Crystal-Chemical Analysis of Defect Subsystem at the Doped and Annealed in a Pair of Selenium Crystals ZnSe:Mn

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Zinc selenide used to create laser screens, LED injection, scintillation sensors, photoconductive, sources of spontaneous and coherent radiation in the blue region of the spectrum. Crystal-quasi-chemical formula for Magnesium doped crystals of n-ZnSe:Mn and p-ZnSe:Mn allows to calculate the concentration dependence of the dominant point defects, free carrier and Hall's concentration from dopant content.

Doping crystals of n-ZnSe by Magnesium increases the electrons concentration and due to doping crystals of p-ZnSe by Magnesium is conversion of conductivity from p- to n- type and further increases of the electrons concentration, confirming the donor effect of Mn (Fig. 1).

a) b)

Fig. 1. Dependence of concentration of dominant point defects N: 1 - $[V_{Se}^{2+}]$, 2 -$[V_{Se}^{+}]$, 3 - $[Zn_i^{+}]$, 4 - $[Zn_i^{2+}]$, 5 - $[V_{Zn}^{2-}]$, 6 - $[Mn_{Zn}^{x}]$, 10 - $[V_{Zn}^{-}]$, main carriers 7 - n, 8 - p and Hall's concentration 9 - n_H from dopant content of Mn for n-ZnSe:Mn (a) and p-ZnSe:Mn (b) ($\alpha = 0{,}1 \cdot 10^{-4}$ at. %, $\gamma = 0{,}99999$, $\delta = 0{,}1$; $\beta = 0{,}1 \cdot 10^{-4}$ at. %, $\mu = 0{,}1$, $\varepsilon = 0{,}1 \cdot 10^{-4}$).

Annealing of n-ZnSe:Mn in a pair Se leads to decrease in the concentration of electrons, conductivity conversion from n- to p-type and further increase in the concentration of holes. During this also increases current carriers in crystals of ZnSe:Mn<Se (Fig. 2).

a) b)

Fig. 2. The spatial dependence of the Hall's concentration n_H from stoichiometric deviation α (Zn) – a, β (Se) – b and content [Se] for crystals n-ZnSe:Mn<Se> (a) and p-ZnSe:Mn<Se> (b), annealing in a pair Se.