Contribution ID: **79** Type: **Poster**

Spontaneous and stimulated UV laser-induced excitonic luminescence from ZnO nanopowder

Friday, November 8, 2024 4:33 PM (3 minutes)

Zinc oxide (ZnO) is one of the best photoactive wide-gap metal-oxide semiconductor materials, whose optoelectronic properties are of great interest for nanophotonics [1,2]. In particular, photoexcited ZnO exhibits strong excitonic UV photoluminescence (PL) at room temperature (RT). But despite all advances in ZnO nanophysics, some features of RT excitonic PL of ZnO nanoparticles (NP) are not so clear, especially in disordered nanostructures with random light scattering. We tried to study this issue in more detail. Experiments were carried out with finely dispersed ZnO powder of high-grade quality obtained by a hydrothermal method and characterized by XRD, Raman and UV-Vis spectroscopy. Measurements showed that ZnO NPs have a nodular shape with sizes from 1 μm to 100 nm and crystallites of ˜20 nm. In the PL spectra excited in ZnO powder by a pulsed N2 laser at 337 nm, we observed a nonlinear amplification of excitonic UV PL emission at 387 nm and a decay of the visible PL emission at 500 nm. A superlinear increase in the intensity of the excitonic UV PL band with its narrowing with increasing excitation intensity indicates stimulated emission of ZnO NPs. This regime is realized over the entire excitation range due to non-resonant diffusion mode of light amplification, similar to random lasing in Letokhov-type scattering photonic media. Estimated gain is ˜100 cm-1, threshold is ˜1 mJ/cm2. Research is in progress.
[1] A.Tashiro, Y.Adachi, T.Uchino, J.Appl.Phys. 133, 221101 (2023).
[2] H.Cao, Y.Eliezer, Appl.Phys.Rev. 9, 011309 (2022).

Type of presence

Presence online

Primary authors: Dr IZMAILOV, Igor (V.E. Lashkaryov Institute of Semiconductor Physics, National Academy of Sciences of Ukraine); Dr NAUMOV, Vadym (V.E. Lashkaryov Institute of Semiconductor Physics, National Academy of Sciences of Ukraine); Dr FEDORENKO, Leonid (V.E. Lashkaryov Institute of Semiconductor Physics, National Academy of Sciences of Ukraine); Prof. YUKHYMCHUK, Volodymyr (V.E. Lashkaryov Institute of Semiconductor Physics, National Academy of Sciences of Ukraine)

Presenter: Dr IZMAILOV, Igor (V.E. Lashkaryov Institute of Semiconductor Physics, National Academy of Sciences of Ukraine)

Session Classification: Poster Session