

Electric polarization flop induced by magnetic phase transition in multiferroic YbMn_2O_5

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A rare-earth (R) manganite of RMn_2O_5 is one of the typical multiferroic materials, which has been extensively studied[1]. However the origin of ferroelectricity is not yet fully understood. We have recently found in TmMn_2O_5 the flop of electric polarization from b -axis to a -axis around 5 K with decreasing temperature[2], which is the first discovery of a -polar phase in RMn_2O_5 system. It was reported previously that the polarization along b -axis disappear below ~ 6 K in YbMn_2O_5 [3]. This is a suggestive result being expected the polarization flop from b - to a -axis below ~ 6 K. We thus carried out neutron diffraction measurements and magnetic structure analysis to clarify the microscopic magnetism in YbMn_2O_5 .

Microscopic magnetic properties were measured using AKANE spectrometer. The results show that all the magnetic phases which successively occur with decreasing temperature are incommensurate and there is no commensurate magnetic order at all in YbMn_2O_5 unlike the other RMn_2O_5 families. Fig. 1(a) shows the magnetic Bragg peak profiles around $Q = (2.55\ 4\ 0.265)$ taken at 2.5 K and 7 K, showing the change of Bragg peak intensity. This indicates that the magnetic phase transition takes place between 2.5 K and 7 K. We measured the electric polarization of this material and found that, as shown in Fig. 1(b), the polarization flop from b - to a -axis occurs below ~ 6 K, indicating the strong relevance between the direction of electric polarization and the magnetic structure. To clarify the microscopic origin of this polarization flop, we have performed magnetic structure analysis in both b -polar phase and a -polar phase using

FONDER diffractometer. A sufficient number of the integrated intensities of magnetic Bragg peaks were successfully measured at both the phases. The magnetic structure analysis is now in progress.

References

- [1] N. Hur *et al.*: Nature **429** (2004) 392.
- [2] M. Fukunaga *et al.*: JPSJ **77** (2008) 094711.
- [3] Y. Koyata *et al.*: JPSJ **65** (1996) 1383.

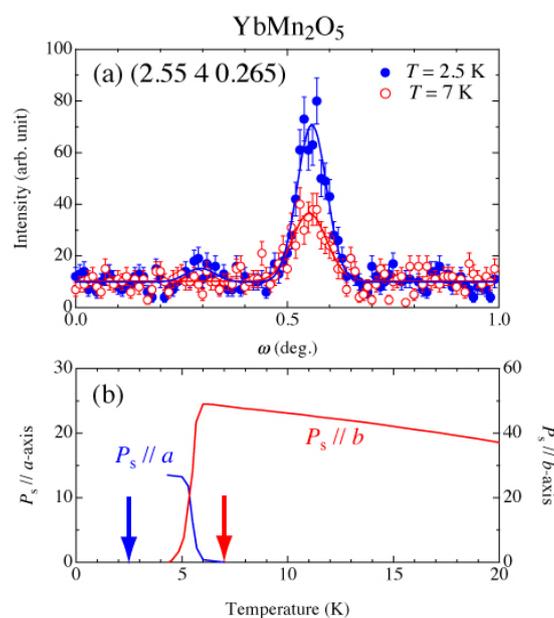


Fig. 1. (a) Peak profiles of magnetic Bragg reflection around $(2.55\ 4\ 0.265)$ of YbMn_2O_5 taken at 2.5 K and 7 K. (b) Spontaneous electric polarization measured along a - and b -axes as a function of temperature.