Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Small-polaron transport and thermoelectric properties of the misfit-layer composite $(BiSe)_{109}TaSe_2/TaSe_2$ JIN-HEE KIM, YOO JANG SONG, JONG-SOO RHYEE, Kyung Hee Univ - Suwon Campus, BONG-SEO KIM, SU-DONG PARK, Korea Electrotechnology Research Institute, HYEUNG JIN LEE, JAE-WOOK SHIN, SK Innovation — We studied the thermoelectric properties of the composite of misfit-layered compounds $(BiSe)_{109}TaSe_2$ and $TaSe_2$. The x-ray diffraction pattern on the cross-sectional plane of the sintered body shows a preferred orientation of the $(00l)$ direction for $(BiSe)_{109}TaSe_2/TaSe_2$ indicating anisotropic alignment during hot pressing. Because of the crystallographic alignment, the temperature-dependent electrical resistivity $\rho(T)$, Seebeck coefficient $S(T)$, and the thermal conductivity $\kappa(T)$ exhibit in-plane and out-of-plane anisotropic transport behavior. The Seebeck coefficient is very low because of the coexistence of electron and hole mixing, as confirmed by the two-carrier model. The lattice thermal conductivity $\kappa_L$of the covalent bonding layer (in-plane) is lower than those of the layer with van der Waals bonding (out-of-plane) implying the existence of a charge density wave along the in-plane. We observed a sign anomaly of the positive Hall coefficient R_H and negative Seebeck coefficient S. According to Holstein's small-polaron model, the sign anomaly may come from the odd number of small-polaron hopping sites.

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Date submitted: 13 Nov 2013 Electronic form version 1.4