マルチフェロイックMn酸化物薄膜の硬・軟X線回折

Hard and soft x-ray diffraction studies of multiferroic Mn-oxide thin films

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Rare-earth manganites with orthorhombically distorted perovskite structure, RMnO$_3$ with R being a trivalent rare-earth ion, have been subject to intensive studies since the multiferroic phases were found in some of these materials. Recently it has become possible to grow a single crystal film of orthorhombic YMnO$_3$ and DyMnO$_3$ by choosing (010) planes of YAlO$_3$ as a substrate [1]. We already succeeded in determining the magnetic structures of YMnO$_3$ thin films [2], and are continuing to study DyMnO$_3$ thin films. Figure 1 (a) shows the temperature dependence of the magnetic (0, ~0.5, 0) peak of the DyMnO$_3$ thin film. One can see temperature-dependent incommensurabilities, showing the existence of cycloidal magnetic structures. From the azimuthal-angle dependence, we conclude that the magnetic peak comes from the c-axis spin components due to the spin canting along c. From the peak intensity as a function of temperature in Fig. 1 (b), the peak appears around ~ 40 K, and the intensity increases around ~ 30 K, suggesting another phase transition.

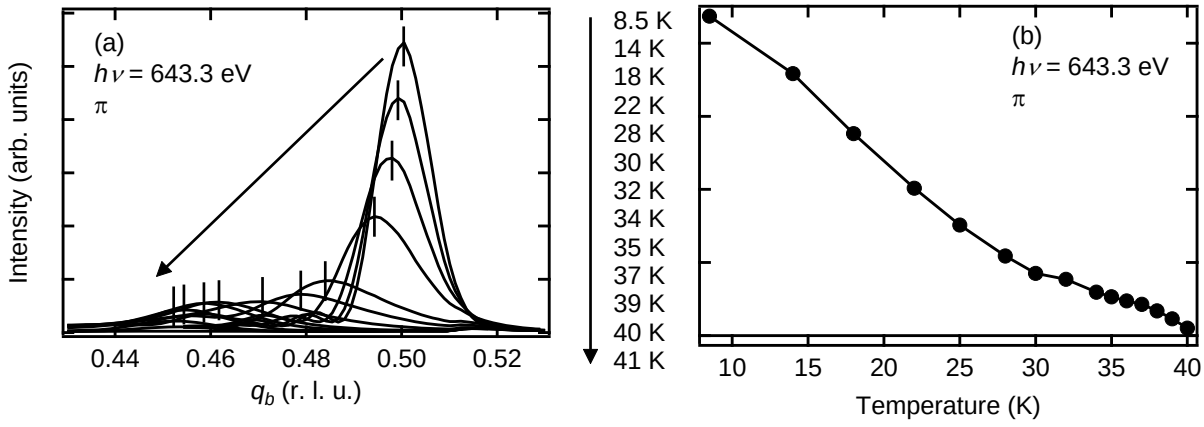

Fig. 1: Temperature dependence of the magnetic (0, ~0.5, 0) peak of the DyMnO$_3$ thin film (a) and the peak intensity as a function of temperature (b).

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[1] M. Nakamura et al., Appl. Phys. Lett. 98, 082902 (2011).
[2] H. Wadati et al., Phys. Rev. Lett. 108, 047203 (2012).