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XMCD study for $Fe_{49.7}Rh_{47.4}Pd_{2.9}$ 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 350 K [1]. This transition has an isotropic volume expansion, Giant Negative Magneto-resistance, and an entropy changes without the crystallographic structure change. Therefore, a technical application that makes best use of such a characteristic 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 rule.

In this report, we measure the XMCD spectrum and apply the sum rule to ratio of Fe L_{III}-edge and L_{II}-edge in Fe and $Fe_{49.7}Rh_{47.4}Pd_{2.9}$

Experimental

The measured samples are Fe and $Fe_{49.7}Rh_{47.4}Pd_{2.9}$ alloy. The $Fe_{49.7}Rh_{47.4}Pd_{2.9}$ alloy was made by the Plasma Arc Melting method.

An incident angle of X-ray is 45 degree. The sample was set under a magnetic field in 0.2T along to the X-ray direction. To obtain both circularly polarized lights, the magnetic field is switched. The absorption coefficient is obtained by the electron yield method. Fe L_{III}-edge and L_{II}-edge XMCD measurements were carried out at BL 7A and BL 11A.

Results and discussion

Figure 1 shows the absorption coefficient around Fe L_{III}-edge and L_{II}-edge in Fe and $Fe_{49.7}Rh_{47.4}Pd_{2.9}$. The absolute values of these peaks for $Fe_{49.7}Rh_{47.4}Pd_{2.9}$ is higher than that for both circularly polarized lights.

Figure 2 shows XMCD spectra in Fe and $Fe_{49.7}Rh_{47.4}Pd_{2.9}$, which are obtained by subtraction each circularly polarized light.

Table 1 shows the integration value of the Fe L_{III}-edge (A) and L_{II}-edge (B) which are calculated from XMCD spectra. The magnetic moment of Fe atom in Fe and $Fe_{49.7}Rh_{47.4}Pd_{2.9}$ are also shown. And further the ratio of the integration values and the magnetic moments are presented.

The ratio of Fe and $Fe_{49.7}Rh_{47.4}Pd_{2.9}$ is 1.68 for A. On the other hand, that is 1.58 for B. And the ratio of Fe and $Fe_{49.7}Rh_{47.4}Pd_{2.9}$ of magnetic moment is 1.59. According to these data, we can confirm ratio of A and B can be approximate to magnetic moment ratio.

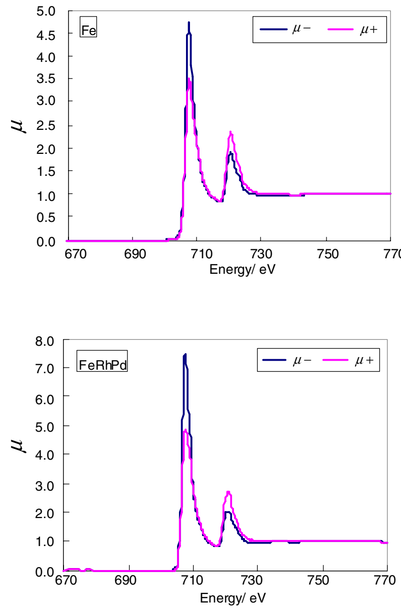

Figure 1: X-ray absorption spectra for Fe L_{III}-edge and L_{II}-edge for Fe and $Fe_{49.7}Rh_{47.4}Pd_{2.9}$.

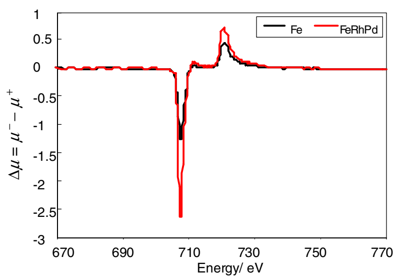

Figure2: XMCD spectra for Fe and $Fe_{49.7}Rh_{47.4}Pd_{2.9}$.

Table 1: Integration values of the Fe L_{III}-edge(A) and L_{II}-edge(B) obtained from XMCD spectra. And ratio of Fe and $Fe_{49.7}Rh_{47.4}Pd_{2.9}$ for A, B and magnetic moments are also presented.

	A	B	magnetic moment/μB
Fe	−2.92	2.14	2.20
Fe in FeRhPh	−4.91	3.38	3.30
FeRhPh/Fe	1.68	1.58	1.50

References

[1] J. S. Kouvel and C. C. Hartelius, *J. Appl. Phys.* **33**(1962)1343.