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Optical and Photoelectrical Properties of $CdIn_2S_4$

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The $CdIn_2S_4$ compound is formed in the $CdS-In_2S_3$ system (1, 2). It was synthesized for the first time by the authors of the paper (3). According to them the $CdIn_2S_4$ compound has the O_7^4-Fd3m space group structure. The preliminary studies (4 to 6) showed a rather high photosensitivity. Optical properties were studied as well in (7 to 9). However, these data do not reveal completely the $CdIn_2S_4$ band structure and disagree with each other in some points, for example $E_g = 2.3$ eV and $E_g = 1.9$ eV according to (5) and (6), respectively.

The present paper contains results of a study of the edge absorption at 293 and 77 °K, the spectral distribution of the photoconductivity, and the reflectivity spectra in the fundamental absorption region. An interpretation of the interband transitions observed is given following the theoretical band structure calculations (10).

The $CdIn_2S_4$ single crystals were obtained by the method of chemical transport reactions, iodine having been used as a transport agent (11, 12). The composition was tested chemically. The single crystals were octahedral, Laue patterns and epigrams showed the secondly growing faces to appear in the [111] direction (13). The edge absorption and reflectivity spectra were measured by a ZMR-3 type monochromator, the radiation being registered by type FEU-62 and FEU-39 A photomultipliers in a compensation circuit. The original surfaces of the single crystals were used for the study of the spectral distribution of the photoconductivity and reflectivity spectra. To study the edge absorption the opposite sides of the crystals were polished to obtain the necessary optical thickness of 50 to 586 μm.

Fig. 1a shows the absorption curves for three samples. The absorption bands in the transparent region are due to local centres in the sample. Excitation bands were observed at the same photon energies. On raising the energy of illuminating