[III-3]

MAGNETIC AND MAGNETO-OPTICAL PROPERTIES OF Co-Pt ALLOY FILMS

G. S. Chang,[1] Y. D. Chung,[1] C. N. Whang,[1] H. G. Lee,[2] and Y. P. Lee,[3]
[1]Dept. of Physics, Yonsei University, Seoul, Korea, [2]KBSC, Daejeon, Korea,
[3]Dept. of Physics, Sunmoon University, Asan, Korea

INTRODUCTION

The study of Co/Pt multilayered (ML) film as a magneto-optical (MO) recording medium attracts wide attention because of its enhanced magneto-optical Kerr effect at shorter optical wavelengths. The additional need for easier fabrication results in research on Co-Pt alloy films. We investigated the magnetic and MO properties at both room temperature (RT) and low temperatures (LT), which were also correlated to the measured structures and stoichiometry.

EXPERIMENT

Co-Pt alloy films were prepared at around RT by ultrahigh-vacuum cosputtering ; CoPt 200 Å / Pt 200 Å / Si and $CoPt_3$ 200 Å / Pt 200 Å / Si. They are expected to have different structures which, in turn, affect the magnetic and magneto-optical properties.
The structures and the compositions of the films were determined using x-ray diffraction (XRD), atomic force microscopy (AFM), in-situ and ex-situ x-ray photoelectron spectroscopy (XPS), and Auger electron spectroscopy. Magnetic properties were measured at RT, 77 K and 5 K with SQUID magnetometer, and MO properties also investigated at both RT and LT with Kerr loop tracers at 457.9 nm, 488 nm, 514.5 nm and 632.8 nm.

RESULTS AND DISCUSSION

The film texture turned out to be (111) by XRD. The rms surface roughness of $CoPt_3$ film is only 2.1 Å by AFM, which is smaller about three times than that of (Pt(10 Å) / Co(3 Å)) x 15 / Pt(200 Å) ML film. The surface of CoPt film is even more smooth than that of $CoPt_3$ film, which may be correlated with the different

structural ordering.

The stoichiometry was confirmed by using Co $2p_{3/2}$ and Pt 4f XPS peaks. In-situ XPS revealed no impurity. The preliminary valence-band spectra of both $CoPt_3$ and CoPt films suggest hybridization between Co and Pt atoms, and induced magnetization of Pt atoms.

The change in coercivity (H_c) of CoPt film according to measurement temperature (T_{meas}) shows an increase by ~ 90% at 5 K, compared with H_c at RT. The saturation magnetization is also increased with T_{meas} to be, at 5 K, ~ 2.5 times that at RT.

As far as the MO properties of Co-Pt alloy films are concerned, the measurements were carried out at RT, 200 K, 77 K and 5 K. Kerr rotation angle (θ_k) at 300 K of CoPt film was increased from 0.265° at 632.8 nm to 0.383° at 488 nm, and these values for θ_k are all larger that those of Pt(10Å) / Co(12Å) ML film in a wavelength range between 457.9 and 632.8 nm. On the other hand, the increase rate of θ_k was larger at 200 K to be 0.455° at 488 nm. θ_k of $CoPt_3$ film was 0.351° at 488 nm and 200 K.

The reflectivity (R) of Co-Pt alloy films was decreased linearly with photon energy in a range between 1.96 eV (632.8 nm) an 2.71 eV (457.9 nm) ; 69 to 64% for $CoPt_3$, and 67 to 61% for CoPt. The similarity in the trend and value is found when we compare $CoPt_3$ with Pt(10Å) / Co(3Å) ML.

CoPt film shows that the increase rate of figure of merit ($\sqrt{R}\ \theta_k$) with photon energy is almost identical at both 300 and 200 K, but that the best figure of merit at 200 K is higher by ~ 20% than that at 300 K.

The detailed discussion will be presented, together with other analysis results.