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Thermoelectric Properties of $Bi_{1-x}Sb_x$ Alloys, Wires and Foils

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In this study we focus on characterization of the transport properties of Bi-10at%Sb wires with different diameters and Bi-9at%Sb foils, prepared by the high speed crystallization. The nanowires samples were cylindrical single- crystals with (1011) orientation along the wire axis and diameters from 300 nm to 3mkm. The rapidly solidified Bi-9at%Sb foils have a microcrystalline structure and texture (1012) and thickness 20-40 mkm. Electrical resistivity and thermoelectric power were measured in the temperature range 4.2-300 K on various wire diameters d. Here we show that the quantum confinement effect in semiconducting $Bi_{0.9}Sb_{0.1}$ nanowires increases the energy gap from 8.2 meV to 17.3 meV. When the diameter of nanowires is increased, the temperature range of exponential growth of resistance shifts into higher temperature region. The dependence of thermoelectric figure of merit on diameter of wires, foils structure and Sn- doping foil was calculated in a broad temperature interval. The results obtained may provide a new way of enhancing the figure of merit in a wide temperature range.