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Evolution of UV luminescence spectrum in ZnO structures under fast electron excitation

A. M. Ismailov[1] *and A. E. Muslimov*[2]

[1] Dagestan State University
43-a Gadjieva st., Makhachkala, 367000, Russia
E-mail: egdada@mail.ru

[2] FSRC "Crystallography and Photonics" RAS
59 Leninskii Ave., Moscow, 119333, Russia

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The presented work presents the results of the study of the evolution of UV luminescence spectra in ZnO whisker and thetrapod ensembles when excited by fast electrons with an energy of 60 keV. It has been shown that increasing the exposure time and focusing the electron beam on the ensemble of crystalline ZnO viscers only leads to widening of the UV band into the long-wavelength region of the luminescence spectrum. A similar effect on the ensemble of defective ZnO tetrapods leads to long-wave mixing and widening of the UV band of the lumignescence spectrum. The observed effects are associated with surface etching of ZnO structures during exposure to fast electrons and an increase in the concentration of interstitial zinc.

Keywords: zinc oxide, cathodoluminescence, near band luminescence.

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REFERENCES

1. Özgür Ü., Alivov Ya. I., Liu C., Teke A., Reshchikov M. A., Dog˘an S., Avrutin V., Cho S.-J. and Morkoç H., J. Appl. Phys. **98**, 041301 (2005).
2. Klingshirn C., Chem. Phys. Chem. **8**, 782–803 (2007).
3. Sharma D., Shukla S., Sharma K. and Kumar V., Materials Today: Proceedings **49**, 3028–3035 (2022).
4. Bagnall D. M., Chen Y. F., Zhu Z., Yao T., Koyama S., Shen M. Y. and Goto T., Appl. Phys. Lett. **70**, 2230–2232 (1997).
5. Mariappan R., Ponnuswamy V. and Suresh P., Superlattices and Microstructures **52**, 500–513 (2012).
6. Roth A. P., Webb J. B., Williams D. F. / Phys. Rev. B. 1982. Vol. 25. P. 7836 (1982).
7. O'Donnell K. P., Chen X. / Applied Physics Letters. 1991. Vol. 58 (25). P. 2924–2926 (1991).
8. Sharma P., Tiwari S., Barman P. / Journal of Luminescence. 2022. Vol. 251. P. 119231 (2022).
9. Jonewbury Patrick Eclin et al., Scanningelectron microscopy and X-ray microanalusis, New Jork; London, 1981.
10. Ismailov A. V. and Muslimov A. E., Applied Physics, № 5, 75–80 (2021) [in Russian].
11. Dierre B., Yuan X. L., Ohashi N., Sekiguchi T. / Journal of Applied Physics. 2008. Vol. 103 (8). P. 083551 (2008).
12. Song Y., Zhang S., Zhang C., Yang Y. Crystals. 2019. Vol. 9 (8). P. 395 (2019).
13. Knotek M. L., Feibelman P. J. / Phys. Rev. Lett. 1978. Vol. 40. P. 964 (1978).
14. Wagner M. R., Callsen G., Reparaz J. S., Schulze J.-H., Kirste R., Cobet M., Meyer B. K. / Physical Review B. 2011. Vol. 84 (3). P. 035313 (2011).