Thermoelectric power in multilayered massless Dirac Fermion system $\alpha$-(BEDT-TTF)$_2$I$_3$

Ryuichi Kitamura, Yutaka Nishio, Naoya Tajima, Koji Kajita, Reizo Kato$^1$, Masafumi Tamura$^2$ and Toshio Naito$^3$

Department of Physics, Toho University, Miyama 2-2-1, Funabashi-shi, Chiba JP-274-8510, Japan
$^1$RIKEN, Hirosawa 2-1, Wako-shi, Saitama JP-351-0198, Japan
$^2$Department of Physics, Faculty of Science and Technology, Tokyo University of Science, Noda, Chiba 278-8510, Japan
$^3$Division of Chemistry and Biology, Graduate School of Science and Engineering, Ehime University, Matsuyama 790-8577, Japan

e-mail address 6411006k@nc.toho-u.ac.jp

$\alpha$-(BEDT-TTF)$_2$I$_3$ is the first bulk material with a zero-gap energy band structure. It realizes the two-dimensional massless Dirac fermion system under high pressure. We have studied the thermoelectric power (TEP) of an $\alpha$-(BEDT-TTF)$_2$I$_3$ system in a zero-gap state (ZGS) under high hydrostatic pressure.

Figure 1 shows the Seebeck coefficient under hydrostatic pressures from 0.2 to 1.0 GPa. Under 0.2 GPa, it gradually decreases from room temperature as decreasing temperature. It shows a small peak at the transition temperature $T_{MI} = 135$ K, and decreased rapidly immediately below $T_{MI}$. With increasing pressure, we found that the transition temperature drops down to 50 K at 1.0 GPa. Above 1.3 GPa, the small peaks and rapid reduction vanish. The Seebeck coefficient shows a broad hump at 50 K and a slow reduction below 30 K. We found that M-I transition accompanied by charge ordering is suppressed, and the ZGS is stabilized above 1.3 GPa.

![Graph of Seebeck coefficient S vs temperature T under hydrostatic pressures from 0.2 to 1.3 GPa.](image)

Fig.1 Temperature dependence of Seebeck coefficient $S$ under hydrostatic pressures from 0.2 to 1.3 GPa.