

Negative- $K_u$  grain Material for SUL and Exchange Coupled Media Application

Shin Saito<sup>1,2</sup>, Dong-Young Kim<sup>2</sup>, and Migaku Takahashi<sup>1,3</sup>

<sup>1</sup>Department of Electronic Engineering, Graduate School of Engineering, Tohoku Univ., Sendai, 980-8579, Japan

<sup>2</sup>Research Center for Advanced Magnetic Materials, Chungnam National Univ., Daejeon 305-764, South Korea

<sup>3</sup>New Industry Creation Hatchery Center, Tohoku Univ., Sendai, 980-8579, Japan

\*Corresponding author: ssaito@ecei.tohoku.ac.jp, Phone: +81 122 795 7134, Fax: +81 22 263 9402

The hcp disordered Colr alloy shows unique behaviour for magneto-crystalline anisotropy. The sign of  $K_u^{grain}$  ( $K_u + K_{ax}$ ): uniaxial magneto-crystalline anisotropy constant) changes positive (axial) to negative (in-plane type) around 7 at. % Ir content and its magnitude is around  $10^6$  erg/cm<sup>3</sup> (Fig. 1) [1]. While the in-plane magneto-crystalline anisotropy constant,  $K_{ip}$ , is quite small ( $\approx 10^4$  erg/cm<sup>3</sup>) [2]. Application of this alloy to SUL layer was found to be quite effective to suppress the AIE and WATE (wide adjacent track erasure) including spike noise for recent CoPtCr-SiO<sub>2</sub> granular media [1].

To solve the recent write-ability problem for high  $K_u^{grain}$  material with high thermal stability, Colr alloy with negative  $K_u^{grain}$  is highly attractive through the spin twisted structure at the interface in positive/negative- $K_u^{grain}$  stacked media [3, 4]. As a technical merit, Colr alloy film can be easily applied underneath CoPtCr alloy film with c-plane sheet texture without any change in c-axis distribution and boundary structure, because of the same crystalline structure of hcp. In the present proposed p-/n- $K_u^{grain}$  stacked media, reversal mode of p- $K_u^{grain}$  part changes drastically from S-W type to incoherent type as seen in Fig. 2. For a medium with the stacking structure of Co<sub>70</sub>Pt<sub>30</sub>Cr<sub>15</sub>-SiO<sub>2</sub> (16 nm)/Co<sub>80</sub>Fe<sub>15</sub>(1 nm)/Ru/Pt/Ta/glass sub., saturation field,  $H_s = 8.1$  kOe, coercivity,  $H_C = 3.3$  kOe, nucleation field,  $H_n = 1.1$  kOe, and  $\Delta H_C = H_C^{(up)} - \Delta H_C^{(down)} = 0.7$  kOe are realized.

Furthermore, coupling strength can be changeable by the extremely thin Ru-SiO<sub>2</sub> insertion layer between p- and n- $K_u^{grain}$  layers due to RKKY coupling. Oscillation phenomena of switching fields such as  $H_n$ ,  $H_C$ , and  $H_s$  in a remanent magnetization curve are clearly observed against the Ru-SiO<sub>2</sub> layer thickness of 0-3 nm.

Media concepts applying with new Colr alloy with n- $K_u^{grain}$  are very promising from the view point of 1) SUL function, 2) switching field reduction of a recording layer with high  $K_u^{grain}$ , and 3) conventional intermediate layer free.

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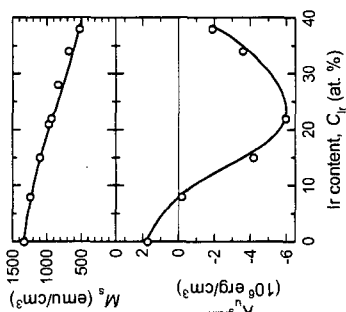


Fig. 1. Change in (top)  $M_s$  and (bottom)  $K_u^{grain}$  as a function of the Ir content for c-plane oriented Colr films using Ta/Pt/Ru underlayer.

