

MECHANISMS FOR DEPOSITION AND GROWTH OF SEMICONDUCTOR NANOSTRUCTURES OF II-IV, IV-VI COMPOUNDS

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Mono- and polycrystalline films of compounds II-IV, IV-VI are prospective as antireflected, absorbing and window layers of photovoltaic unijunction and tandem solar cells (SC), base layers of photodetectors and hard radiation detector devices for infrared technology structures and thermoelectric materials [1]. However, the problem of practical use of films still have not fully solved due to lack of completed advanced technologies for structures with defined, stable and reproductive parameters in time.

Nanostructure films were obtained from the vapor phase by hot wall. As the substrates fresh chips of (0001) muscovite mica were used. Deposition temperature was varied within $T_S = (520-620)$ K. The temperature of evaporation of pre-synthesized compounds was changed within $T_E = (670-770)$ K. The speed of steam condensation on the substrate was $V = (0,02-2)$ microns/min. The wall temperature T_W was maintained at 50 K above the evaporator temperature T_E . Thickness of condensate was define by the deposition time $t = (0,5-15)$ min within (0,1-20) microns. Thickness of obtained films was determined by two methods: optical (interference pattern on the optical transmission spectra) and mechanical (using profilometers). To study the surface morphology of the samples it was used the scanning probe microscope.

These nanostructures were investigated by atomic force microscopy (AFM) Nanoscope 3a Dimention 3000 (Digital Instruments USA) in the periodic contact. According to the results of AFM except of surface morphology and and profilohram in program WSxM 4.0 Develop 10.4 it was defined nanocrystals sizes in the lateral direction, height and roughness of surface.

In the paper the analysis of possible mechanisms of origin of CdTe and PbTe

nanostructures on mica chips as at low ($T_P = 77$ K) and at high $T_P = (520-620)$ K deposition temperature was done. It was shown that the topology of crystals, their orientation and sizes are determined by evaporation and deposition temperatures and deposition time.

Low deposition temperature of CdTe pair form nanostructures due to formation of chemically strained layer. High deposition temperature of CdTe contribute to the growth of nanostructures accordingly to Folmer-Weber mechanism.

It was shown that the growth of nanocrystals is realized by the mechanism of "pair-crystal" without coalescence with quasiparallel orientation (111) $[1\bar{1}0]$ PbTe parallel to (0001) $[11\bar{2}0]$ mica-muscovite.

Defect structure of PbTe nanocrystals on mica is determined by mechanisms of merging of tetrahedron of growth and contains the packing defects and twinning boundaries of various types.

Based on the approximation of the height of nanocrystals dependence on evaporation T_E and deposition T_D temperatures by activating dependencies its energy characteristics were defined and the dominant growth mechanisms: diffusion or electron associated with the formation of chemical bonds were established.

It was shown that the size of individual nanostructured formations are defined processes Osvald maturation by the dominance of electronic processes responsible for the formation of chemical bonds.

- [1] I.N. Kalinkin, V.B. Aleskovsky, A.V. Symashkevych. Epitaxial layers of $A^{II}B^{VI}$ compounds. publ. LSU, Lviv. (1978).