## PC08

# Magnetic Properties and Microstructure of $Cr_{90}Ru_{10}/Fe_{55}Pt_{45}$ Bilayer Thin Film

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FePt alloy with tetragonal structure has drawn much attention due to its high anisotropic energy ($K_u \sim 7\times10^7$ erg/cm$^3$) and shown great potential for high density magnetic recording. The high substrate temperature (>500℃) during deposition and/or post-annealing process are necessary to obtain highly ordered FePt alloy films. For practical application, to reduce the fabrication temperature is important, and Zhao has succeeded to reduce it by adopting CrRu underlayer [1]. However, detailed $Fe_{55}Pt_{45}$ thickness effect on the magnetic properties of $Cr_{90}Ru_{10}/Fe_{55}Pt_{45}$ bilayer thin films are still lack. Therefore, $Cr_{90}Ru_{10}/Fe_{55}Pt_{45}$ bilayer thin films were prepared by dc magnetron sputtering on Si(100) substrate at 350℃. With increasing $Fe_{55}Pt_{45}$ thickness (t), the squareness and coercivity for longitudinal configuration was increased from 0.38 and 1.9 kOe for t = 15 nm to 0.91 and 3.2 kOe for t = 40 nm, respectively, and thicker $Fe_{55}Pt_{45}$ films exhibit longitudinal anisotropy, but didn't show perpendicular one. Transmission electron microscopy (TEM) result showed that the isolated grain were observed for all samples and the average grain size increased from 9 nm for t = 25 nm to 11 nm for t = 40 nm with increasing thickness. The thicker $Fe_{55}Pt_{45}$ with higher ordering degree might be due to the recrystallization of disordered nanograins from fcc to fct structure, which was dependent on the grain size [2]. On the other hand, effect of annealing temperature on the magnetic properties and microstructure of the $Fe_{55}Pt_{45}$ films were also studied. When the annealing temperature is increased from 350 to 550℃, the prefer orientation was transformed from fct (200) to fct (111) and the easy axis would deviated from the in-plane direction. Accordingly, $Cr_{90}Ru_{10}/Fe_{55}Pt_{45}$ bilayer film possesses good longitudinal magnetic properties and possibility for high density magnetic recording media application.

**REFERENCES**
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## PC09

# Magnetic Force Microscopy Study on the Ultrathin FePt Films

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Due to its large magnetocrystalline anisotropy, equiatomic FePt alloy thin films with $L1_0$ ordered structure have been extensively studied for its potential application as a high-density recording media. It was found that strong exchange coupling between the FePt nano-sized grains can result in high noise level, which can be decreased by isolation of the FePt grains by nonmagnetic matrix such as carbon etc [1] or by controlling the film thickness [2]. In this work, the effect of substrate temperature ($T_s$) on the morphology, magnetic properties and domain structure of ultrathin FePt thin film with isolated morphology was studied.

FePt thin films with a nominal thickness of 7 nm were prepared on MgO (100) substrate using dc magnetron sputteringwith $T_s$ varied from 300℃ to 400℃. Room temperature magnetic measurements were carried out using vibrating sample magnetometer (VSM). Topography together with magnetic domain patterns was obtained by Digital Instrument 3000 Magnetic Force Microscope (MFM).

With the increasing $T_s$, the cluster size became larger. Meanwhile coercivity increased from 480 Oe at 300℃ to more than 3000 Oe at 400℃. Stripe domain structures were observed in these films. The domain size first increased from 300℃ to 350℃ and then slightly decreased with further increasing of $T_s$. Clearly different domain reversal behaviours was found with the variation of $T_s$. Fig. 1 and 2 show the MFM images of two samples with $T_s$ = 325℃ and 375℃, respectively. The samples were in its remanent state after applying a reverse magnetic field. For low $T_s$ sample, nucleation of reverse domain could be observed under critical magnetic field (Fig. 1a), the reverse domain expanded via further nucleation and growth when the field increases. On the contrary, as shown in Fig. 2 a and b, no nucleation of reverse domain could be observed till coercivity field for sample with $T_s$ =375℃. In Fig. 2c, the white and black contrast implied a domain wall movement. The different domain reversal behaviours may relates with the different film morphology such as cluster size etc..

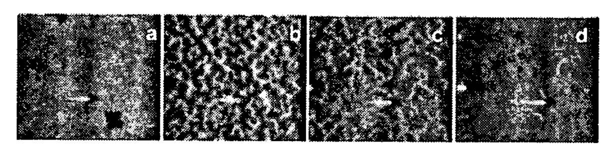


**Fig.1.** The MFM images of FePt thin film with $T_s$ =325℃ after applying a reverse field of (a)-400 Oe; (b)-480Oe; (c)-700 Oe; (d)-860 Oe. The scan size is 10 μm.

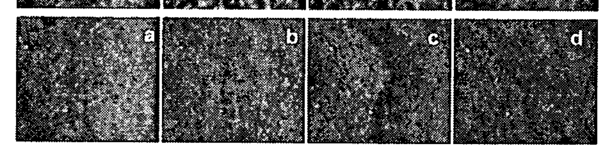


**Fig. 2.** The MFM images of FePt thin film with $T_s$ =375℃ after applying a reverse field of (a)-400 Oe; (b)-1700 Oe; (c)-2100 Oe; (d)-2700 Oe. The scan size is 10 μm.

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