Neutron Diffraction Studies on a Dy7Rh3 Single Crystal

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The rare earth compound Dy7Rh3 crystallizes in the hexagonal Th7Fe3 type structure with the space group P63mc. From the magnetic measurements, it was shown that the compound possesses the two magnetically ordered states, an antiferromagnetic one between TN = 59 K and TC = 34 K and a ferrimagnetic or canted one below TC[1]. We have also determined the magnetic propagation vector of k = (0 0 0.366) in the ferrimagentic phase by the powder neutron diffraction[2]. In this study, more detailed neutron diffraction measurements have been carried out on a Dy7Rh3 single crystal in the a* - c* reciprocal plane using the HQR spectrometer of JRR-3M in the temperature range from 10 to 70 K.

Fig.1(a) shows the magnetic and nuclear reflections in the a* - c* reciprocal plane at 10 K. The magnetic reflections appear at the positions indexed by the propagation vector k = (0 0 0.375). Since a small spontaneous magnetization was observed both along the c-axis and in the c-plane, the conical or canted magnetic structure is proposed. Fig.1(b) shows the integrated intensity of the magnetic reflection (0 0 0)+ and the z component of the propagation vector k as a function of temperature.The integrated intensity shows a peak at about 20 K and an anomaly at TC, while the kz is almost constant with temperature up to TN. In the intermediate antiferromagentic state above TC, the positions of magnetic reflections are almost the same as that in the lower temperature phase. The absence of magnetic component at the nuclear positions may be explained by the fact that the spontaneous magnetization is only 0.1 Bohr magneton below TC. Magnetic structure analysis for the two magnetic phases is in progress using a Rietveld method.

[1]T. Tsutaoka et al., J. Phys. Soc. Jpn. 70 (2001) 199.

[2]T. Tsutaoka et al., Activity Report on Neutron Scattering Research Vol. 13 (2005).

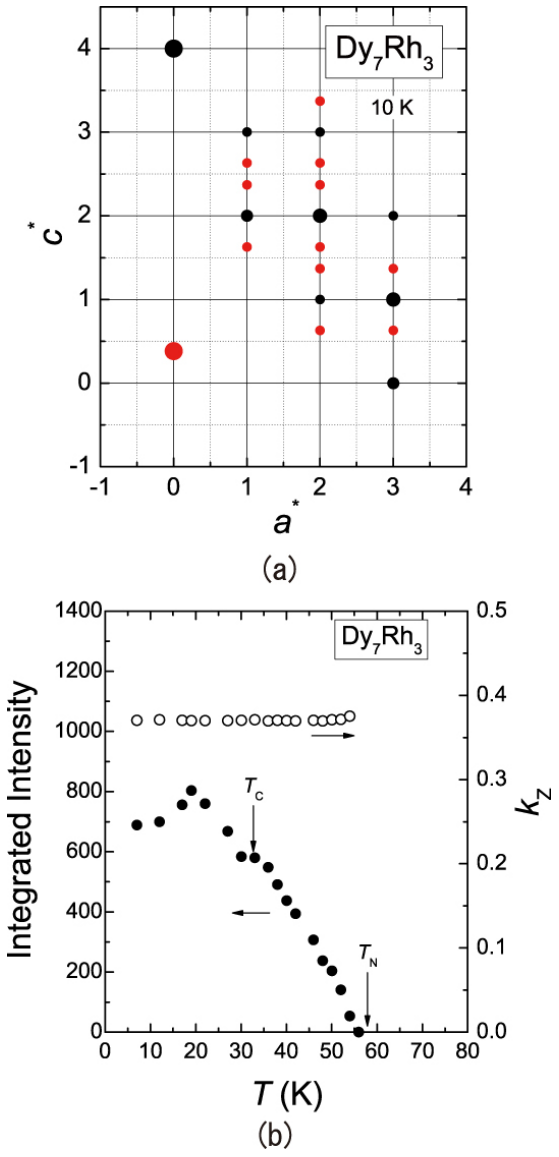

Fig. 1. Magnetic and nuclear reflections in the a* - c* reciprocal plane at 10 K (a); the integrated intensity of the (0 0 0)+ reflection and kz component of the propagation vector as a function of temperature(b).