

DIRECTIONAL INHOMOGENEITIES OF
ELECTRICAL PARAMETERS AND ATOMIC
DEFECTS IN LEAD CHALCOGENIDES THIN
FILMS AT ANNEALING IN THE OXYGEN
ATMOSPHERE

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S u m m a r y

It is established that the annealing of p -type films does not lead to important changes of effective values of electrical parameters. The inappreciable increasing of a hole concentration takes place only. Some increase of the Hall mobility of current carriers on the initial stages of annealing caused by improvement of a structure of textured films. It is a cause of the increase in the direct-current conductivity of films versus annealing time. A two-layer structure with specific physical properties is formed in polycrystalline lead chalcogenides films of n -type conductance at annealing in the oxygen atmosphere. Its formation is connected to the diffusion of oxygen along crystalline boundaries from a surface of the film to the substrate. The model of a homogeneous film with nonstoichiometric defects such as V_{Pb}^- and V_X^+ and with concentrations n_1^0 and n_2^0 , respectively, is theoretically considered. Inhomogeneity is caused by a uniform diffusion of oxygen ions O^- on the boundaries of crystallites during annealing. Regarding the requirement of local electroneutrality on absorption of oxygen and comparing theoretical and experimental results, the estimate of the diffusion constant of oxygen ions in an n -PbS film is obtained. We infer that this value of diffusivity is connected with the oxygen diffusion mechanism on crystallite boundaries from the surface of a textured film to the substrate under sufficient uniformity of the diffusion front and their recombination with chalcogene vacancies. This diffusive-recombination mechanism well enough explains the space-time distribution of the concentration of charge carriers. So, the formation of a two-layer $p\bar{n}$ -structure on annealing of electronic lead chalcogenides films in the oxygen atmosphere is connected with diffusion of ions on crystallite boundaries and their recombination with chalcogene vacancies.