EXFOLIATION AND THERMOELECTRIC PROPERTIES OF BISMUTH TELLURIDE AND BISMUTH CHALCOGENIDES LAYERS N- AND P- TYPE

Albina NIKOLAEVA[1*], Leonid KONOPKO[1], Krziysztof ROGACKI[2], Igori GHERGHISHAN[1], Oxana BOTNARI[1], Tatiana KOROMYSLICHENKO[1]

[1] *Ghitu Institute of Electronic Engineering and Nanotechnology, Academiei str. 3/3, Chisinau, Moldova*
[2] *Institute of Low Temperatures and Structural Research, PAS, Wroclaw, Poland*
*Corresponding author: Albina Nikolaeva, A.Nikolaeva@nano.asm.md

Bismuth telluride and its alloys are the best thermoelectric material at room temperature.

Bulk thermoelectric modules are used widely in industry as Peltier cooling devices and only bismuth telluride materials are commercially available for power generation.

Last years the development of new concepts- topological insulators (TI) have been made, that predicted the enhancement thermoelectric efficiency $ZT=\alpha^2\sigma/\chi$ in TI [1].

In this presentation we describe a ”mechanical exfoliation” method of single crystal bismuth telluride layers with thickness 10-20 μm n- and p- type [2].

X- Ray diffraction studies showed that the layers were single- crystal with C_3 axis was perpendicular to the plane layers. From Shubnikov de Haas (SdH) oscillations, cyclotron effective mass and quantum mobility are calculated. It was shown high mobilities $\mu= 12*10^3$ $cm^2/V*s$, that is subtionally higher than in the bulk alloy sand also surpasses Hall mobilities.

It was revealed the phase shift of the Landau levels index SdH oscillations in longitudinal and transverse magnetic field $\gamma= 0.5$. That connected with Barry’s phase and is characteristic surface state [3].

Thermoelectric properties in temperature range 2.2- 300 K indicate the high thermoelectric efficiency at room temperature. Using n- and p- type layers as n- and p- lags in microcoolers we receive cooling ≈ 4° from one pare. Segmentation n- and p- branches leads to increase temperature gradient at 300 K.

The composition of the layers in thermoelectric carriers material made of bismuth-chalcogenide and Bi- telluride layers at thickness of about 10 μm for applications in room temperatures.

Micro- peltier coolers with efficient cooling capacity, small areas and short response time are in high demand on the telecommunication markets and of the future.

Keywords: *topological insulators, layers, surface state, thermoelectricity, magneto-peltier coolers.*

References

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