Orientation peculiarities vapor-phase condensation PbTe-Bi_2Te_3 on substrates of mica and pyroceram

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Thanks to its unique properties nanostructured materials occupy a leading position in modern materials science. To create a new semiconductor devices find increasing application multicomponent solid solutions, allowing quite widely varied the parameters of the material. In particular, solid solutions on the basis of lead telluride have proved as useful industrial materials that can be widely used in thermoelectricity. It is important to study the structural characteristics of thin-film condensates solid solutions based on Lead Telluride. It is important to study the structural characteristics of thin-film condensates solid solutions based on Lead Telluride.

By methods of atomic-force microscopy and computer simulations we investigated the effects of orientation and crystallographic form of nanocrystals in vapor-phase condensates of solid solutions PbTe-Bi_2Te_3, grown for fresh cleavages (0001) of mica-muscovite and pyroceram by open evaporation in a vacuum at various deposition time (τ = 15 - 75 s) and the optimal temperature evaporation T_V = 970 K and deposition T_S = 470 K.

We researched the obtained samples with atomic force microscope (AFM) Nanoscope 3a Dimention 3000 (DigitalInstruments USA) in the periodic contact mode. Measuring was conducted in the central portion of samples using serial silicon probes NSG-11 with a nominal tip radius of up to 10 nm.

For the first time based on the analysis of averaged azimuth angles of nanocrystals by discrete transformation methods and the use of the autocorrelation function we determined the dominance of figures, symmetrical to axes of the 6-th and 3-rd order which in most cases are coordinated between themselves and are always coordinated with the figures that have symmetry of the 4-th order.

On the basis of normal distributions for averaged radial angles of nanocrystals for the first time we defined the correlation of steep and gently sloping crystallographic forms of cubic system nanocrystals, their orientation and mutual consistency. We found out the prevalence of planes {110}, {123}, where their relative contribution depends on the time of deposition of the pair on the substrate (thickness of condensates).

Determined that the substrate of pyroceram does not provide a particular orientation of crystallites, and the surface of the samples generated objects formed by planes rhombic dodecahedron and the cube and their combinations.

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