Thermoelectric properties of carrier-doped *R*ZnSbO and $SrMnO_3$

Y. Taguchi[1], T. Suzuki[1], H. Sakai[1], M. S. Bahramy[1], R, Arita[1,2], and Y. Tokura[1,2,3]

[1]*Cross-Correlated Materials Research Group (CMRG) and Correlated Electron Research Group (CERG), RIKEN Advanced Science Institute, Wako 351-0198, Japan*

[2]*Department of Applied Physics, University of Tokyo, Tokyo 113-8656, Japan*

[3]*Multiferroics Project, ERATO, JST, Tokyo 113-8656, Japan*

One of the important issues in exploring good thermoelectric materials is to find an effective way to control and optimize the carrier density without reducing mobility of the carriers. In this talk, we would like to discuss two attempts for that purpose. One is to use layer-structured materials where conduction layer and charge reservoir layer are spatially separated and stacked alternately. The other is to utilize the strong screening effect of dopant ions in materials in the vicinity of ferroelectric instability.

The material belonging to the first category is *R*ZnSbO (*R*= La and Ce) with the same structure as the Fe-based superconductors. We have succeeded in doping holes into the ZnSb layer by partially substituting Sr or Ca for the *R*-site, and controlling the hole density without reducing the mobility [1]. The dimensionless figure of merit *ZT* continues to increase without showing any sign of saturation upto 390 K, which is the highest temperature of our measurement, and the maximum value is approximately 0.03 for 5% carrier density in polycrystalline samples. For single-crystalline specimen, even higher ZT values would be expected.

The second material is $SrMnO_3$ with the perovskite structure [2]. The electron-doped $CaMnO_3$ are well known as good *n*-type thermoelectric materials at high temperatures [3]. Analogous compound $SrMnO_3$ is more close to the ferroelectric instability, and thus possesses large dielectric constant around 110. Therefore, we expected more effective screening of the impurity potential in $SrMnO_3$ than in $CaMnO_3$, and hence higher mobility. However, due to the stronger Jahn-Teller effect operating in the cubic structure, the resistivity does not show much decrease upon electron doping by partially substituting Mo for Mn. The maximum *ZT* value obtained for $Sr(Mn_{1-x}Mo_x)O_3$ is 0.003 (for $x = 0.025$) in the temperature range below 390 K.

This work was in part supported by Funding Program for World-Leading Innovative R&D on Science and Technology on “Quantum Science on Strong Correlation” from JSPS.

[1] T. Suzuki, M. S. Bahramy, R. Arita, Y. Taguchi, and Y. Tokura, Phys. Rev. B 83, 035204 (2011).

[2] T. Suzuki, H. Sakai, Y. Taguchi, and Y. Tokura, J. Elect. Mat. (2011).

[3] I. Matsubara, R. Funahashi, T. Takeuchi, S. Sodeoka, T. Shimizu, K. Ueno, Appl. Phys. Lett. 78, 3627 (2001)