## Nanooptics and nanophotonics

# Influence of laser annealing on photoluminescence of ZnO nanopowders

**V.M. Zhyrovetsky[1], D.I. Popovych[1,2], A.S. Serednytskii[1]**

*[1] Pidstryhach Institute for Applied Problems of Mechanics and Mathematics, National Academy of Sciences of Ukraine, Naukova, 3b, Lviv-79060, Ukraine. E-mail: popovych@iapmm.lviv.ua*

*[2] National University "Lvivska Polytechnika", Bendera Str., 12, Lviv-79013, Ukraine.*

In the present study, we investigate influence of laser annealing on photoluminescence of ZnO nanopowders obtained by means of pulsed laser ablation [1]. After laser annealing ($E_i$=0.18-0.25 J/cm$^2$, $\tau_i$=10 ns, $\lambda$=1.06 μm) of ZnO nanopowders has a displacement of the yellow-orange emission band in the short wavelength region. That is the result of redistribution of the intensities of the elementary peaks associated with zinc vacancies $V_{Zn}$ ($\lambda_{max}$=585 nm) and interstitial oxygen $O_i$, ($\lambda_{max}$=605 nm) forming this band. Green band photoluminescence spectrum of ZnO is characterized by a significant decline in the intensity of luminescence in vacuum (*P=10 Па*), and an increase in the peak intensity of purple luminescence, that is the result of changes in the surface electronic states of defective structures. In this region of the spectrum, there are two pronounced peaks, one of which ($\lambda_{max}$=430 nm) corresponds to the interstitial zinc $Zn_i$ and another ($\lambda_{max}$=410 нм) is attributed acceptor oxygen vacancies $V_O$. In turn, laser annealing leads to increased number of oxygen vacancies in the ZnO nanopowder and, consequently, to increase the number of luminescent centers of this kind. Laser annealing powder leads to a shift of the exciton peak in the long wavelength region, which is associated with a decrease in the exciton binding energy in a growing degree intrinsic defects structure. A significant proportion of the quantities and intensities of the exciton and the intrinsic defects peaks obviously indicates a high degree of structural ordering synthesized c laser nanopowders.

1. *Gafiychuk V.V., Ostafiychuk B.K., Popovych D.I., Popovych I.D., Serednytski A.S.* ZnO nanoparticles produced by reactive laser ablation // Applied Surface Science. -2011. -**257.** P.8396–8401.