Journal of Luminescence
Volume 149, May 2014, Pages 19-27

Optical properties and band structure of ZnP_2-D_4^8

I. G. Stamov, N. N. Syrbu, V. V. Zalamai

https://doi.org/10.1016/j.jlumin.2013.11.078

Abstract

The emission lines of bound and free excitons and their phonon replicas were observed in the luminescence spectra of ZnP_2-D_4^8 crystals doped with Mn, Sn, Cd and Sb measured at 10K. The emission lines are described by the model of axial center levels. Models of the bands of the bound excitons with different axial centers (Mn, Sn, Cd and Sb) are presented. It was observed that the indirect transitions in the excitonic bands were nonpolarized and that the direct transitions were polarized. The minimal direct energy gaps in the polarization E||c are due to the allowed $\Gamma_1 \rightarrow \Gamma_1$ transitions, and the gaps in the polarization $E \perp c$ are due to the $\Gamma_2 \rightarrow \Gamma_1$ transitions. The temperature shift coefficient of the bands gaps differs for different polarizations in the temperature interval from 2 to 10K ($\Delta E/\Delta T$=3.5meV/K and 1meV/K for $E \parallel c$ and $E \perp c$, respectively). The optical constants n, k, ε_1, ε_2, $d^2\varepsilon_1/dE^2$ and $d^2\varepsilon_2/dE^2$ were calculated for the energy interval 1.5–10eV using the Kramers-Kronig analysis of measured reflection spectra. The features observed in these spectra were interpreted using two types theoretical calculations of band structure as optical transitions.