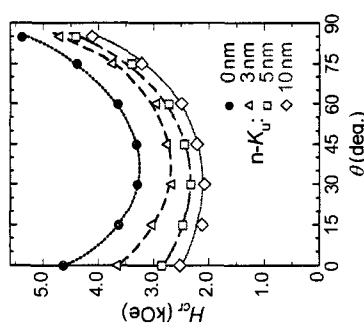


Fig. 2. Remanence coercivity as a function of applied field angle  $\theta$  for the media with the stacking structure of Co<sub>80</sub>Pt<sub>20</sub>Cr<sub>15</sub>-SiO<sub>2</sub> (20nm)/Co<sub>80</sub>Fe<sub>15</sub>-SiO<sub>2</sub> (0-10nm)/Ru/Pt/Ta/glass.

Fabrication of Monodisperse FePt-Au Core-Shell Nanoparticles

C. S. Ho<sup>1</sup>, J. W. Wang<sup>1,2</sup>, D. H. Wei<sup>2</sup>, D. S. Hung<sup>3</sup>, and Y. D. Yao<sup>4</sup>

<sup>1</sup>Department of Chemical Engineering, Tunghai University, Taichung, Taiwan, R.O.C.

<sup>2</sup>Institute of Physics, Academia Sinica, Taipei, Taiwan, R.O.C.

<sup>3</sup>Dep. of Information and Telecommunications Eng., Ming Chuan University, Taoyuan, Taiwan, R.O.C.

<sup>4</sup>Department of Materials Engineering, Tatung University, Taipei, Taiwan, R.O.C.

\*Corresponding author: j943109@tshu.edu.tw, Phone: +886-2-27880058 ext. 1220

Core shell nanoparticles with magnetic or optical properties have been actively pursued for potential biological applications. The hydrophobic FePt nanoparticles were synthesized by reduction of platinum acetylacetonate (1 mmol) and iron acetylacetonate (1.5 mmol) in the presence of oleic acid and oleyl amine stabilizers (oil phase). The average particle size of FePt was about 3 nm without significant aggregation observed from the TEM image. The FePt nanoparticles of selected sizes were then used as seeding materials for the reduction of gold acetate (1.5 mmol) to form gold coated FePt nanoparticles. All procedures were carried out under an argon gas atmosphere and used commercially available reagents [1]. Here, we present a scalable chemical reduction method to synthesize core (FePt) shell (Au) nanocrystals that are soluble and stable in water solutions. We envisage that such core shell magnetic nanoparticles could be a useful nanomaterial in biological applications. Then, the gold acetate reduced in the presence of the seeds to synthesized gold coated FePt nanoparticles. The surface modification of the FePt Au nanoparticles transferred form oil to water soluble state was prepared by the 11 mercaptoundecanoic acid which possesses thiol group, as shown in Fig. 1. From the X ray diffraction (XRD) patterns, the as synthesized FePt nanoparticles show a disordered face centered cubic (fcc) structure. While for the FePt Au nanoparticles, the diffraction peaks appear at  $2\theta = 38.2^\circ, 44.4^\circ, 64.6^\circ, 77.5^\circ$ , and  $81.7^\circ$ , which can be indexed to (111), (200), (311), and (222) planes of gold in a fcc phase. This provides an evidence for the complete coverage of the FePt core by Au. Its saturation magnetization value was measured at 2.43 emu/g. The surface plasmon (SP) resonance band measurement is another way to make sure the situation of FePt Au core shell nanoparticles. From UV vis. spectra (Fig. 2), the surface plasma appears at 520 nm which indicates that the FePt nanoparticles are covered by the gold shell. In summary, we have demonstrated the completely water soluble FePt Au nanoparticles which possess magnetic and optical properties and will be a potential candidate for biological applications.

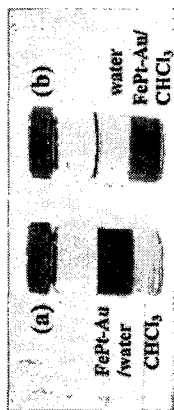


Fig. 1. Pictures of FePt-Au nanoparticles (a) after and (b) before phase transfer process.

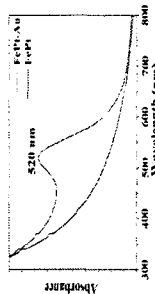


Fig. 2. UV-vis spectra for FePt and FePt-Au nanoparticles in organic phase.

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