Structure and thermoelectric properties of the vapor-phase condensation LAST on the ceramics

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LAST compounds, which are based on PbTe, recently attracte the attention through the considerable sensitivity of their thermoelectric properties to the chemical composition and the ability to obtain n- and p-type conductivity [1,2]. The thin-film material through the impact of the structure, surface, thickness on the transport phenomena, all of these greatly extend useing of the LAST compounds. There are investigated the patterns of changing the thermoelectric parameters and features of the carrier scattering in vapor-phase structures on the ceramics $Pb_{18}Ag_{2-x}Sb_xTe_{20}$ from their thickness in this work.

Based on AFM-images the depending on the size of nanocrystals of conductivity and carrier mobility in the thin film, which are based on the compounds LAST $Pb_{18}Ag_{2-x}Sb_xTe_{20}$ are researched according to their thickness and chemical composition.

Established that electrical conductivity (σ) of the thickness (d) increases for all of these structures. The small values of the conductivity (σ) and the Hall's mobility (μ) with the substantial concentration of n-type carriers ($n \approx 1019$ cm - 3), were caused by the phase inhomogeneity of the condensate: there were not only PbTe but Sb8Te3 and Sb. The current carrier mobility (μ) of the condensates adequately replaces with a thickness (d): slightly increases with d.

The average length of free path of the current carriers and their mobility are determined at presence scattering on the surface and the intergrain limits of the nanocrystals. It is shown that the dominant carrier is scattering carrier on the surface, not on the intergrain limits, due to its huge size of the nanocrystals in the thin film structures.

The thermoelectric parameters of the surface layer is defined and the significant quantities of their Seebeck's coefficient is found by using Petrits's model.

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1. K. F. Hsu et al., Science 303, (2004), 818.
2. H. Wang et al., Appl. Phys. Lett. 88, (2006), 092104