EVTODIEV, Igor. Anisotropy of the Exciton Processes in GaSe Crystals with Low S and Te Concentrations. In: Journal of Nanoelectronics and Optoelectronics. 2009, Vol .4, nr.1, pp. 76-88. ISSN 1555-130X .

The anisotropy of the excitonical processes in the GaSe crystals and GaSe with small quantities of GaS($GaSe_{0.99}S_{0.01}$) crystals has been studied through the optical specters (SO) and through the photoluminescence (PL) from the perpendicular surface on the symmetry axis C_6 ($E \perp C$ polarization) and from the flat surface parallel with the C_6axis ($E \| C$ and $E \perp C$ polarization). The edge of the fundamental band of the GaSe crystals as well as of the $GaSe_{0.99}S_{0.01}$ and $GaSe_{0.99}Te_{0.01}$ crystals is formed at T = 78 K of the direct excitons' band. The width of the free excitons' band is determined by the processes of interaction between the excitons and optical and acoustic phonons. Phonons with energy of 17 meV and 27 meV participate to the formation of the edge towards small energies of the excitonic band in the GaSe crystals. The average energy of the phonons that participate to the formation of the excitonic absorbtion band in the GaSe crystals with small concentrations of S and Te equals 17 meV. Due to the mechanism of interaction of the excitons and phonons the integral absorption coefficient for the studied crystals (polarized $E \perp C$) is in small increase once with the temperature whilst the integral absorption coefficient in the maximum of the direct excitons' band. The n = 1 state is in diminution. For example, for the $GaSe_{0.99}Te_{0.01}$ crystals, α increases from 2700 at T = 78 K to 2025 cm^{-1} at 220 K. The edge towards small energies of the free excitons' band in the GaSe crystals and GaSe crystals with small quantities of S and Te is in a great concordance with Toyozowa's theory. The constant of interaction between the free excitons with phonons with an average energy of 135 cm^{-1} equals 0.9. Using the spectral characteristic of the reflection coefficient from the surface parallel to the C_6 axis, there has been determined the refraction index placed in the center of the excitons n = 1 which equals 2.62 for GaSe and 2.58 and 2.55 respectively for the $GaSe_{0.99}S_{0.01}$ and $GaSe_{0.99}Te_{0.01}$ crystals. The shifting of the reflection specters towards big energies like ~10 meV in a $E \perp C$ polarization comparing to $E \| C$ is determined by the difference of the oscillators' strength in these polarizations. The PL at T = 78 K specters from the surface parallel with the C_6 axis (polarized $E \| C$) confirm the difference between the forces of the excitons' oscillators in the $E \| C$ and $E \perp C$ polarization. The intensity of PL bands, at the (001) surface as well as at the (100) surface depends on the excitation intensity by a function of a $I = L^n$ force towards the emission bands of the direct and indirect free excitons the force factor is overlinear, and for the impurity nature bands it represents ~0.5. The parameters that determine the width of the bands of excitonic PL is determined, considering the strong concentration of the structural faults at the (100) surface of the GaSe and $GaSe_{0.99}Te_{0.01}$ and $GaSe_{0.99}S_{0.01}$ GaSe crystals. Out of the spectral analysis $I(L)$ the nature of the impurity bands has been determined, and from the PL specter structure there has been determined the energy of the accepting level which equals 93 meV from the maximum of the valence band of the GaSe crystals. Out of the analysis of the PL specter in a $E \| C$ and $E \perp C$ polarization (the (100) surface) it was stated that the process of emissional annihilation of the indirect excitons in the $E \| C$ polarization takes place once with the emission of the phonons of a 38 meV energy whilst at the $E \perp C$ polarization there are emitted phonons with an energy of 17 meV. GaSe with small concentrations of GaS and GaTe leads to the forming of a considerable concentration of localizing centers of the direct excitons and at the same time to the shifting towards small and big energies of the excitonic emission band (state n = 1) comparing to the GaSe crystals with a stoikiometric composition.