



Prospects of nanostructures $\text{Bi}_{1-x}\text{Sb}_x$ for thermoelectricity

Albina A. Nikolaeva, Leonid A. Konopko, Tito E. Huber,
Pavel P. Bodiul, Ivan A. Popov

<https://doi.org/10.1016/j.jssc.2012.03.063>

Abstract

It has been predicted that surface states of topological insulators have large a thermopower and also ultrahigh mobilities. The authors report results of a magneto-thermoelectric investigation of single crystal $\text{Bi}_{1-x}\text{Sb}_x$ nanowires in a glass cover with diameters ranging from 90nm to 5 μm . The wide-ranging antimony concentration enabled us to study the effect of nanowire dimensionality in the semimetal, semi-conductor and gapless regimes. Quantum size effects in Bi-2at%Sb nanowires, which are shown in temperature dependences of resistance $R(T)$ and thermopower $\alpha(T)$ for the diameters significantly higher than the critical diameter for pure Bi-wires, are observed. The thermopower in weak magnetic fields, reaches values +400 $\mu\text{V}/\text{K}$ at $T=20-40\text{K}$. Power factor $\alpha^2\sigma$ depending on diameter of wires, structure, temperature and magnetic field is calculated. In connection with topological insulators, we will discuss the surface effect in the thermoelectric properties that we observe.

Keywords: thermoelectricity, size quantization, topological insulator, nanostructure