

Preparation of Boron Carbide Thin Films by DC Magnetron Reactive Sputtering

K. E. Lee^{1,2}, C. H. Kim², and C. O. Kim^{*1,2}

¹ Department of Material science & engineering, Chungnam National University, 220 Gung-Dong, Yu-Seong Gu, Daejeon, 305-764, Korea

² ReCAMM, Chungnam National University, 220 Gung-Dong, Yu-Seong Gu, Daejeon, 305-764, Korea

*Corresponding author: magkim@cnu.ac.kr. Phone: +82 42 821 6233. Fax: +82 42 822 6272

This experiment was carried out to apply to the surface of computer hard-disk. Boron carbide thin films were prepared by DC magnetron sputtering. The films were deposited onto CoCr/Cr/SiO₂/Si(100) substrates with a power of 100W at room temperature, 100°C and 200°C. The reactive gas was introduced up to 1.6% (CH₄/(Ar + CH₄)) during deposition, and the resulting composition of the films matched these ratios, as observed by X-ray photoelectron spectroscopy (XPS). Two well-resolved peaks in C(1s) spectra were observed around 284 eV. The peak at 284.5 eV indicated C-C bond, while a lower binding energy feature at 283.5 eV was assigned to carbide as B4C. The X-ray diffraction results of these films showed the amorphous or nanocrystalline characteristics. The surface hardness was measured using nano-indenter. The values increased up to about 2500 Hv with the substrate temperature of 100°C and the gas volume ratio of 0.8% using nano-indenter. Also, the scratched films endured the load of 35N.

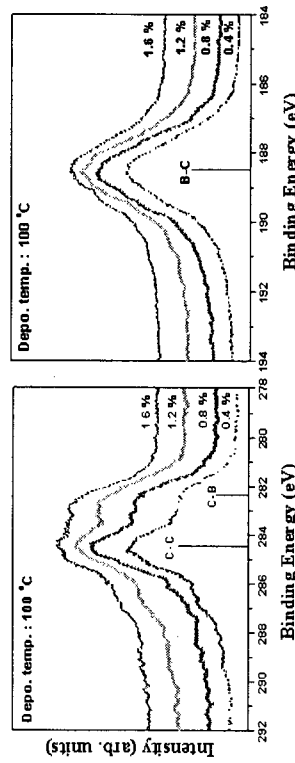


Fig. 1. XPS spectra of carbon (1s) and boron (1s) for boron carbide thin films prepared with CH₄/(Ar+CH₄) of 0.8% at substrate temperature 100°C and working pressure of 3.0 mTorr.

REFERENCES

[1] T. Eckardt, Surface and Coatings Technology, 126(2000) 69.
 [2] M.T. Spohn, Am. Ceram. Soc. Bull. 74(1995) 113.
 [3] E. Pascual, E. Martinez, J. Esteve, A. Lousa, Diamond and Related Materials, 8(1999) 402.
 [4] H.T. Jisou, W. Kowbel, Surf. Coat. Technol. 79(1996) 139.

Magnetic Properties and Microstructure of TbCo/(Co/SiN_x)_n Films

Pai Li Lin^{*1}, Po Cheng Kuo¹, Sheng Chi Chen², and Yen Hsiang Fang¹

¹ Institute of Materials Science and Engineering, National Taiwan University, Taipei 106, Taiwan

² Department of Materials Engineering, MingChi University of Technology, Taipei 243, Taiwan

*Corresponding author: 2000_sam@yahoo.com.tw. Phone: +886 2 2364 8881. Fax: +886 2 2363 4562

In this study, the Tb₃₂Co₆₈/(Co/SiN_x)_n films with high saturation magnetization (M_s) about 263 emu/cm³ which is high enough as a heat-assisted magnetic recording (HAMR) medium were prepared by magnetron sputtering. The magnetic anisotropy of all Tb₃₂Co₆₈/(Co/SiN_x)_n films (n = 0-3) are perpendicular to the film plane. The vibrating sample magnetometer (VSM) measurements indicate that the M_s and perpendicular coercivity (H_{c,⊥}) of Tb₃₂Co₆₈/(Co/SiN_x)_n film (n = 3) are 263 emu/cm³ and 3592 Oe, respectively. These are higher than those of single-layered Tb₃₂Co₆₈ film (M_s = 167 emu/cm³ and H_{c,⊥} = 3284 Oe). The enhancement of M_s is due to the contribution of Co layers moments. The cross-sectional high resolution transmission electron microscope (HRTEM) image in figure 1 shows that the interface roughness between the (Co/SiN_x)_n layers and TbCo layer is increased as n increases from 1 to 3. The rough surface provides more obstacles and pinning sites that hinder the motion of the domain walls [1-3] at interface between the (Co/SiN_x)_n layers and TbCo layer, and therefore the H_{c,⊥} value of the Tb₃₂Co₆₈/(Co/SiN_x)_n films is increased from 3103 Oe to 3592 Oe as n increases from 1 to 3.

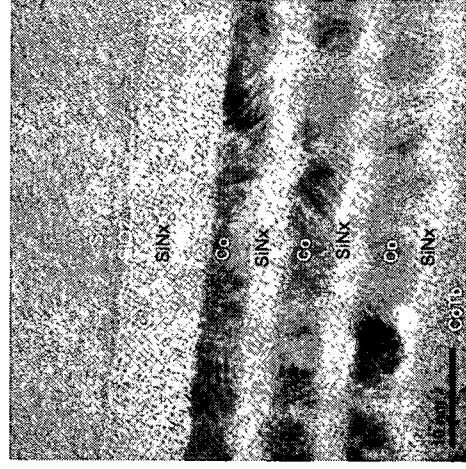


Fig. 1. The cross-sectional TEM image of the (Co/SiN_x)_n/CoTb multilayer films.

REFERENCES

[1] H. Katayama, K. Watanabe, K. Takayama, J.-I. Sato, S. Miyamishi, K. Kojima, and K. Ohta, Appl. Phys. Lett. Vol. 81, No. 26, 4994 (2002)
 [2] W. Yang, D. N. Lambeth, L. Tang, and D. E. Laughlin, J. Appl. Phys. 81 (8) 4370 (1997)
 [3] V. Ng, J. F. Hu, A. O. Adeyeye, J. P. Wang, and T. C. Chong, J. Appl. Phys. Vol. 91, No. 10, 7206 (2002)