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

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

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There has been increasing demand to decrease the size of and to increase the capacity for magnetic recording media. For this purpose, perpendicular magnetic anisotropy is 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 the $L1_0$–ordered FePt reaches as large as $5x10^7$ erg/cc. 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 moment between the in-plane and out-of-plane magnetic field directions. If $L1_0$ ordered FePt thin films follow the Bruno formula, the anisotropy of the orbital moment of Fe 3d electrons plays a key role in their magneto-crystalline anisotropy. We have measured X-ray magnetic circular dichroism (XMCD) of FePt films at the Fe L2,3 edge in order to obtain the orbital and spin magnetic moments for various directions of magnetic field from in-plane to out-of-plane. Figure 1 shows the XMCD intensity as a function of magnetic field direction for the FePt thin films annealed at 600 °C (S = 0.7), 500 °C (S = 0.5), 300 °C (S = 0.4), and un-annealed one (S = 0.0). The behavior of the XMCD intensity is seen to strongly depend on the degree of $L1_0$ order S.

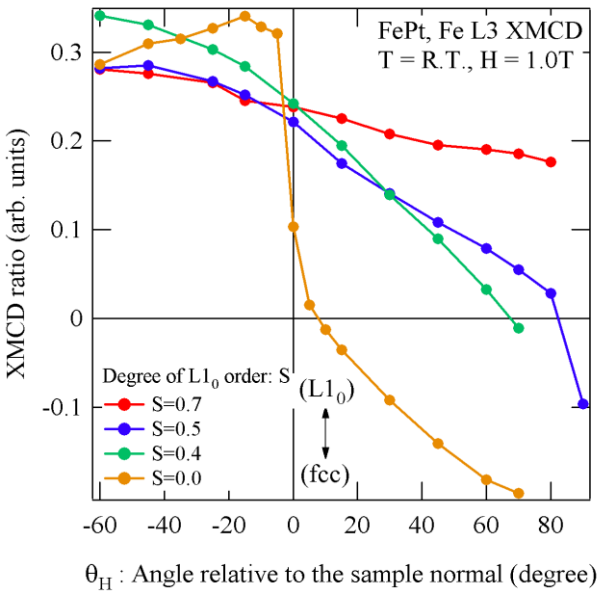

Fig 1. Magnetic field direction dependence of the XMCD intensity of FePt thin films with different degrees of $L1_0$ order.

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

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