New Approach in Exploration of Oxide Thermoelectrics

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As it is difficult to control an electronic system and a phonon system simultaneously in a single crystal field, a complex crystal composed of more than two sub-lattices (nano blocks) with different compositions and crystal symmetries (we call it a "hybrid crystal") is considered to be effective to control electron transport and phonon transport separately in order to cooperatively enhance the total thermoelectric conversion efficiency From this point of view, we attempted to look at the Ruddlesden-Popper homologous series, $Sr_{m+1}Ti_{m}O_{3m+1}$, that have layered perovskite structures in which SrO and $(SrTiO_3)_m$ layers are alternately stacked sequentially These oxides can be regarded as natural superlattices, and therefore sub-lattice interfaces are expected to scatter phonons to suppress thermal conduction and hence to improve thermoelectric performance In fact, thermoelectric measurements for ceramic samples have shown that electrical conductivity and thermopower of a layered perovskite polycrystal were similar to those of a STO polycrystal, while its thermal conductivity was about 30% lower than that of STO This result firmly indicates that superlattice formation is really effective to reduce thermal conductivity, hence improving total energy conversion efficiency