Thermoelectric properties of single-crystalline InTe

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Résumé

In the recent decade, thermoelectricity has become a forefront, green technology in capturing the waste heat to generate electrical power. The binary InTe compound has emerged as an interesting thermoelectric material with a high dimensionless thermoelectric figure of merit ZT of 0.9 at 600 K in polycrystalline samples.1 One of outstanding properties is the extremely low lattice thermal conductivity reaching _˜ 0.3 – 0.4 W m-1 K-1 at 600 K.1,2 Despite numerous reports on the electronic properties measured on single-crystalline InTe, no detailed investigation of its thermal properties and hence thermoelectric properties have been undertaken so far.

In this work, a detailed study of the transport properties at high temperatures (300 – 800 K) was performed on single-crystalline InTe. The successful growth of a large single crystal of InTe was realized using the Bridgman technique. As observed previously, InTe exhibits very low lattice thermal conductivity, explained by the presence of low-energy, optical phonon modes evidenced by inelastic neutron scattering experiments.3 Our results also confirmed the cleavage plane of single-crystalline InTe to correspond to the (110) plane, confirming that InTe has a layered crystal structured with weak interchain bonds. A high ZT of 0.61 was obtained along the [110] direction at 780 K.4

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Mots-Clés: Single crystal, thermal conductivity, Inelastic Neutron Scattering, Thermoelectric