Chiral Helimagnetic Order in T1/3NbS2 (T=Cr, Mn)

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Systematic understanding of the interplay between a crystallographic structure and magnetic order is an important issue in the field of magnetism. In particular, the magnetic chirality triggered by crystallographic chirality has been discussed as a long-standing problem. An intercalate system of 2H-NbS2 type chiral crystal structure T1/3NbS2 (T = transition metal) has been paid attention as a candidate of chiral helimagnetic compounds. It shows a variety of magnetic order; paramagnetic (T = Ti, V), ferromagnetic (T = Mn) and antiferromagnetic (T = Fe and Co). Cr1/3NbS2 shows an magnetic anomaly at around Tc ˜ 130 K and small-angle neutron scattering experiments show helimagnetic ordering.[1] While neutron diffraction in Mn1/3NbS2 shows ferromagnetic, magnetization shows a magnetic anomaly as observed in Cr1/3NbS2.[2] Angle resolution of thermal neutron diffraction experiments is not high enough to separate fundamental Bragg peaks and magnetic satellite peaks. Therefore, Mn1/3NbS2 may be misinterpreted as a ferromagnetic ordering.

To examine the helimagnetic ordering in Cr1/3NbS2 and Mn1/3NbS2, we performed small angle neutron scattering experiments at SANS-U, a small-angle neutron scattering instrument with a 64 cm-wide position sensitive area detector, installed at JRR-3M, Tokai, Japan. The wavelength of incident neutron beam was 11 A. The data was taken by using powder samples. The magnetic satellite peak was detected by subtracting the room temperature data from the low temperature data, though the intensity at lower q position is negative value due to failing to subtracting paramagnetic scattering. Fig. 1 shows the observed magnetic peak position q and magnetic peak intensities. We succeed in observing the magnetic satellite peak, which indicates helimagnetic ordering with the pitch of 420 A for Cr1/3NbS2 and 700 A for Mn1/3NbS2. Therefore, the magnetic ordering in Mn1/3NbS2 is not ferromagnetic, but helimagnetic.

[1] T. Miyadai et al.: J. Phys. Soc. Jpn. 52 (1983) 1394.
[2] Y. Kousaka et al.: Nucl. Instr. and Meth. A 600 (2008) 250.

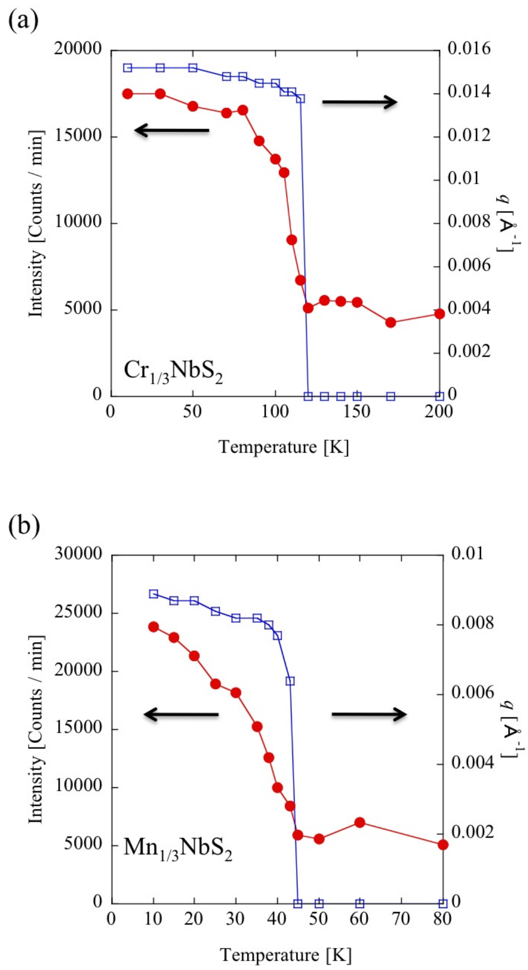

Fig. 1. Magnetic peak position q and the peak intensity in (a) Cr1/3NbS2 and (b) Mn1/3NbS2