Mechanisms of Growth and Topology of Nanostructures in Thin Films of PbTe:Bi, SnTe:Bi

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The efforts of scientists currently focused on the development of new materials using nanotechnology. Atomic force microscopy (AFM), electron microscopy, high-resolution open up new possibilities for observation and analysis of different stages of growth of nanoobjects. Lead and Tin Telluride - promising thermoelectric materials for middle temperatures (500-750) K and devices that operate in the infrared region of the optical spectrum [1]. Alloying PbTe and SnTe Heterovalent impurities fifth group (Bi) Periodic table causes modification of electron and phonon subsystems crystal, which affects whole complex physical and chemical properties[2].

Vapor-phase condensates PbTe:Bi and SnTe:Bi obtained by the method of open evaporation in a vacuum on a substrate of mica and pyroceram. For PbTe:Bi deposition temperature $T_S = (420\text{-}520)$ K, the sample temperature evaporation $T_V = (920\text{-}1020)$ K and deposition time $\tau = (3\text{-}120)$ s.

We researched the obtained samples with atomic force microscope (AFM) Nanoscope 3a Dimention 3000 (DigitalInstruments USA) in the periodic contact mode.

Determined the size of individual crystallites PbTe:Bi, SnTe:Bi and constructed histogram distribution of normal and lateral dimensions. With increasing deposition time is quite adequate increase in the average size of nanocrystals. It is shown that in the process of nucleation Folmer-Weber mechanism dominates, when the three-dimensional nanostructures are formed on the substrate surface. Mechanisms of nanocrystal are growth explained from the standpoint of ostvald maturation. It has been that the surface of ceramics are formed from combinations of individual nanocrystals planes {100} and {110} of NaCl structure.

It is shown that the change in the electrical conductivity σ of T_V technology factors, T_S and τ observed dependence of carrier concentration n, and not their mobility μ, due to the peculiarities of processes like evaporation sample and steam condensation on the substrate.

1. Zimin. S.P., Gorlachev E.S. Nanostructuring lead chalcogenides: monograph. - Yaroslavl: Yaroslavl State University, 2011. - 232 p.
2. Abrikosov N.H., Shelimova L.E. Semiconductor materials based on compounds A^4B^6. – M.: "Nauka", 1975. - 195 p.