Nanooptics and nanophotonics

ZnO nanostructures – a perspective material for the optoelectronic applications

V.B. Kapustianyk[1,2], B.I. Turko[1,2]

[1] *Solid State Physics Department, Faculty of Physics, Ivan Franko National University of Lviv, Dragomanova str., 50, Ukraine.*
E-mail: kapustianyk@yahoo.co.uk

[2] *Scientific-Technical and Educational Center of Low Temperature Studies, Ivan Franko National University of Lviv, Dragomanova str., 50, Lviv-79005, Ukraine.*

Nowadays, in the world of cutting-edge technologies it is very important to invent highly efficient and low-cost ways of designing of the light-emitting diodes (LED) consuming as minimum energy as possible. For the last years such a wide band gap semiconductor as zinc oxide have been substantially drawing an attention as a superior material for optoelectronic applications over GaN. The most challenging problem of ZnO based electronic devices is the lack of stable and reliable *p*-type doping; mainly due to the self-compensation property of ZnO. For this reason the ZnO-based LEDs were fabricated by combining of *n*-type ZnO with a *p*-type semiconductor other than ZnO, for example, Cu_2O, ZnTe, $SrCu_2O_2$, AlGaN, GaN or *p*-type conduction polymers. For the past few years, rapid progress has been made in research of *p*-type ZnO doping. Some successful work has been done using I and V group elements as acceptors and deviations from stoichiometry [1]. In the case of ZnO it is possible to obtain the lasing effect based on the exciton recombination. Study of the mechanisms of laser generation in ZnO is of great importance for creation of the high-power semiconductor lasers. Despite the long history of industrial applications of ZnO, there is no clear understanding of some of the fundamental properties of this material. We propose interpretation of the emission bands in the nanostructured zinc oxide. A precise understanding of the nature of these bands is considered as a basis for creating of the light emitting devices based on ZnO, such as light emitting diodes and lasers [2].

1. *Kapustianyk V., Turko B., Luzinov I., Rudyk V., Tsybulskyi V., Malynych S., Rudyk Yu., Savchak M.* LEDs based on p-type ZnO nanowires synthesized by electrochemical deposition method // Phys. Stat. Sol. C.-2014.- **11**.- P. 1501-1504.
2. *Panasiuk M. R., Turko B. I., Kapustianyk V. I., Stanko O. P., Mandryka A. V., Serkiz R. Y., Dubov Y. H.* Photo- and thermostimulated luminescence of ZnO nanowires // J of Appl. Spect.- 2013.- **80**,- P. 240-243.