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METHODS OF SYNTHESIS OF CdSe FILMS WITH GOOD ADHESION TO GLASS SUBSTRATES

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The weak adhesion to the surface of glass substrates is characteristic for CdSe semiconductor thin films, synthesized from aqueous solutions. We have proposed two methods of synthesis to produce these films with good adhesion to glass substrates.

The first method consists in preliminary forming of CdS_xSe_{1-x} solid solution on the substrate surface, where the sulfur atoms in the structure are the linking bridge between the coating and glass substrate. For this, the synthesis was carried out in two baths. First, the substrate was immersed in a solution, prepared by mixing of 0.001 M cadmium chloride ($CdCl_2$), 0.01 M sodium selenosulfate (Na_2SeSO_3) as a chalcogenizer, 0.005 M trisodium citrate ($Na_3C_6H_5O_7$) as a complexing agent and additionally 0.01 M thiocarbamide ($CS(NH_2)_2$). The concentration of the latter was 50 times lower than the concentration of sodium selenosulfate in the solution. The substrate was removed after holding for several minutes in the solution, then immersed in a second bath containing the same reagents except thiocarbamate and continued synthesis for 30 minutes at the 70°C temperature.

According to results of the X-ray diffraction analysis of film samples, the presence of CdSe cubic phase was established. The amount of formed solid solution is much smaller than of deposited CdSe, so the optical characteristics of obtained the films are unchanged. The optical transmission spectrum $T(\lambda)$ of the CdSe film (CdS_xSe_{1-x}) at the wavelengths from 340 to 900 nm was investigated. The slight growth of light transmission starts from the begining of investigated range and in the region of 600 nm a small jump is observing. The optical band width of the forbidden band of the film is localized in the range of 1.83 eV, which agrees with the literature data for CdSe films.

The atomic ratio of cadmium and chalcogen in the CdS_xSe_{1-x} film sample is close to the stoichiometric, with a slight excess of chalcogen atoms. The atomic content of sulfur in the coating does not exceed 3%.

The synthesized in this way CdSe films have better adhesion to the surface than those, obtained without the thiocarbamide use. But they break down by making mechanical efforts.

Therefore, a second method for the synthesis of CdSe films has been proposed with using the chemical surface deposition method. In this case, the minimum volume of solution, which containing cadmium and selenium ions was applied by a dispenser to a heated substrate surface. Minimizing the volume of the solution reduces energy consumption and waste.

The freshly prepared solutions of one of the 5 cadmium-containing salts ($Cd(CH_3COO)_2$, $CdCl_2$, CdI_2, $Cd(NO_3)_2$, $CdSO_4$) and sodium selenosulfate were used for the synthesis of CdSe thin films. No additional reagents were added. Molar concentration of salts was 0.03 M, sodium selenosulfate – 0.1 M. The duration of synthesis was 6 min at the 70 °C temperature.

The obtained films are smooth and solid. Spectral absorption dependencies of synthesized CdSe films show the presence of the fundamental absorption edge. localized in the region of 1.80 eV, which agrees with literature data. It is localized in the region of 1.80 eV, which agrees with literature data.

The number of particles on the surface of CdSe films did not exceed 10^8 sm^{-2}. For comparison, the best-known results for the number of particles on the surface are 10^5 sm^{-2}, while for chemical deposition – 10^8 sm^{-2}.

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