Angler dependent of XMCD study Fe\textsubscript{49.7}Rh\textsubscript{47.4}Pd\textsubscript{2.9} alloy

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Introduction
FeRh alloy has an ordered CsCl structure and undergoes a transition from antiferromagnetic (AF) to ferromagnetic (FM) phase around 350K [1]. This transition has an isotropic Negative Giant Magneto-resistance, and an entropy change without the crystallographic structure change. Therefore a technical application that makes best use of such a characteristics is paid attention now. The transition temperature decreases as replacing small amount of Pd atoms from Rh in FeRh.

XMCD (X-ray Magnetic Circular Dichroism) can separately measure a spin and orbital magnetic moment. These moments are calculated by the orbital and spin sum rules.

In this report, we measure the XMCD spectra and angular dependence of spin and orbital moment of Fe in Fe\textsubscript{49.7}Rh\textsubscript{47.4}Pd\textsubscript{2.9}.

Experimental
The Fe\textsubscript{49.7}Rh\textsubscript{47.4}Pd\textsubscript{2.9} alloy was made Plasma Arc Melting method [2].
The sample was set under a magnetic field of 0.2T along to the X-ray direction. An incident angle of X-ray changes in 0, 5, 10, 20, 30, 40, and 45 degrees. The measured temperature is room temperature and 50 ℃. To obtain XMCD spectra, the magnetic field was switched alternatively. The absorption coefficient is obtained by the electron yield method. Fe L\textsubscript{III} and L\textsubscript{II}-edge XMCD measurements were carried out at BL-7A and BL-11A.

Results and discussion
XMCD orbital and spin sum rules of transition from 2p to nd show as follows [3] [4]:

\[
m_{spin} + m_{orb} = 2 \int_{LIII} (\mu_s - \mu) d\omega - 2 \int_{LII} (\mu_s - \mu) d\omega + \frac{1}{3} \int_{LIII+LII} (\mu_s + \mu) d\omega \]

\[
m_{orb} = - \frac{1}{3} \int_{LIII+LII} (\mu_s + \mu) d\omega - \frac{1}{3} \int_{LII} (\mu_s - \mu) d\omega + \frac{1}{3} \int_{LIII} (\mu_s - \mu) d\omega \]

where \( m_{spin} \) and \( m_{orb} \) is spin and orbital magnetic moment, \( m_s \) being in proportion to anticipated value of inner atomic magnetic dipolar operator, \( n_h \) is hole number, and \( \mu_s \) is Bohr magneton

Figure 1 shows spin magnetic moment at room temperature and 50 ℃ as a function of the sample angle. Here, Fe\textsubscript{49.7}Rh\textsubscript{47.4}Pd\textsubscript{2.9} is polycrystal and term of \( m_t \) can be neglected.

From this figure, the result at room temperature is almost same 50 ℃. The spin magnetic moment seems to increase as the sample angle.

Figure 2 shows the orbital magnetic moments at room temperature and 50 ℃ as a function of the sample angle. The orbital moment also seems to slightly increase as the angle. Spin moment is almost ten times larger than the orbital moment at two temperatures.

References