Gb/in^2 areal density and Hc = 5.2 kOe was used as the sample. The HDD disk was cut into small pieces to observe the magnetization structure under an MFM. A magnetic field perpendicular or parallel to the medium surface was applied by using an electro-magnet. A same sample area was repeatedly observed with the MFM by referring a special scratch mark formed on the sample.

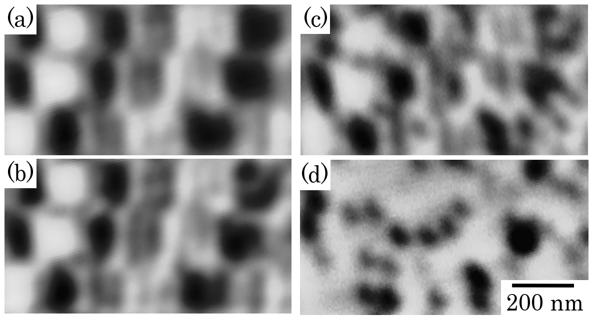

Fig. 1. MFM image variation of PMR medium after applying perpendicular magnetic fields of (a) 0, (b) 3.5, (c) 4.5, and (d) 6 kOe.

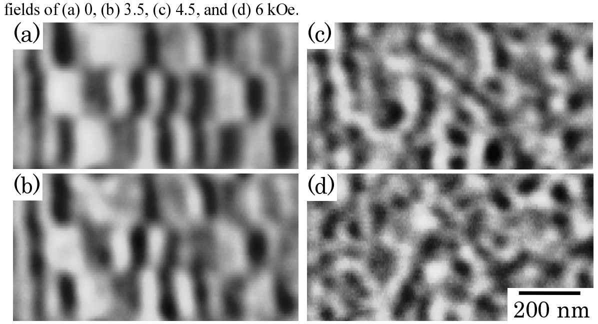

Fig. 2 MFM image variation of PMR medium after applying longitudinal magnetic fields in cross track direction of (a) 0, (b) 4, (c) 4.6, and (d) 6 kOe.

Results Figs. 1 and 2 respectively indicate the magnetization structure variations when perpendicular or longitudinal external magnetic field was applied to PMR medium samples. The magnetic field strength above which the bit shape starts to change was similar at about 3.5 ~ 4.0 kOe for both magnetic field directions. The threshold magnetic field is far lower than the medium coercivity of 5.2 kOe. When perpendicular external magnetic field was increased greater than the threshold value, the recorded bit shape started to change in different manners which can be classified into four types. An appearance of reversed contrast region within a bit is one of the types. On the contrary when the field direction was longitudinal, cross-linking of recorded bits between the neighboring tracks started to be observed. It is shown that the variation of bit shape is quite different depending on the application direction of external magnetic field. The details of bit shape variation will be presented at the conference.

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REFERENCES
[1] H. Takahoshi et al., J. Magn. Soc. Jpn., 26, 286 (2006). [2]Y. Yasui et al., J. Magn. Soc. Jpn., 31, 312 (2007).

AR05

Determination of the Object Size and Position in Magnetic Inductance Tomography System

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Tomography system is one of technology to measure an object with non contact and non destructive way. In the system, the magnetic field is applied from the outside coils and the variation of magnetic field caused by sensing object could be measured in the sensors surrounded by the tube[1]. The changes of the magnetic field due to the object could be measured and collected in PC, from which the shape of object could be determined. The determination of the shape from the measured signals is a typical example of the inverse problem[2].

In this paper, the detection scheme of the magnetic inductance tomography (MIDT) system as in Fig. 1 is developed. The variation of magnetic field in this paper is computed by nonlinear finite element method and verified with experimental measurement. Sensing signals of 24 Hall sensors are collected and from the sensing signals as in Fig. 2, the disturbances of the magnetic field by the presence of the sensing object are obtained. The position of a sensing object could be determined by the patterns of sensing signals, and the size of the sensing object could be determined by total amount of sensing signals. The computed results agreed well with experimental measurement.

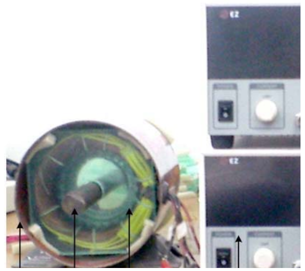

Fig. 1. Equipment of the Magnetic Inductance Tomography System.

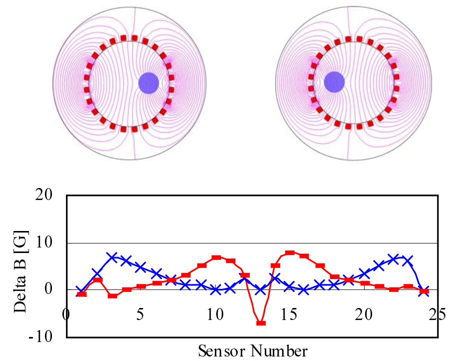

Fig. 2. Variations of magnetic field w.r.t. object position. (x: Right, -: Left)

REFERENCES
[1] D.S.Kim and G.S.Park, "Development of a Magnetic Inductance Tomography System", IEEE Trans. Magn., vol. 41, no. 5, pp. 1932-1935, May 2005.
[2] Mufluler, L.T. & Y.Z. Ider. "Measuring AC magnetic field distribution using MRI". In Proc. 18th Int. Conf. IEEE Eng. Med. Biol. Soc, (Amsterdam). 1996.