Nanocomposites and nanomaterials

Quantum Size Effect in Thin Films Based on p-type Compound PbSnAgTe.

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Recently, interest in the study of quantum motion of quasiparticles in films increased due to the extensive use of thin films in semiconductor microelectronics [1,2]. Compounds based on PbTe are a high-performance thermoelectric materials. Recently, a new thermoelectric material PbAgSbTe, named LAST was received based on PbTe, with high thermoelectric figure of merit. There are many modifications of the LAST compounds. Thermoelectric properties of these compounds are very sensitive to the chemical composition. In this work the patterns of thermoelectric parameters of films based on compounds Pb-Sn-Ag-Te (LATT) are researched.

Films for the investigation are received by the deposition of the vapor on pre-synthesized material in vacuum on the fresh chips (0001) of mica-muscovite. The measurement of the thermoelectric parameters of condensates was realized at the room temperature in the constant magnetic and electric fields on the developed automated installation. The obtained films are characterized by high values relative thermoelectric power $S^2\sigma$, which for thin films reaches ~ 2.5 μW/cm K^2.

Based on the model of quantum flat rectangular and with infinitely high walls pit, the correspondences were calculated and received value of the Fermi energy and kinetic coefficients (conductivity σ, Seebeck coefficient S and thermoelectric power S2σ) for PbSnAgTe, by the Boltzman kinetic equation. The cases with strongly degenerate and degenerate hole gas in the films of lead telluride with p-type of conductivity are considered separately. The oscillating character of dependences of thermoelectric parameters of nanostructures based on PbSnAgTe for the degenerate and strongly degenerate electron gas has been theoretically proved. The quantization of hole energy spectrum at low thickness are the cause of high values of Seebeck coefficient is established.

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2. *Singh M.P., Bhandari C.M.* Non-monotonic thermoelectric behavior of lead telluride //Solid State Communications. . – 2005.– **133**, N 1. – P.29-34.