Magnetic structure analisys of incommensurate phase in multiferroic $R\mathrm{Mn_2O_5}$

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$R\mathrm{Mn_2O_5}$ shows a colossal magneto-electirc effect in which magnetization is induced by electric field or inversely electric polarization is induced by magnetic field. The key ingredient in the CME effect is *multiferroics* in which (anti)ferromagnetic and ferroelectric orders coexist and connect with each other. It has been experimentally shown that this system shows successive magnetic transitions of incommensurate–commensurate–incommensurate phases with decreasing temperature, where the bulk electric polarization is induced only in the commensurate phase. However, the relation between the microscopic magnetism (magnetic structure) and bulk dielectrics in this system has been not fully understand yet. We thus performed magnetic structure analyses using single crystals for the low temperature incommensurate phase to compare the magnetic structure of the incommensurate phase with that of the commensurate phase solved previously.

The measurements were performed at four circle neutron diffractometer FONDER installed at T2-2 beam port in JRR-3M. In this report, we introduce the results only for $\mathrm{YMn_2O_5}$. Integrated intensities of magnetic reflections were collected at $T = 7.5$ K. Total number of observed magnetic reflections are more than 200 including zero intensity. Note that the averaged crystal structure at $T = 7.5$ K was also solved successfully to obtain the absolute quantities of magnetic structure factor. Since the incommensurate magnetic peaks are located at $\pm q_M = (1/2 \pm \delta_x\, 0\, 1/4 - \delta_z)$, the reciprocal scan along Q_x was carried out, which can integrate a pair of magnetic peak intensities accurately. Figure 1 shows observed structure factors as absolute quantity in $(h\ 1\ l)$ zone taken at (a); 25 K (commensurate phase) and (b); 7.5 K (incommensurate phase). It is seen that the distribution of amplitude for the structure factor at incommensurate phase is similar but is not completely same as that at commensurate phase, indicating that the magnetic structure in the incommensurate phase is different from that in the commensurate phase. Detailed structure analysis is in progress.

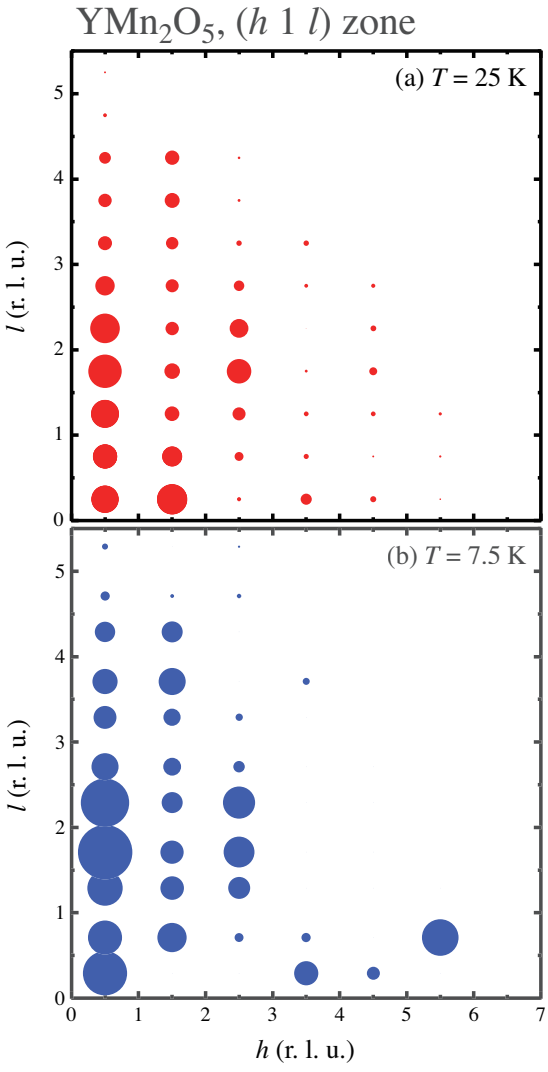

Fig. 1. Observed magnetic structure factors in $(h\,1\,l)$ zone at (a); 25 K (commensurate phase) and (b); 7.5 K (incommensurate phase).