The influence of chromium thermal-diffusion-based doping on the spatial distribution of luminescence intensity in ZnSe

A. Gladilin[1], O. Uvarov[1], S. Mironov[1], N. Timofeeva[2], E. Gavrischuk[2], V. Kalinushkin[1]

[1] *Prokhorov General Physics Institute of the Russian Academy of Sciences, 38 Vavilova st., 119991 Moscow, Russia*

[2] *Devyatykh Institute of Chemistry of High-Purity Substances of the Russian Academy of Sciences, 49 Tropinina st., 603950 Nizhny Novgorod, Russia*

We have studied the luminescence intensity distribution in polycrystalline ZnSe doped with Cr by thermal diffusion. The initial (undoped) polycrystals were prepared by chemical vapor deposition (CVD). The concentration of Cr was up to $3 \times 10^{19}\,\mathrm{cm}^{-3}$. The chormium doping process leads to luminescence quenching in visible spectral range [1]. Areas characterized by high intensity luminescence of defective-impurity centers, looks like wide ($\sim 100\,\mu$m) light strip paralleled to the doping surface were reported in [2]. These strips were registered in all studied samples prepared by different technological routes both doped from crystal surface and hot-press, referred to as doped from the center. We suggested that at least two types of luminescent centers are appear due to the thermal-diffusion-based iron doping forming emission lines in the spectral range of $450 - 950$ nm.

The present investigation is based on measurements of photoluminescence under conditions of two-photon excitation. The method provides the possibility of signal mapping in the sample volume with the intensity profiles of the luminescnce bands of ZnSe:Cr crystals similar to those previously studied for ZnSe:Fe. We propose that formation of the areas with high intensity luminescence (AHIL) in sample volume is an effect of general nature. Apparently, the defective-impurity centers forming the AHIL are related to impurities and/or intrinsic defects, and are associated with neither the optically active Cr^{2+} or Fe^{2+} in ZnSe nor with shallow impurity. The reported study was funded by RFBR according to the research project N^0 18-29-20048.

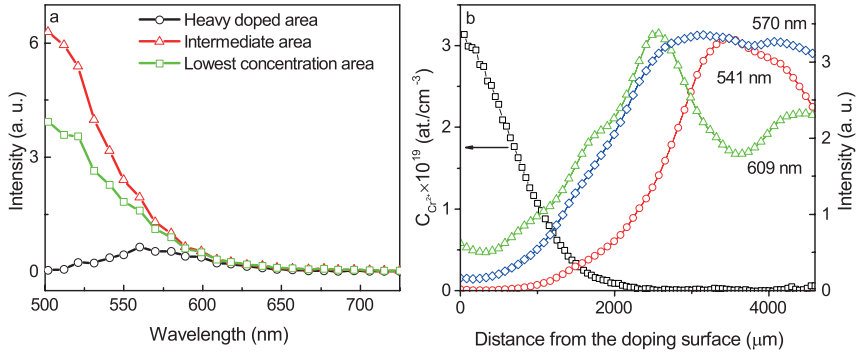

Figure 1: The spectra (a) of ZnSe:Cr in high Cr concentration area (black circle), intermediate area (green square) and the lowest Cr consentration area (red triangle). The spatial distributions (b) of Cr (right Y-axis, black square) and luminescence intensity of 541 (red circle), 570 (blue dimond) and 609 (green triangle) nm wavelength

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