Magnetic properties of thin films controlled by molecular adsorption

Kenta Amemiya
Institute of Materials Structure Science, High-Energy Accelerator Research Organization

Surface and interface magnetic structures of ultrathin films have attracted much interest, since the surface and interface play important roles in the magnetic properties of the whole film. For instance, the magnetic easy axis of Ni films grown on a Cu(100) substrate changes from in plane to perpendicular direction by adsorption of molecular CO on the surface. Thus, the magnetic properties of thin films can be controlled by molecular adsorption.

Although the origin of the adsorption-induced modification in the magnetic structures has been extensively investigated, it is quite difficult to directly study the surface magnetism with conventional techniques such as the magneto-optic Kerr effect and X-ray magnetic circular dichroism (XMCD), because such techniques observe only the average over the whole film. Recently, we have developed a new technique, depth-resolved XMCD, in which the probing depth of the X-ray absorption spectrum is controlled by the electron detection angle as depicted in Fig. 1 [1].

In this contribution, the magnetic depth profile of ultrathin films will be presented after a brief introduction to the depth-resolved XMCD technique. Effects of surface adsorbates such as molecular CO on the magnetic properties of the film will be shown, focusing on the change in the magnetic structure of the surface [2,3].

[1] K.Amemiya *et al*., Appl. Phys. Lett. 84 (2004) 936.
[2] K.Amemiya *et al*., Phys. Rev. B 71 (2005) 214420.
[3] H.Abe *et al*., Phys. Rev. B 77 (2008) 054409.

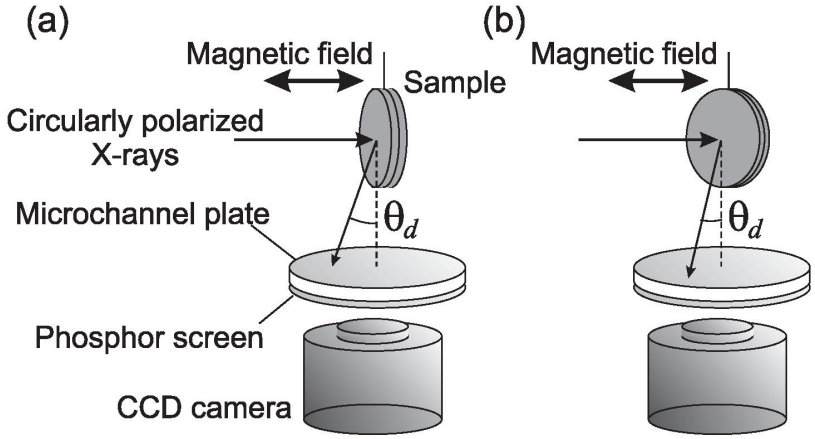

Fig. 1: Schematic diagram of the depth-resolved X-ray magnetic circular dichroism technique at normal (a) and grazing (b) X-ray incidence. The emitted electrons are collected with an imaging type detector at different detection angles, which determine the probing depths.