Post annealing effect on perpendicular magnetic properties for CoCrPt media

Shin Saito[*1], Norikazu Itagaki[*1], and Migaku Takahashi[1,2]

[1] Department of Electronic Engineering, Graduate School of Engineering, Tohoku Univ., Japan
[2] New Industry Creation Hatchery Center, Tohoku Univ., Japan

*Corresponding author: e-mail: norry@ecei.tohoku.ac.jp, Phone: +81-22-217-7134, Fax: +81-22-263-9402

To achieve well defined non-ferromagnetic grain boundaries among magnetic grains for a CoCrPt perpendicular medium, several attempts, especially post anealing, have been made focusing on the utilization of interdiffusion of nonmagnetic element used under- or cap- layer into the grain boundaries [1-3]. The interdiffusion of 1) Cr of under-layered $Co_{65}Cr_{35}$ in CoCrPt/$Co_{65}Cr_{35}$/$Ti_{90}Cr_{10}$ stacked media [2], and/or 2) Cr and Mn of cap-layered CrMn in CrMn/CoCrPt/Ti stacked media [3] is concluded to be essential to enhance macroscopically observed H_c, respectively. However, to discuss the detailed origin of enhancement of H_c, we have to know the details concerning the interlayer diffusion process, which is material dependent, in connection with the various physical quantities like as H_k^{grain} (intrinsic magnetic anisotropy field of one grain), V_{act}, and so on. Therefore, in the present study, to clarify the nature of real post annealing effect, we examined the above mentioned quantities for the UC-processed [4] CoCrPt stacked media with Ti, Ta, Pt, and Ru as an under-layer, and with CrMn, MnSi, Ru, and Ti as a cap-layer. Remarkable shape change of loops was observed in the case of post annealed media with Ti under- and cap-layer (Fig.1). Namely, H_c = 9.2 kOe, S = 1, and α = 1. This media also reveals H_k^{grain} = 27 kOe, H_c/H_k^{grain} = 0.30, and $GD_{act} \approx GD_{phys}$ = 8 nm. These facts suggests that Ti is the most promising element for this purpose with retaining small CoCrPt grain size, without any degrading the intrinsic physical quantities. This new conclusion is quite different from the one commonly accepted up to present [2]. For other different material combination, precise thickness dependence of H_c, α, H_c/H_k^{grain}, V_{act} will be discussed in connection with the change of microstructural results.

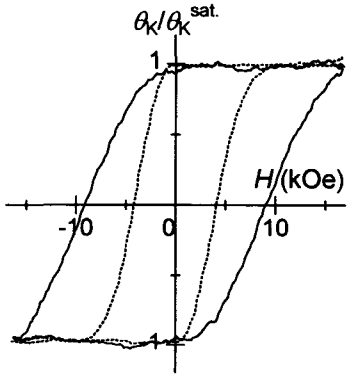

Fig.1. Kerr loops for media with Ti cap-layer and under-layer. Solid and broken lines correspond to post annealed and non-annealed media, respectively.

References

[1] T. Keitoku et al.: J. Magn. Soc. Jpn., **21**, 289 (1997).
[2] Y. Hirayama et al.: J. Appl. Phys., **87**, 6890 (2000).
[3] A. G. Roy et al.: J. Appl. Phys., **93** 8179 (2003).
[4] M. Takahashi et al.: IEEE Trans. Magn. **33**, 2938 (1997).