Contribution ID : **125** Type : **Invited Oral**

X-ray dichroism studies of magnetic anisotropies in thin films

Wednesday, 15 August 2018 13:00 (60)

Magnetic anisotropy (MA) is one of the most important properties of ferromagnetic materials since it leads to magnetic hysteresis and coercive forces, which are necessary for permanent magnets and information storage devices [1]. MA arises from combined effects of spin-orbit cou-pling (SOC) and anisotropic electronic structure. Soft x-ray dichroism is a powerful method to investi-gate the anisotropic electronic and magnetic states of atoms in solids, at interfaces, and at surfaces, and the effect of SOC on them. Through measurements of x-ray magnetic circular dichroism (XMCD) with varying magnetic field direction including transverse geometry, we have studied the origin of MA in 3d transition-metal oxide ($La_{1-x}Sr_xMnO_3$) thin films whose MA is controlled by epitaxial strain [2], and in 3d transition metal-heavy metal alloy ($L1_0$-ordered FePt) thin films showing strong perpendicular MA [3].

In the transition-metal-oxide thin films, epitaxial strain from the substrate is shown to induce aniso-tropic distribution of spin-polarized electrons [2], which leads to MA through the orbital magnetic moment anisotropy (OMA). As a reverse process of the strain-induced MA, we have detected a field-induced anisotropic electron distribution using x-ray magnetic linear dichroism (XMLD). In the transition metal-heavy metal alloy thin films, the relationship between the MA and OMA, well-known Bruno relationship, is shown to breakdown [3], and the anisotropic distribution (i.e. quadrupole moment) of spin-polarized electrons, which is unrelated with OMA, is shown to make dominant contribu-tions to MA.

This work has been done in collaboration with G. Shibata, K. Ikeda, Y. Nonaka, Y. Takahashi, K. Ishi-gami, T. Harano, T. Kadono, T. Koide, K. Amemiya, M. Sakamaki, Y. Takeda, M. Suzuki, N. Kawamu-ra, T. Seki, K. Takanashi, M. Kitamura, M. Minohara, K. Yoshimatsu, H. Kumigashira and A. Tanaka.

References

[1] M. J. D. Coey, Magnetism and Magnetic Materials (Cambridge, 2009).

[2] G. Shibata, A. Fujimori *et al.*, npj Quantum Mater. **3**, 3 (2018).

[3] K. Ikeda, A. Fujimori *et al.*, Appl. Phys. Lett. **111**, 142402 (2017).

Primary author(s) : Prof. FUJIMORI, Atsushi (University of Tokyo)

Presenter(s) : Prof. FUJIMORI, Atsushi (University of Tokyo)

Session Classification : Plenary

Track Classification : Magnetic Surfaces, Interfaces and Nanostructures