NNN 20 P **NONLINEAR QUALITIES OF ZnO NANOSTRUCTURES.**

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Zinc oxide (ZnO) films and nanostructures attract increased interest of researchers due to the unique optical properties of ZnO. It has excitonic luminescence in the ultraviolet diapazon that makes it very perspective cheap material for applications in optoelectronic devices. Besides, not only bulk ZnO crystals and films, but also micro and nanostructures show high optical harmonics conversion efficiency, which is an extremely attractive property for integrated optics. It has been revealed that thin films of ZnO provide even more efficient harmonic generation than crystals due to size effects. Even ZnO nanolaser has been reported with single-photon and two-photon excitation [1,2]. Apart from application in thin-film based devices, this circumstance makes it possible to use the second harmonic generation (SHG) as a convenient and sensitive method for testing the textures of ZnO films fabricated by different techniques and conditions of growth. ZnO nanorods can be used to create high-performance short-optoelectronic devices. Nanostructuring of ZnO makes it possible to control the properties of fluorescent materials in a wide range of parameters: the spectral composition, performance, and the polarization pattern, which allows you to create a fundamentally new devices of optoelectronics.

In this work we report the results of microscopic research of ZnO nanostructures. We use two-photon far-field as well as near-field microscopy in order to find conditions and geometry for more efficient second harmonic generation, superluminescence and lasing with femtosecond excitation in the range of 700-1000 nm. Efficiency of nonlinear optical processes is calibrated using ZnO single crystal and epitaxial film. To extract the components of the nonlinear susceptibility tensor for both samples as well as characteristics of the film's texture we have developed a theoretical model that allows us numerically to simulate all measured dependencies.

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