Structure and Physical Properties of Lead Chalcogenide Films Under the Influence of External Factors

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The regularity of reformation of chemical and phase compositions, real structure both as-grown films of lead chalcogenides and tin telluride and those influenced by thermal effect in atmospheric oxygen and vacuum is determined [1,2].

The heterogeneity in their thickness is found. It is demonstrated that degradation processes are determined by the condition of condensate crystal structure, temperature and annealing time. Within the limits of the average free path of charge carriers, drift barrier and Petric model of double layers kinetic parameters of films with different structure (monocrystal, polycrystal) are calculated and it is determined their dependence upon thickness.

It is demonstrated that due to the dispersion of charge carriers on grain boundary the average length of free run of the charge carriers in polycrystal films is vastly less than in monocrystal and depends significantly upon temperature.The electrical parameters of near-surface layers and the value of energetic barriers are determined.

The research was conducted as to the dependence of electrical parameters of polycrystal films of lead chalcogenides with different thickness d=(20-250) nm from the oxygen pressure $P_{O2}=10^{-4}$ -10^{4} Pa. There are two different mechanisms of oxygen acceptor interaction with the thin films surface which are connected with replacement of chalcogenide in anionic interlattice and rootage main matrix between nodes. It is also proposed their crystal-chemical models.

It is determined the degradation processes at isochronous and isothermal annealing of lead chalcogenides, tin telluride of different structure, type of conductivity, initial carrier concentration in the open air and explained by introphase and phase processes with oxygen involvement.

It is demonstrated that the complicated character of electric parameters change at vacuum annealing kept in the open air films is caused by the oxygen and chalcogenide desorption and demonstration of their own conductivity.

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2. Boykov Yu.A., Kutasov V.A. Yzmenenyya kontsentratsyy y podvyzhnosty nosyteley zaryada v plenkakh posle zavershenyya protsessa kondensatsyy // Fyzyka tverdoho tela. – 1981. – T.23, #8. – S.2527–2529.