

## XMCD Measurements at Pt $L_3$ -Edge in Fe-Pt Alloys

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Circularly polarized X-rays are indispensable for measuring X-ray magnetic circular dichroism (XMCD). Diamond phase plate has performance to generate the circularly polarized X-rays with a high-rate and a tunability. Moreover, the phase plate is applicable to the so-called helicity modulation technique [1], by which XMCD can be recorded as modulating the helicity using an appropriate vibrator. In this work, to establish this new technique, Fe-Pt alloys have chosen as a ferromagnetic material because of a large dichroic signal, and angular condition of the phase plate is determined from the XMCD recorded in the usual magnetic field reversing mode.

In the first place, the phase plate was adjusted so as to produce the  $\pi/4$  phase shift at the Pt  $L_3$ -edge. A diamond (111) crystal slab of 0.73 mm in thickness was operated around the 220 reflection in transmission Laue geometry. When offset angle was adjusted to  $\pm 20$  arcsec from the Bragg angle, degree of circular polarization  $P_C$  approximated to  $\pm 1$ . Under this angular condition, i.e., a fixed helicity, XMCD spectrum was recorded in transmission mode, while the direction of magnetic field was reversed.

Figure 1 shows XMCD and XANES spectra at the Pt  $L_3$ -edge in 61.5at%Pt-Fe alloy. The XMCD indicates that Pt  $5d$ -unoccupied states are magnetically polarized and Pt moments are arranged parallel to Fe  $3d$ -moments. The amplitude reaches 8 % just above the edge.

At the peak position of the XMCD spectrum, we measured the dependence of XMCD intensity on the offset angle, which gives us the variation of  $P_C$  as a function of offset angle. Figure 2 shows the XMCD amplitude as a

function of offset angle of the phase plate. This indicates that the helicity can be alternated between the offset angles of  $\pm 20$  arcsec, and a thicker diamond crystal is suitable for a larger offset angle, which will be fairly easy for control the helicity.

This test demonstrates that the diamond phase retarder efficiently functions as a device for alternating the helicity of polarized X-rays.

### References

- [1] T. Ishikawa *et al.*, *Rev. Sci. Instrum.*, **63** (1992)1098.

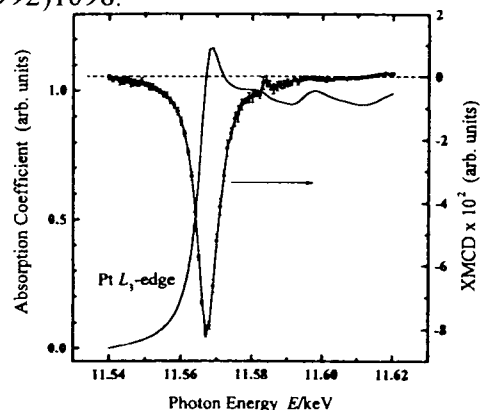


Fig.1. XMCD and XANES spectra at the Pt  $L_3$ -edge in 61.5at% Pt-Fe alloy.

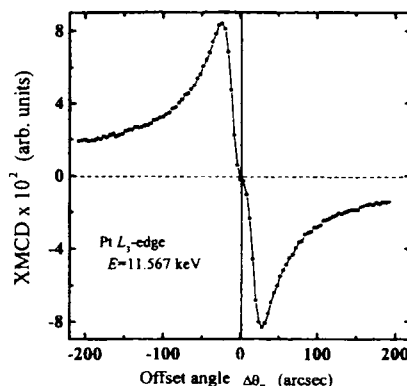


Fig.2. XMCD amplitude as a function of the offset angle.