Magnetic Order of magnetoplumbity-type cobalt oxide $SrCo_{12}O_{19}$

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Various physical properties of cobalt oxides has been intensively investigated, which comes from the variety of the electronic states for Co ions. 2+, 3+, and 4+ are stable for the valence of Co ions in oxides. Additionally, the Co^{3+} ions surrounded by oxygen ions octahedrally can take two different electronic configurations, high-spin state (S = 2) and low-spin state (S = 0). $SrCo_{12}O_{19}$ has the magnetoplumbite-type crystal structure as shown in Fig. 1(a) [1]. There are 5 equivalent sites for Co ions in the unit cell. From the bond-valence sum analysis, the valence of the Co ions in Co(3) and Co(4) sites is predicted to be 3+ and 2+, respectively [1]. On analogy of $SrCo_6O_{11}$ [2], the Ising-like character is expected for the spins of the Co(3) ions. The uniaxial colossal magnetoresistance was observed in the insulating phase [3]. Ishiwata *et al*. suggests that the origin of the magnetoresistance is that the charge order in the conduction paths, which is formed by the Co(1), Co(2), and Co(5) sites, is destabilized by the applied field [3]. The magnetic susceptibility has a sharp increase in the case that the magnetic field is perpendicular to the crystallographic c axis at 80 K [3]. It suggests the magnetic long-range order. The magnetic structure should be investigated to clarify the origin of the magnetoresistance. Neutron diffraction experiment was performed on High-Intensity Powder Diffractometer WONBAT installed at ANSTO. We used the orange cryostat for achieving low temperature. The PG filter is located in front of the sample. We used 0.9 g of the sample. We chose the neutron wavelength of 2.41 Å. Figure 1(b) shows the neutron diffraction patterns at 1.5 and 100 K. We observed the magnetic peaks indexed by (004), (101), (103), (006) or (104), and (105). It suggests that the magnetic propagation vector k_{mag} is (0, 0, 0). The temperature dependence of the integrated intensity for the magnetic (101) peak is shown in Fig. 1(c). The peak intensity gradually increases with increasing temperature below 80 K, which is the magnetic transition temperature determined by the magnetic susceptibility. It indicates that these magnetic peaks are intrinsic. The magnetic structure analysis is still in progress. [1] S. Ishiwata *et al*., J. Solid State Chem. **181**, 1273 (2008). [2] S. Ishiwata *et al*., Phys. Rev. Lett. **98**, 217201 (2007). [3] S. Ishiwata *et al*., Phys. Rev. B **83**, 020401 (2011).

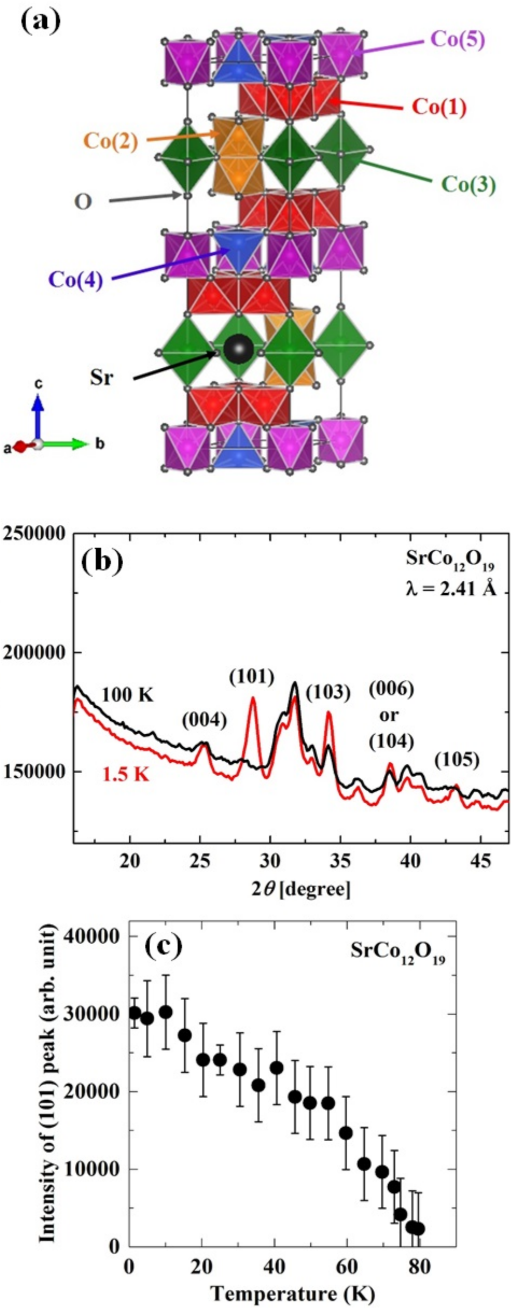

Fig. 1. (a) Crystal structure of $SrCo_{12}O_{19}$. (b) Neutron diffraction patterns at 1.5 and 150 K. (c) Temperature dependence of the integrated intensity for (101) magnetic peak.