

Author's Accepted Manuscript

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PII: S0022-2313(17)31679-4
DOI: <https://doi.org/10.1016/j.jlumin.2018.09.051>
Reference: LUMIN15934

To appear in: *Journal of Luminescence*

Received date: 28 September 2017
Revised date: 29 May 2018
Accepted date: 21 September 2018

Cite this article as: V.Ya. Degoda, M. Alizadeh, Ya.P. Kogut, N.Yu. Pavlova and S.V. Sulima, The influence of UV excitation intensity on photoconductivity and luminescence in ZnSe crystals, *Journal of Luminescence*, <https://doi.org/10.1016/j.jlumin.2018.09.051>

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The influence of UV excitation intensity on photoconductivity and luminescence in ZnSe crystals

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Abstract

It has been experimentally obtained Lux-ampere characteristics of the photoconductivity (I_{ex} - i_{PL}) and lux-luminescent characteristics of the two main dominant luminescence bands in zinc selenide (ZnSe) crystals with maxima at 630 nm and 970 nm (I_{ex} - J_{630} and I_{ex} - J_{970}) at different temperatures (8, 85, 295 and 420 K). It was also discovered that the maximum accumulated light sum on shallow traps increases with an increase in the intensity of ultraviolet (UV) excitation; yet on deep and phosphorescent traps, it remains constant and does not depend on the intensity of UV excitation.

The theoretical consideration of the kinetics of photoconductivity and photoluminescence in the framework of a multi-centre crystal model is conducted. Unlike classical theories of photoluminescence kinetics and photoconductivity was obtained that, concentrations of free electrons and holes are proportional to intensity of exciting radiation; and concentrations of localized electrons on deep traps reach saturation, the value of which does not depend on the excitation intensity. Theoretical conclusions mainly well explain the experimental results.

The several possible processes which could influence a small non-linearity of lux-luminescent characteristics at low temperatures: (1) ionisation by free charge carriers of the recharged traps; (2) competition between non-radiative and radiative recombination centres; (3) non-radiative and radiative recombination of free holes

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