MAGNETO- SEEBECK COEFFICIENT $Bi_{1-X}Sb_X$ MICROWIRES FOR THERMOELECTRIC APPLICATIONS

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Due to development of new concepts such as the low- dimensional structures [1] and influence the quantum confinement of change carrier acoustic phonon –boundary scattering for increase figure of merit $ZT=\alpha^2\sigma/\chi(T)$ opened up a completely different strategy for ZT enhancement in one- dimensional structures [1].

We study the thermoelectric properties of $Bi_{1-x}Sb_x$ in semimetal and semiconductor wires with different diameter in the presence of magnetic field in the temperature range 4.2-300 K.

Single- crystal $Bi_{1-x}Sb_x$ micro- and nanowires with orientation (1011) with diameter 60 – 1000 nm in glass capillary were prepared by Ulitovsky method [2].

Semimetal Bi-2at%Sb nanowires exhibited a semimetal- semiconductor transition (SMSCT) (according effect size quantization) at d_c= 300 nm which is on five times higher, than d_c for pure Bi nanowires. The reason is that the electron (L), hole (T) energy overlap- according calculations, received from Shubnikov de Haas oscillations in 2 times less then in pure bismuth.

It was establish that at the SMSCT the thermopower becomes positive and considerably increase with reduction of wire diameters.

Here we demonstrate experimentally that $Bi_{1-x}Sb_x$ micro and nanowires display positive shifts in longitudinal and transverse magneto-thermopower in slowly magnetic field (0.4 T), at high range temperature (T< 200 K).

It is know that the production p- branches in thermoelectric converters is a challenge, especially at T< 150 K.

This approach may enable the development of low- cost thermoelectric materials and providing access to high powder thermal energy conversation applications.

Keywords: *nanowires, quantum size effect, magnetothermopower, thermoelectric efficiency.*

References

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