Structure-related thermoelectric properties of $SrNbO_{3.4}$

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Low-dimensional materials can be a good thermoelectrics owing to their reduced thermal conductivity by phonon scattering and the enhanced thermopower by steep change in density of states at the Fermi level. We have studied quasi-one -dimensional (Q1D) Hollandite $Ba_{1.2}Rh_8O_{16}$ and found large power factor of 30 μW/cmK^2 at 75 K comparing with that seen in Na_xCoO_2 at 300 K [1].

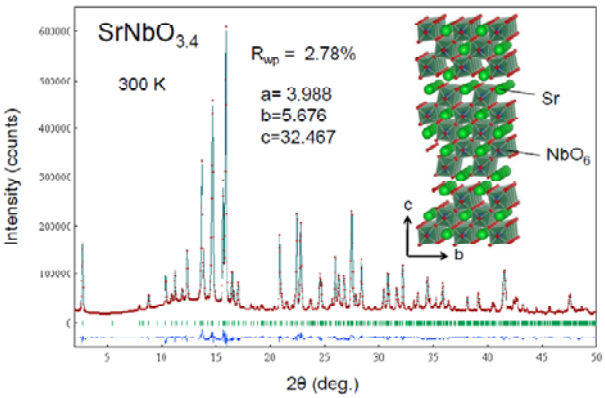

Fig. 1 X-ray powder diffraction pattern of $SrNbO_{3.4}$ at 300 K

$SrNbO_{3.4}$ with $Nb^{4.8+}$ ($4d^{0.2}$) is known to be a good Q1D conductor [2]. $SrNbO_{3.4}$ (n=5) belongs to homologous series of $Sr_nNb_nO_{3n+2}$, and is derived from the three-dimensional network of $SrNbO_3$ perovskite structure by separating the NbO_6 octahedra parallel to the (110) planes and introducing additional oxygen. (see the inset of Fig. 1) We have grown single crystals of $SrNbO_{3.4}$ and investigated structure-related thermoelectric properties performing synchrotron x-ray diffraction measurement.

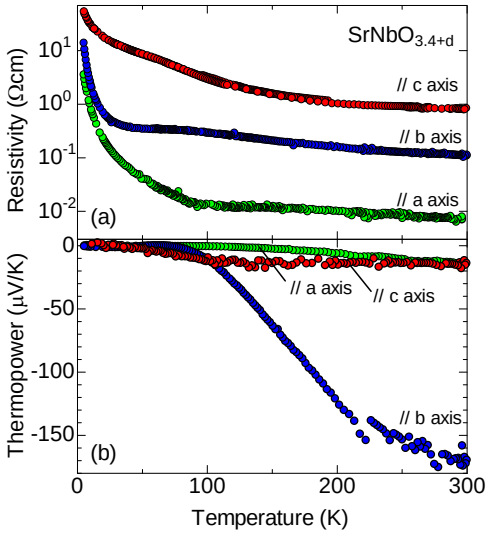

Fig. 2 (a) Resistivity and (b) thermopower of $SrNbO_{3.4}$

As shown in Fig. 2(a), the resistivity is found to be 7, 110, and 840 mΩcm for the *a*, *b*, and *c* axes, respectively showing the anisotropy of ~15 in the *ab* plane. The thermopower along *b* axis is -150 μV/K, which is one order of magnitude larger than those of -15 and -25 μV/K along *a* and *c* axes. In particular, the anisotropy in the thermopower appears at around 100 K, which relates to change of activation energy of the resistivity shown in Fig. 2(a). We will discuss a possible origin of the huge anisotropy in the thermopower showing the temperature dependence of lattice parameters and atom positions.

[1] W. Kobayashi et al., Phys. Rev. B 79, 085207 (2009).

[2] C. A. Kuntscher et al., Phys. Rev. Lett. 89, 236403 (2002).