BP02

Effect of CoPt Magnetic Layer Thickness on Magnetic Properties of CoPt/Ag Patterned Media

C. W. Chen*, P. C. Kuo, G. P. Lin, and Y. H. Fang

Department of Materials Science and Engineering, National Taiwan University, Taipei 106, Taiwan.

*Corresponding author: Author3 Park, e-mail: b93507032@ntu.edu.tw

To overcome the superparamagnetism and achieve ultra high magnetic storage densities, patterned magnetic media is a feasible method. In this work, CoPt/Ag patterned media made by metal island films composed of metal nanoparticles have been studied. Silver was chosen to form metal islands film due to its low temperature fluctuation [1]. On the other hand, CoPt alloy was selected to be the magnetic layer due to its high magnetiocrystalline anisotropy and good thermal stability [2]. Different thicknesses of Ag metal films were deposited on Corning glass substrate by DC magnetron sputtering at room temperature under Ar pressure of 10 mTorr. Then, a island structure was formed by annealing these films at 200°C for 30 minutes. Fig. 1. is the SEM image of the Ag island films which was formed with the deposition of 8 nm Ag metal on the glass and annealed at 200°C for 30 minutes. It is shown that the distributions of the Ag islands are uniform and most of the islands are circullar-shaped. Subsequently, the CoPt magnetic layers with different thicknesses were deposited on the post-annealed Ag island films by DC magnetron sputtering at room temperature under Ar pressure of 3 mTorr. The composition and thickness of the films were determined by an electron probe X-ray microanalysis (EPMA) and an atomic force microscope (AFM), respectively. Magnetic properties of the films were measured by using a superconducting quantum interference device (SQUID). The microstructure of the films was examined by a scanning electro microscope (SEM). The average island size is about 25 nm. The saturation magnetization (Ms) of CoPt/Ag film is 220 emu/cm^3. The in-plane squareness and coercivity are about 0.80 and 13 kOe, respectively. The out-of-plane squareness and coercivity are 0.71 and 12 kOe, respectively.

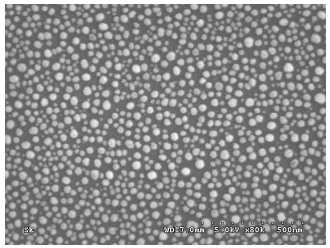


Fig. 1. The SEM image of Ag island film with a thickness of 5 nm and annealed at 200°C for 15 minutes.

REFERENCES

[1] K. Baba, K. Hayashi, and M. Miyagi, Optical Data Storage, 2338, 175, (1994).

[2] C. P. Luo, S. H. Liou, L. Gao, Y. Liu, and D.J. Sellmyer, Appl. Phys. Lett., 77, 2225, (2000).

BP03

Enhancement in Perpendicular Hard Magnetic Properties of Co-rich Co-Pt films by Epitaxial Deposition without Capped Layer

S. C. Chen[1]*, P. C. Kuo[2], Y. H. Fang[2], S. L. Ou[2], G. P. Lin[2], K. T. Huang[2], S. L. Hsu[2], and T. Y. Kuo[1]

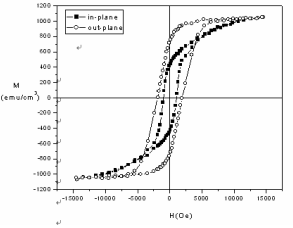
[1]Department of Materials Engineering, Ming Chi University of Technology, Taipei 243, and Center for Nanostorage Research, National Taiwan University, Taipei 106, Taiwan

[2]Institute of Materials Science and Engineering, National Taiwan University, Taipei 106, Taiwan

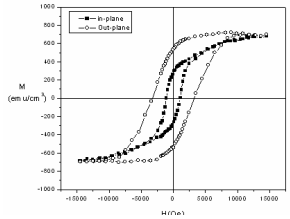
*Corresponding author: S. C. Chen, e-mail: ssccchh@ms28.hinet.net

The Co-rich Co-Pt films without Pt capped layer having perpendicular coercivity of 3375 Oe and perpendicular squareness of 0.82 can be achieved by epitaxial growth of 14 nm thick Co-rich Co-Pt film on 100 nm Pt underlayer and post-annealed in a vacuum of 1 mTorr at 300°C for 30 min.

The HRTEM cross-sectional lattice image shows that a well epitaxial growth of hcp (002) Co-rich Co-Pt on (111) Pt underlayer, which leads to present the perpendicular magnetic anisotropy of Co-rich Co-Pt film. It is found that both the perpendicular coercivity and perpendicular squareness of Co-rich Co-Pt films without Pt capped layer are larger than that of Co-rich Co-Pt films with Pt capped layer,as shown in Fig.1(a) and (b). This may be due to the following reasons: (1) The cross-sectional TEM-EDS shows that the Pt atoms will diffuse from Pt layer into Co-rich Co-Pt layer, and changes the compositions to approach CoPt that decreases the perpendicular anisotropy of hcp Co-rich Co-Pt film. Besides, most of Pt atoms exist at grain boundary of Co-rich Co-Pt, and increases the grain boundary energy to promote the transformation of hcp Co-rich Co-Pt to fcc Co-rich Co-Pt. This transformation will also reduce the perpendicular hard magnetic properties of the Co-rich Co-Pt film with Pt capped layer [1]. (2) The AES analysis confirms that the oxygen atoms diffuse from film surface into the Co-rich Co-Pt film without Pt capped layer, and react with higher activity cobalt atoms to form CoO which is detected by XPS analysis. The increase in perpendicular hard magnetic properties of Co-rich Co-Pt film without Pt capped layer may be also attributed to the exchange coupling interaction between ferromagnetic Co-rich Co-Pt grains and anti-ferromagnetic CoO as in Co-CoO film [2].



(a)



(b)

Fig. 1. M-H loops of Co-rich Co-Pt (14 nm) / Pt (100 nm) films which annealed at 300°C for 30 min. (a) with and (b) without 5nm Pt capped layer.

REFERENCES

[1] S. D. Willoughby, R. A. Stern, R. Duplessis, J. M. MacLaren, M. E. McHenry, and D. E. Laughlin, J. Appl. Phys., 93, 7145 (2003).

[2] M. Ohkoshi, K. Tamari, S.Honda and T.Kusuda, IEEE Trans. Magn., 20, 788 (1984).