

Photo and Cathode Luminescence of CuInSe₂

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The optical properties of the CuInSe₂ chalcopyrite are not studied considerably and the data of fundamental parameters and energy band structure are either contradictory or absent. In the present paper the results of investigation of photo and cathode luminescence spectra for the same single crystals grown by Bridjman method are given. The cathode luminescence (CL) and photo luminescence (PL) spectra are studied in the temperature interval T=77-200K. At T=77K in the CL-spectra for p-type CuInSe₂ three stripes of radiation with maxima $\lambda_1=0,93$ eV, $\lambda_2=1,0$ eV and $\lambda_3=1,065$ eV were observed. The temperature rise results in the decrease of intensity of three stripes of radiation, the depression of E1 and E2 stripes are stronger. In CL-spectrum of n-type CuInSe₂ at T=77K two stripes of radiation are observed with maxima $\lambda_1=0,87$ eV and $\lambda_2=0,93$ eV. As against of $\lambda_2=0,93$ eV for $\lambda_1=0,87$ eV the strong temperature depress of radiation is observed. The increase of excitation level for CL from $i=100$ mA to $i=200$ mA lead to 1)depress of low energy part of CL-spectrum, 2) separation of radiation stripes and 3) displacement of spectrum to the high energy area. FL-spectra at T=77K consist of three overlapping stripes of radiation with maxima $\lambda_1=0,85$ eV, $\lambda_2=0,87$ eV and $\lambda_3=0,95$ eV. The stripes of radiation $\lambda_1=0,85$ eV and $\lambda_2=0,87$ eV can be explained by donor – acceptor transitions, where donor is In-Cu defect pair (0/), and acceptor is vacancy of In (-/0), and by transition from donor of “cu-prum”- type (0/) to acceptor formed by vacancy of In (-/0). (-/0) is different charge state of defects.