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Thematic course: Hydrochemical synthesis of metal chalcogenide thin films. Part 30.

The activation annealing of the thin films of solid solutions $Hg_xPb_{1-x}Se$ obtained by ion-exchange synthesis

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Abstract

Evaluation of the effect of temperature, the duration of the ion-exchange process of transformation is chemically precipitated thin films plumbum selenide in a solution of salts of mercury and role activation annealing on the composition, morphology and structure of the thin films substitutional solid solutions $Hg_xPb_{1-x}Se$. During the contact of chemically precipitated PbSe thin films with a water solution of mercury acetate for 0.5-24 hours at 293 K due to the heterogeneous ion-exchange replacement of the formation $Hg_xPb_{1-x}Se$ substitutional solid solutions with content in it to 40 mol. % mercury selenide. Increasing temperature of the ion-exchange process from 298 to 333 K reduces the concentration of mercury in solid solution $Hg_xPb_{1-x}Se$ from 40 to 26 mole (%) due to the formation of individual HgSe phase under the same conditions of the process. By comparing the data of X-ray research and elemental analysis PbSe films were in contact with a solution of mercury acetate at the K 333, found presence in layers up to 3.1-4.5 mol. % of amorphous phase HgSe. Structure, composition, and morphology of new precipitated and heat-treated in air atmosphere at 653 K thin films of solid solutions $Hg_xPb_{1-x}Se$ were investigated. Differences in their crystal structure and composition were identified and found heat-treated in the presence of layers of lead oxide and selenite (PbO, $PbSeO_3$). After activation annealing evolution surface layer $Hg_xPb_{1-x}Se$ were detected by optical microscopy. The layer structure becomes fine crystalline with average particle size ~0.5 mkm and on the thin film surface segregated phase's globules of mercury selenide diameter 1-5 mm is formed. The values of the optical forbidden band width of the synthesized solid solutions, the value of which depends on the composition are in the range 0.257-0.168 eV.

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