XMCD Spectrum at Pt $L_{2,3}$-Edges Recorded by Helicity Modulation Technique

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Helicity modulation technique using a diamond λ/4-phase plate has been successfully developed for recording X-ray magnetic circular dichroism (XMCD). We have previously examined feasibility of the phase plate to alternate plus and minus helicities of circularly polarized X-rays, and decided optimum angular conditions to control the polarization state. This technique is realized by a combination of a piezoelectric vibrator for operating the phase plate and a lock-in amplifier for monitoring the XMCD signal. In this report, we briefly present this new technique and XMCD spectrum recorded at the Pt $L_{2,3}$-edges.

A synthetic diamond (111) crystal slab 0.73 mm in thickness was operated around the 220 reflection in transmission Laue geometry. Figure 1 shows the block diagram of this system. A piezoelectric vibrator functioned with 200 Hz for alternating between the offset angles, depending on wavelength, Bragg angle, path length of X-ray, etc., so as to produce a π/4 phase shift. XMCD signal was monitored by a lock-in amplifier. The direction of magnetic field of 0.6 Tesla was fixed and tilted by 45° away from the incident X-ray. Data were accumulated every 0.2 sec at intervals of 1 eV. The pseudobinary $(Cr_{1-x}Mn_x)Pt_3$ ferrimagnetic compounds were used.

Figure 2 shows the Pt L_3- and L_2-edge XMCD spectra, aligned the absorption edge energy, in the compounds with x=0.25 and 0.75. The L_3-edge XMCD is systematically changed from a positive profile to a negative one. This trend is interpreted as an increase of volume fraction of the ferromagnetic $MnPt_3$ in the ferrimagnetic $CrPt_3$. On the other hand, the L_2-edge XMCD always keeps a positive sign, which indicates that the Pt 5*d*-magnetic moments mainly possess orbital character in Cr-rich side. Analysis based on the sum rules is in progress. It should be emphasized that these spectra have improvement in S/N ratio, efficiency, and statistical accuracy in comparison with the early data in 2nd generation SR. Actually, several subsidiary structures have been clearly observed in higher energy side.

It is demonstrated that the technique developed allows us to record XMCD spectrum with a remarkable improvement.

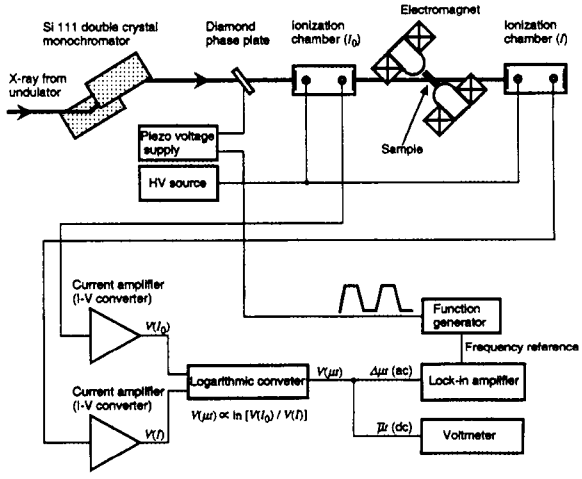

Fig.1. Block diagram of the helicity modulation technique for XMCD.

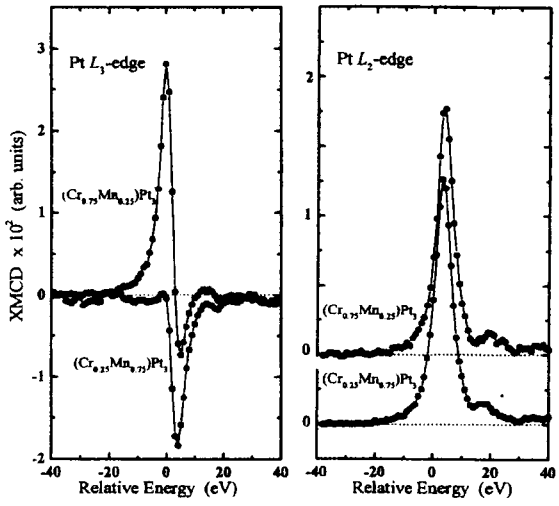

Fig.2. XMCD spectrum at the Pt $L_{2,3}$-edges.