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Edge Absorption of $CdIn_2S_4$ Single Crystals in the Region of Indirect Transitions

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Several papers (1 to 3) have been devoted to optical and photoelectrical properties of the compound $CdIn_2S_4$, these papers show that this material possesses interesting and perspective parameters. According to the data available it has been found that the minimum of the interband gap is due to indirect transitions (2, 4). But the edge absorption in the region of small absorption coefficients has not been studied yet.

This note presents results of edge absorption investigations of $CdIn_2S_4$ single crystals in the region of indirect transitions on crystals having different carrier concentration. The types of phonons involved in indirect transitions and their energies have been determined and the indirect band gap E_g has been specified. $CdIn_2S_4$ single crystals have been obtained by the chemical transport technique and zone recrystallization (3, 5). The experimental method is described in paper (6).

The dependence of $\sqrt{K}$ versus photon energy $h\nu$ at 293 °K (curves a, b, c, and d) and at 77 °K (g, e, and f) is represented in Fig. 1 to determine the structure of the absorption edge due to indirect transitions. Samples with different concentrations have been investigated; curve a corresponds to $n = 10^{20}$ cm^{-3}; b, g to 10^{18} cm^{-3}; c, e to 8×10^{16} cm^{-3}, and d, f to $n = 10^{15}$ cm^{-3}. As is shown in Fig. 1, the absorption coefficient for the sample with concentration of 10^{20} cm^{-3} for each temperature has a greater value in the region of 2 to 2.15 eV than for the samples with smaller concentration. Besides the structure characteristic of single crystals with smaller charge carrier concentration is not observed on these samples (Fig. 1). An increase in the concentration up to 10^{18} cm^{-3} makes the structure somewhat worse (it become less visible), but does not displace its energetic position. This is explained by the fact that the compound $CdIn_2S_4$ is a defective semiconductor. A change in the concentration of this compound takes place due to the fact that sulphur