Low-Temperaure Thermoelectric Properties for Single Crystals of the Electron-Doped Perovskites $Sr_{1-x}Ca_xTi_{1-y}Nb_yO_3$

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Electron-doped perovskite $SrTiO_3$ is known to be one of candidates for a good n-type thermoelectric (TE) oxide[1]. In this study, we have tried to improve the TE property of the lightly-electron-doped $SrTiO_3$ single crystal below room temperature by the substitutions of Ca and Nb for Sr and Ti[2]. We found that $SrTi_{0.99}Nb_{0.01}O_3$ shows a large power factor of about 90 $\mu W/K^2$ cm at 50 K and the largest dimensionless TE figure-of-merit ($ZT \sim 0.07$) below 60 K among the ever reported materials, which are perhaps due to the distinct electron-phonon interaction. On the other hand, the Ca^{2+} substitution for Sr^{2+} increases the ZT at 300 K for $Sr_{1-x}Ca_xTi_{0.97}Nb_{0.03}O_3$ from about 0.08 to about 0.105. The enhancement of ZT originates not only in a large reduction of a thermal conductivity due to an introduced randomness into the crystal structure and an induced structural transition, but also in an unexpected enhancement of Seebeck coefficient by the Ca substituiton.

[1]T. Okuda, *et al.*, Phys. Rev. B **63**, 113104 (2001).
[2]J. Fukuyado, *et al.*, in preparation.