SSNN 47P TOPOLOGICAL INSULATOR Bi_2Te_3 LAYERS, TRANSPORT AND THERMOELECTRIC PROPERTIES

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We have investigated thermoelectric properties and Shubnikov de Haas (SdH) oscillations in topological insulator (TI) Bi_2Te_3 layers. TI are electronic materials that have a bulk band gap like an ordinary insulator but have protected conduction state on their edge of surface. These states are possible due to the combination as spin- orbit interactions and time- reversal symmetry [1]. It has been predicted theoretically that thermoelectric figure of merit $ZT = \frac{\alpha^2\sigma}{\chi}T$ can be strongly enhanced in Bi_2Te_3 thin films TI [2].

Single- crystals of Bi_2Te_3 layer were prepared by "mechanical exfoliations" from bulk Bi_2Te_3 single crystal [3]. The resultant layers with thickness from 2-20μm cleaved perpendicular to the C_3 trigonal axis.

The cyclotron mass, Dingle temperature, and mobilities are experimentally determined from SdH oscillations at 4.2- 2.1K in longitudinal (H||I) and transverse (H⊥I) magnetic field according expression:

$$T_D = \frac{\hbar}{\pi\kappa_B}\frac{1}{\tau},$$

were T_D- Dingle temperature, κ_B-Boltzmann constant.

$$\mu = \frac{e\tau}{m_{cyc}}.$$

The maximum values mobilities was 15000cm^2/sec. The temperature dependences the mobilities was establish from Hall effect.

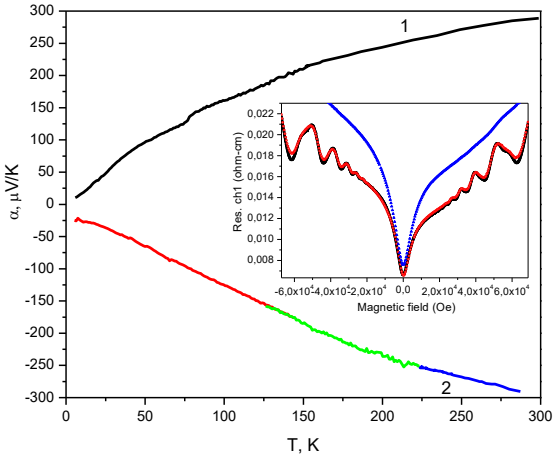

Fig.1 Temperature dependences thermopower α(T) n- and p- type Bi_2Te_3 micro- layers. Inset: SdH oscillations in longitudinal magnetic fields.

We show that the room temperature power factor $\alpha^2\sigma$ (α- thermopower, σ- electrical conductivity) and figure of merit ($ZT = \frac{\alpha^2\sigma}{\chi}T$, χ- thermal conductivity) calculations for Bi_2Te_3 layers exhibit the maximum value at 300 K, that can be used for n and p- lags for thermoelectric applications.

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