Direct Synthesis of fct-FePt Nano particles and Magnetic properties of its Monolayer Films Stabilized on Functionalized Surface by Chemical Route

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Hot attentions have been paid for the ferromagnetic FePt nanoparticles with high uniaxial magnetocrystalline anisotropy, K_u (~ 10^7 erg/cc), for the application of future storage media with ultrahigh recording density beyond 1 Tb/in^2. However, lack of the fully understandable knowledge for chemical synthesis, there still exists various physical problems for the synthesis of ferromagnetic nanoparticles. Up to present, several attempts based on hot-soap process [1] are made for FePt nanoparticles. However, the nanoparticles synthesized by this method have revealed superparamagnetic, chemically disordered, and fcc in structure just after synthesis. To obtain high K_u, annealing at temperature about 600℃ is indispensable to induce the phase transition from fcc to fct. But this annealing procedure also causes irregular coalescences of nanopaeticles. Therefore, it is important to establish new process to obtain FePt nanoparticles with the $L1_0$-typed structure without annealing. In this frame work, we will show a recent successful attempt on direct synthesis of FePt nanoparticles with the $L1_0$-typed structure utilizing a modified "polyol process" [2].

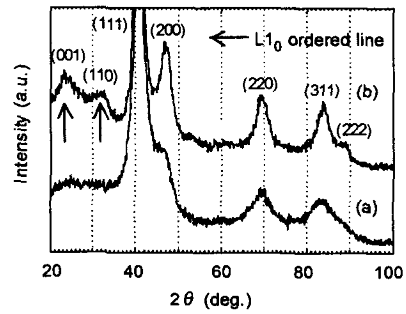

Fig. 1 XRD profiles for FePt nanoparticles synthesized in TEG at (a) 260℃ and (b) 300℃, respectively.

Fig. 1 shows XRD profiles for FePt nanoparticles synthesized at (a) 260℃ and (b) 300℃, respectively. As seen in the profile of sample (b), diffracted lines from (001)- and (110)-planes of the ordered $L1_0$ fct structure are clearly observed. Fig. 2 shows rotational hysteresis loss, W_r, as a function of applied field, H, for the samples (a) and (b), respectively. Judging from the intersection of the extended line of the linear portion of W_r vs. H curve with the H axis, intrinsic magnetic anisotropy field, H_k, of ferromagnetic FePt nanoparticles in the sample (b) is revealed at about 31 kOe. Detailed magnetic and structural properties of nanoparticles will be discussed in connection with chemical process conditions.

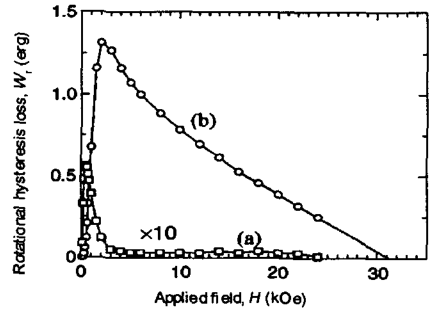

Fig. 2 Rotational hysteresis loss, W_r, as a function of applied field, H, for samples synthesized in TEG at (a) 260℃ and (b) 300℃, respectively.

References

[1] S. Sun et al., Science, **287**, 1989 (2000).
[2] B. Jeyadevan et al., J. Appl. phys., **42**, 305 (2003).