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수직자기이방성을 갖는 CoCrPt 합금박막의 국소보자력 분포 연구

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Local Coercivity Variation in CoCrPt Alloy Films Having Perpendicular Magnetic Anisotropy

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1. INTRODUCTION

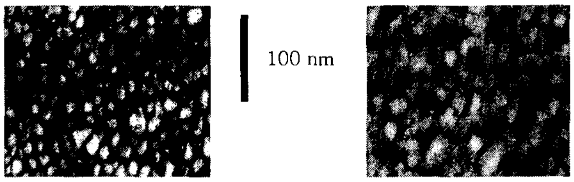
CoCrPt alloy films are one of the most promising candidates for high density perpendicular magnetic recording media due to their strong perpendicular magnetic anisotropy (PMA) and high coercivity [1]. Local coercivity variation in real films is a fundamental issue for in-depth understanding of domain configuration and structural irregularity [2]. In this work, we have investigated the local coercivity variation of CoCrPt alloy films having PMA by measuring the local hysteretic loops with using a magneto-optical microscope magnetometer (MOMM) and analyzed the variation by comparing with the film structure

2. EXPERIMENT

Serial samples of 500-Å Si_3N_4/400-Å $(Co_{72}Cr_{18})_{100-x}Pt_x$/1100-Å Ti films were prepared under an optimal condition to achieve PMA by dc-magnetron co-sputtering under an Ar pressure of 3 mTorr at ambient temperature with changing Pt composition x from 0.14 to 0.28. High-angle x-ray diffraction (XRD) studies showed that the samples grew along [002] hcp orientation. Film surface morphology was characterized using a scanning electronic microscope (SEM). Magneto-optical properties were measured by a magneto-optical Kerr effect (MOKE) spectrometer and the magnetic properties were characterized by vibrating sample magnetometer (VSM). The local coercivity distribution was investigated using the magneto-optical microscope magnetometer (MOMM) system. Additionally, the spatial coercivity distribution was obtained by mapping the colors onto the map.

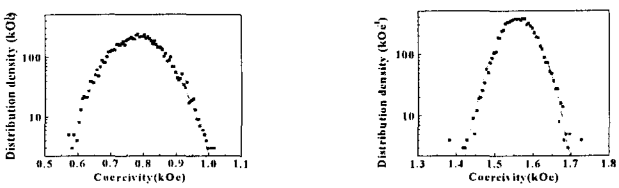
3. RESULTS AND DISCUSSION

Figure 1 shows the surface morphorogies measured by SEM for the samples having x = (a) 14 at. % and (b) 21 at. %, respectively. In the figures, one can clearly see isolated grains due to the segregation at grain boundaries. With varying the Pt composition from 14 at. % to 21 at. %, the average diameter of isolated grains increased from 25 nm to 30 nm, while the segregation between neighboring grains was reduced. In Fig.2, we plot the distribution density of the local coercivity of these samples. Interestingly, the local coercivity variation clearly showed Gaussian distribution, which could be explained based on random local magnetic properties due to the Cr segregation. The standard deviation of the local coercivity variation decreased from 0.14 kOe to 0.085 kOe with increasing Pt composition from 14 at. % to 21 at. %. It might be associated with increasing the magnetic interaction due to imperfect isolated grains of CoCrPt alloy film.



(a) (b)

Fig.1. SEM images of 400-Å ($Co_{0.7}$ $Cr_{0.18})_{100-x}$ Pt_x/1100-ÅTi alloy films with Pt composition of (a) x=14 at.% , (b



(a) (b)

ig.2. Distribution density of the local coercivity of the 400-Å ($Co_{0.72}$ $Cr_{0.18}$ $_{100-x}$ Pt_x/ 1100-Å Ti alloy films with P composition (a) x=14 at.% , (b) x=2

4. CONCLUSIONS

We have found that the local coercivity variation of CoCrPt alloy films could be well explained by a Gaussian distribution. The degree of the local coercivity variation was closely correlated with the structural variation for the samples having various Pt composition.

Acknowledgments

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