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$L1_0$ オーダーを制御した FePt 薄膜の Pt $L_{2,3}$ 吸収端 X 線磁気円二色性

Pt $L_{2,3}$-edge X-ray magnetic circular dichroism of FePt thin films with controlled $L1_0$ order

東大理[1]，東北大金研[2]，JASRI[3] ○石上啓介[1]，芝田悟朗[1]，関剛斎[2]，
坂本祥哉[1]，野中洋亮[1]，鈴木基寛[3]，高梨弘毅[2]，藤森淳[1]
Univ. of Tokyo[1], IMR Tohoku Univ.[2], JASRI[3] ○Keisuke Ishigami[1], Goro Shibata[1], Takeshi Seki[2],
Shoya Sakamoto[1], Yosuke Nonaka[1], Motohiro Suzuki[3], Koki Takanashi[2], Atsushi Fujimori[1]
E-mail: ishigami@wyvern.phys.s.u-tokyo.ac.jp

There has been increasing demand to decrease the size of and to increase the capacity for magnetic recording media. For this purpose, magnetic materials with perpendicular magnetic anisotropy are necessary to increase the recording density. FePt with the $L1_0$ structure shows particularly strong perpendicular magneto-crystalline anisotropy and is a promising candidate material for high-density magnetic recording media because the magnetic anisotropy constant (K_u) of $L1_0$–ordered FePt reaches as large as 5×10^7 erg/cc. In addition, the degree of $L1_0$ order (S) in the FePt thin films can be controlled by changing the annealing temperature and time [1].

As a general mechanism of magneto-crystalline anisotropy, Bruno [2] has proposed that K_u is proportional to the difference in the orbital magnetic moments between the in-plane and out-of-plane magnetic field directions. Because of the strong hybridization between the Fe 3*d* and Pt 5*d* orbitals, the anisotropy of the orbital moment not only of Fe 3*d* but also of Pt 5*d* electrons will play an important role in their magneto-crystalline anisotropy. Previously, we measured X-ray magnetic circular dichroism (XMCD) of FePt films at the Fe $L_{2,3}$ edge in order to obtain the orbital and spin magnetic moments of Fe 3*d* electrons and the obtained data did not support the Bruno's formura. In the present work, we have measured XMCD at the Pt $L_{2,3}$ edge. Figure 1 shows the m_{spin} and m_{orb} of Pt 5*d* electrons in the FePt thin films with varying degrees of $L1_0$ order, measured for different magnetic-field angles (γ). The difference of m_{orb} between the out-of-plane and in-plane directions is seen to strongly depend on the degree of $L1_0$ order S.

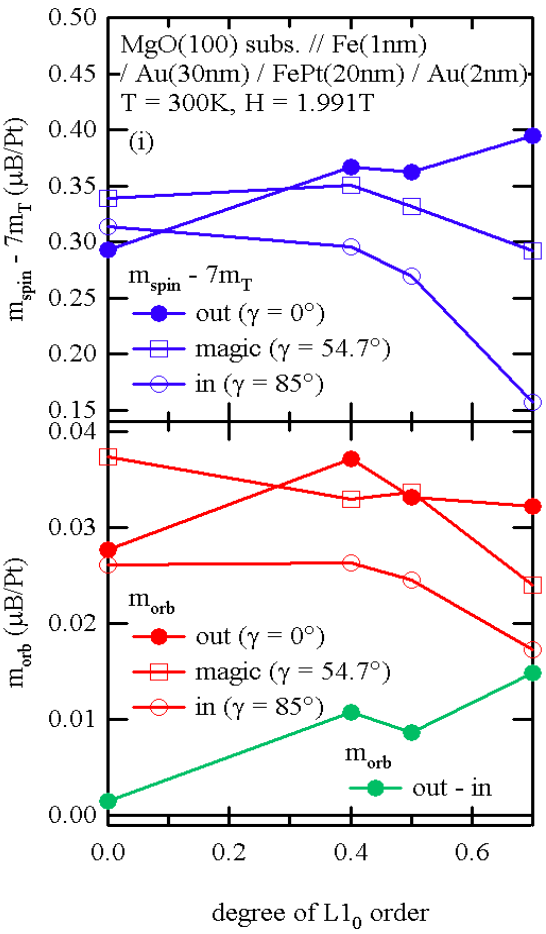

Fig 1. m_{spin} and m_{orb} of Pt 5*d* electrons in FePt thin films with varying degrees of $L1_0$ order (S), measured for different magnetic-field angles (γ).

[1] T. Seki *et al.*, J. Phys. D: Appl. Phys. **44** 335001 (2011).

[2] P. Bruno, Phys. Rev. B **39**, 865 (1989).