Nanooptics and nanophotonics

Room-temperature ultraviolet laser emission from ZnO hexagonal microprisms and nanowires

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The current state of optoelectronics requires search of efficient laser materials that would emit light in blue and ultraviolet spectral regions. The random laser generation was observed in ZnO micron size powder, thin films and nanorods arrays [1,2]. Study of the mechanisms of random lasing in ZnO is of great importance for creating of the high-power semiconductor lasers.

The ZnO microprisms were grown on the single crystal (100) silicon substrates by a solid-vapor-phase (VLS) process in a horizontal tube furnace in air using Zn powder. The ZnO nanowires were grown by electrochemical deposition method. The structure and photoluminescence of ZnO microprisms and nanowires were studied. The laser generation was obtained in the ultraviolet spectral range in vicinity of 388 nm. The threshold intensity for ZnO microprisms and nanowires was found to be approximately 685 kW cm^{-2} and 560 kW cm^{-2}, respectively. The coherent feedback in ZnO microprisms can be provided by two basic mechanisms. In the first case the coherent feedback is provided by multiple reflections from the end facets of the microprisms serving as a Fabry–Perot resonator. In the second case, the coherent feedback is connected with the multiple scattering events (random lasing from ZnO). In contrast to this, for the ZnO nanowires it is possible to realise only random laser generation. The mechanism of laser emission for ZnO microprisms and nanowires would be connected with the exciton-exciton scattering at intermediate intensities but may be switched to the electron-hole plasma emission at higher intensities.

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2. *Cao H., Xu J., Seelig E., Chang R.* Microlaser made of disordered media // Appl. Phys. Letters.-2000.-**76.**-P. 2997-2999.