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Galvano-thermomagnetic properties of Bi/sub 1-x/Sb/sub x/ nanowires at semiconductor-semimetal transition induced by elastic elongation

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Abstract

In the work thin single crystal (0.3 < d < 5 /spl mu/m) wires Bi/sub 1-x/Sb/sub x/ obtained by the liquid phase casting in a glass coating were investigated under elastic deformations up to 2-3% relative elongation in the temperature range 4.2-300 K. In the nondeformed state the wires are semiconductor with minimal indirect gap and have a characteristic semiconductor dependence on T. Under elastic stretch, the semiconductor-semimetal transition was realized, accompanied by the sample metallization and appearance of the Shubnikov-de Haas oscillations from L charge carriers. The decrease of the resistance here 40-50% is observed, and of the thermopower absolute value near 15-20% decreases. Both values depend on wire diameter d. The longitudinal magneto-Seebeck coefficient in the magnetic field up to 0.3 T was measured. It is shown that elastic stretch and longitudinal magnetic field lead to 30-40% increase of the power factor /spl alpha//sup 2//spl sigma/ in the temperature range 150-200 K and at 77 K in the longitudinal magnetic field up to 0.07 T. The temperature region wherein the power factor increase takes place, depends significantly on wire diameter d.

Keywords: single crystal wires, wires, liquid phase casting, semiconductor-semimetal transitions

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