4th International Symposium on
Energy Challenges & Mechanics
- working on small scales

11-13 August 2015
Aberdeen, Scotland, UK

Anisotropic electrical and thermal transport properties of layered compound In_2Te_5 single crystal

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Accepted for publication on 25th April 2015

Over the past decade, thermoelectric materials have been great interest because of their direct solid state energy conversion between waste heat to power generation and electricity to electronic refrigeration [1-3]. The performance of thermoelectric materials can be quantify by the dimensionless figure of merit ZT= S^2T/ρ (κ_{lat} + κ_e). Here S is the thermopower, ρ is the electrical resistivity, κ_{lat} is the lattice thermal conductivity, κ_e is the electronic thermal conductivity and T is the absolute temperature. We analyze the anisotropic electrical and thermal transport measurements in a single crystal of In_2Te_5 with the temperature gradient assigned || and $\perp$ to the crystallographic *c*-axis of the crystal in the temperature range 5 K to 390 K. The $\kappa_{||}$ was found to be very low about two fold less than the $\kappa_{\perp}$ to the *c*-direction over the whole temperature range, while the thermopower $S_{||}$ to the *c*-direction was found to be higher than its value for $S_{\perp}$. These combined effects improves figure of merit ZT. $ZT_{\|}$ is about four fold higher than the $ZT_{\perp}$ around 270 K. These improvements can be taken as an indication that the corresponding low dimensional counterpart of In_2Te_5 (viz., thin films, nanowires) with specific growth direction could act as promising thermoelectric materials.

Keywords: Anisotropy, Single crystal, Seebeck Coefficient, Thermal Conductivity, layered structure

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