# Anisotropy and thermoelectric properties pure and Sn- doped Bi nanowires

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We study the thermoelectric properties of bismuth and Sn –doped Bi nanowires with different crystallographic orientations along the wire axis. Measurements of the resistance and thermopower wires with different wire diameters have been carried out over a wide range temperature (1.5 – 300K) and magnetic field (0-14 T).

Electron transport in semimetal wires has been actively studied recently [1–3] due to the fact that there was predicted considerable, almost an order of magnitude, increase of thermoelectric figure of merit in *Bi* on transition to semiconductor state with a narrow gap. In particular, this can be achieved by means of dimensional quantization of energy spectrum of carriers [2]. Taking into account that de Broglie wavelength in *Bi* ≈ 60–80 nm, one should expect manifestation of this effect at rather high temperatures (≈ 100 K), which is most important for practical applications.

For manifestation of dimensional quantization effect an important role is played by crystallographic orientation of samples.

One of the aim this work is to obtain nanowires with high anisotropy of the thermopower, high structural perfection, which can be used to create anisotropic thermal generators with low current consumption.

For the first time, anisotropies of resistance and thermopower of glass-insulated wires of pure and tin-doped bismuth are studied both in the absence of magnetic field and in magnetic field. The wires with diameters from 100 nm to 5 μm are fabricated by liquid phase casting [4, 5]. The wires with $C_3$ orientation along the axis are fabricated by zone recrystallization with seed. The anisotropy of magnetoresistance is studied using the method of angular diagrams of rotation of the transverse magnetoresistance. As shown, the magnetic field leads to an increase in the thermopower in absolute value.

Of particular significance result is the fact that thermopower anisotropy in Bi-0.05at.%Sn wires is $\Delta\alpha \approx 100$ μV/K at 250-300 K that is in two times more than in pure bismuth. With elastic strain it reaches the value $\Delta\alpha = 150$–170 μV/K, which is important in terms of practical use of single-crystal glass-coated Bi-0.05at.%Sn wires as anisotropic thermoelectric power generators.

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