PR-19. ION EXCHAGE AS A METHOD FOR THE FORMATION OF $Cd_xPb_{1-x}S$ THIN-FILM SOLID SOLUTION

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Substitutional solid solutions in the CdS–PbS system were obtained by holding a chemically deposited cadmium sulfide thin film in a lead acetate $Pb(C_2H_3O_2)_2$ aqueous solution. The effect of solid-state diffusion on the morphology, composition, and optical properties of the CdS films was investigated.

The XPS analysis with layer-by-layer sputtering revealed that lead is incorporated in the film everywhere throughout its thickness with the formation of substitutional solid solutions CdS–PbS with a varying composition. To a depth of ~ 40 nm, the solid solution based on lead sulfide is formed. The layer at a depth of ~ 40 nm is a transition layer. Deeper, over the entire thickness from the transition layer to the substrate, the film comprises the solid solution based on cadmium sulfide. This agrees with the X-ray diffraction data obtained earlier. In addition, it was demonstrated that the surface film layer with a thickness to 3 nm includes the elevated content of oxygen-bearing compounds.

The introduction of lead into the CdS polycrystalline film is satisfactorily described with the Fick's equation for the diffusion from a constant source into a semi-infinite slab. The calculated coefficient of lead diffusion into the cadmium sulfide film at a temperature of 368 K is $(3{,}6 \pm 0{,}5) \cdot 10^{-15}$ cm^2 s^{-1}, which is comparable to the literature data for the film systems based on metal chalcogenides.