BP06

Effect of SiN_x Capped Layer on the Microstructure and Magnetic Properties of CoPt/Ag Thin Films

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The $L1_0$ CoPt thin films with face-centered-tetragonal (FCT) phase are employed as the ultra high density magnetic recording media due to their high magnetocrystalline anisotropy and high coercivity. [1-3] In this study, the microstructure and magnetic properties of CoPt (20 nm)/Ag (25 nm) films with and without 32 nm SiN_x capped layer are investigated. All films were sputtered at ambient temperature then annealed at 500 ~ 700°C for 30 minutes in vacuum. The saturated magnetization (M_s), perpendicular coercivity ($H_{c\perp}$, and perpendicular squareness ($S_\perp$) of the CoPt (20 nm)/Ag (25 nm) films which annealed at 650°C are 430 emu/cm3, ⊥), and perpendicular squareness (S⊥) of the CoPt (20 nm)/Ag (25 nm) films which annealed at 650°C are 430 emu/cm^3, 13525 Oe, and 0.96, respectively. Figure 1 shows the M-H loops of the SiN_x (32 nm)/CoPt (20 nm)/Ag (25 nm) films which annealed at 650°C for 30 min. After 32 nm SiN_x capped layer is added, the M_s, $H_{c\perp}$, and $S_\perp$ values are 508 emu/cm^3, 11696 Oe, and 0.96, respectively. The most obvious effect of adding SiN_x capped layer is to increase the M_s value from 430 to 508 emu/cm^3. The difference of M_s values between the films with and without the SiN_x capped layer is larger as the annealing temperature is increased. This means that the SiN_x capped layer is effective to resist the oxidation of CoPt layer at higher temperatures. However, it is found that the SiN_x capped layer would inhibit the (001)CoPt texture growth. The X-ray peak intensity ratio between (001)CoPt and (111)CoPt planes (I_{001}/I_{111} ratio) which is used to describe the (001) texturing of the CoPt layer decreases drastically from 13.05 to 1.54 as the 32 nm SiN_x capped layer is added.

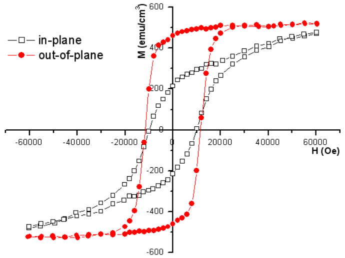

Fig. 1. M-H loops of the SiN_x (32 nm)/CoPt (20 nm)/Ag (25 nm) films which annealed at 650°C for 30 min.

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BP07

Ordering and Magnetic Properties of Post-annealed CoPt and CoPt/Au Thin Films

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Ll0 FePt and CoPt are both received much attention based on the high magnetocristalline anisotropy (>5×10^7 erg/cm^3), Curie temperature, and corrosion resistance. Thormodynamically, the phase evolution of equi-atomic CoPt and FePt are similar: from an ordered structure with fct lattice at low temperatures to a disordered fcc phase as temperature exceeds transformation point. In thin films, however, the two materials act distinctly. As-deposited FePt films exhibit disorder phase and it orders to Ll_0 structure after annealing. Comparing to FePt, phase transformation in CoPt films is more complex. An intermediate phase of Ll_1 with a rhombohedral lattice [1,2] was found in the low temperature grown epitexial film, which may also take place in the ordering process of sputtered films. The purpose of this study is to investigate the structural evolution of CoPt film on glass and gold layer by post annealing at wide temperature range.

$Co_{46}Pt_{54}$ films with and without Au underlayer were sputtered on glass substrates with fixed thickness of 20 nm at room temperature. Gold is adopted as underlayer material based on the immiscibility to CoPt alloy, which stables the binary composition of CoPt phase. A post annealing is applied subsequently at temperatures (T_p) from 100 to 800°C for 30 minutes. Magnetic hardening of CoPt films was found at T_p = 600°C, but it was appeared at T_p = 500°C in the CoPt/Au film. The X-ray results indicate that this magnetic hardening is resulting from the formation of order phase. Different morphology evolution of the two films suggests that the reason for the ordering enhancement can be related to the relaxation of in-plane strain and the promotion of grain growth by gold underlayer. When T_p was increased to 700°C, the coercivity of the both films reached a maximum value and the films were fully ordered. As T_p further reached 800°C, abnormal changes in both magnetism and crystal structure occurred in both films. The coercivity of the two films dropped drastically below 1 kOe accompanied an increase in magnetization. The lattice structure transformed from tetragonal of order phase to cubic symmetry. We suggest that this lattice distortion and magnetic softening may result from the intensive tensile strain/stress produced by the over growth of the CoPt grains. The results of this study provide original information for this material.

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