TC01

Micromagnetic Study of Magnetization Reversal in Patterned Perpendicular Media

Ching-Ming Lee[1], L. X. Ye[1], J. M. Lee[2], and Te-ho Wu*[1]

[1] Taiwan SPIN Research Center, National Yunlin University of Science and Technology, 123 University Road, Section 3, Douliou, 64002, Yunlin Taiwan, R.O.C.

[2] Graduate school of Engineering Science & Technology, National Yunlin University of Science and Technology, 123 University Road, Section 3, Douliou, 64002, Yunlin Taiwan, R.O.C.

*Corresponding author: wuth@yuntech.edu.tw, Phone: +886-5-5312120, Fax: +886-5-5312174

The rare-earth transition-metal (RE-TM) alloys, because of its large perpendicular anisotropy, can be applied as a media for data storage. To avoid bit distortion andreduce the media noise, instead of continuous RE-TM films, patterned films with artificial hole array were used to stabilize written domains with fixed shape and free from jaggedness [1]. In previous works [1], we observed that the hole depths can affectthe coercivity variation and domain structure substantially. In the present study, we use micromagnetic simulations to investigate the influence of geometry factors, such as hole radius, hole depth, and inter-hole distance. The geometric model used for simulation was shown in Fig. 1(a): an 1 μm×1 μm×50 nm square film with a circle hole of diameter 500 nm on it and the hole depths ranged from 0 nm to 30 nm. Among several micromagnetic solvers, the parallel finite-element package *magpar* [2] was adopted because it is more suitable for three-dimensional structures. From the simulation results, we found that the coercivities in the land and the hole region are the same for shallower hole cases, however, for deeper holes (hole depth ≥20 nm), the coercivity in the hole region is larger than in the land region. Fig. 1(b)shows the distribution of perpendicular component of magnetization (M_z) after the reversal of the land region (hole depth=24nm). Our results are consistent with the previous experimental observations by Kerr microscope for $Dy_{20}(FeCO)_{80}$ patterned thin films.

(a) (b)

Fig. 1. (a) The geometric model used for simulation of patterned perpendicular recording media.(b) Magnetization in the land region has smaller coercivity and reverses first (blue color).

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TC02

Interaction Field Strength and Spectrum of Anisotropic RE-TM Magnetic thin Films.

Lin-Xiu Ye[1], Jia-Mou Lee[1,2], and Te-ho Wu*[1,2]

[1] Taiwan SPIN Research Center, Nat'l Yunlin Univ. of Science and Technology, 123 University Road, Section 3, Douliou, Yunlin 64002, Taiwan

[2] Graduate school of Engineering Science & Technology, Nat'l Yunlin Univ. of Science and Technology, 123 University Road, Section 3, Douliou, Yunlin 64002, Taiwan

*Corresponding author: wuth@yuntech.edu.tw, Phone: +886 5 5342601 ext.3166, Fax: +886-5-5312174

In order to further understand the interaction strength of microhysteresis loops, we analyzed the magnetic domain reversal behaviors and obtained interaction strength from the Gaussian Preisach function. We obtained the interaction field strength and spectrum [1-2] from the measurements of microhysteresis loops [4] for a series of amorphous $Dyx(FeCo)_{1-x}$ magnetic thin films. The coercivity distribution and interaction field spectrum were obtained from 90,000 microhysteresis loops and acquired susceptibility distribution. The interaction field spectrum of $Dy_{19.59}(FeCo)$ and $Dy_{33.67}(FeCo)$ are shown in Fig. 1(a) and 1(b). The color bar on the right side of Fig.1 indicates the susceptibility strength. In Fig. 1(a), the coercivity is within the range of 1270 to 1320 Oe and interaction field range is between -40 and 0 Oe. In Fig. 1(b), the coercivity is within the range of 1225 to 1350 Oe and interaction field range is between -150 and -60 Oe. The interaction field strength, defined as σ_i/σ_k, is 3.398 and 0.907, respectively. The σ_i and σ_k are the standard deviations in the critical field and interaction field that obtained by fitting the experimental data from Gaussian Preisach function. We find that the interaction field strength decrease as Dy composition is close to compensation point. The domain reversal behaves toward to the nucleation dominate when σ_i is smaller than σ_k. The relationships between domain reversal behavior and interaction field strength will be meticulously discussed.

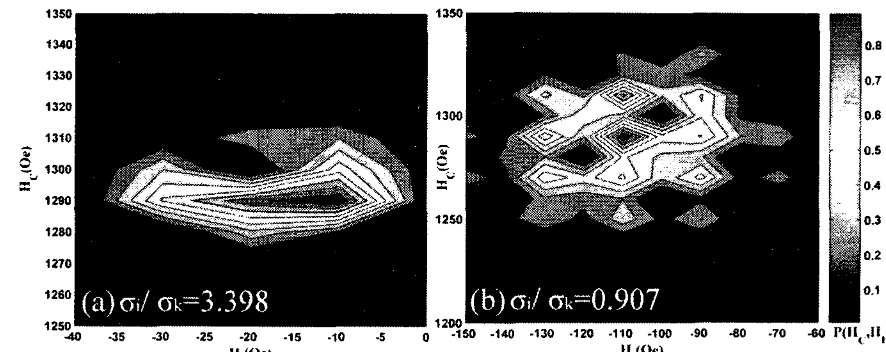

Fig. 1. Comparison of the interaction field strength and spectrum from 90,000 microhysteresis loops of (a) $Dy_{19.59}(FeCo)$ and (b) $Dy_{33.67}(FeCo)$ magnetic thin films.

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