

Optical Harmonic Generation In Nanostructured And Nanocomposite ZnO Films

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Nanoscale materials are of current interest because of their unique electrical, optical as well as nonlinear optical (NLO) properties which suggest their potential application as frequency converters and logic elements in the optoelectronic circuitry.

We have investigated structural, optical and NLO properties of nanostructured ZnO thin films obtained by RF-magnetron sputtering technique and ZnO/PMMA nanocomposite films which were prepared by embedding of ZnO nanocrystals (NCs) into PMMA polymer matrix. These films manifest a high optical transmittance in near UV-vis region. The temperature study of photoluminescence in ZnO/PMMA nanocomposite films demonstrates the intensive UV emission, which was connected with donor-bound excitons and lower green emission due to the presence of internal intrinsic defects [1].

The second and third harmonic generation studies of ZnO/PMMA nanocomposite films with different concentration of ZnO NCs and nanostructured ZnO films of different thickness were carried out at $\lambda=1.064$ nm with 16 ps pulse duration. It has been found that quadratic NLO susceptibility of nanostructured ZnO film of thickness less than 1 μm is highly dependent on its grain size and exceeds the value for bulk ZnO. The ZnO/PMMA nanocomposite films show quite high second and third order nonlinearity at low ZnO NCs concentration and high resistance to the intensive laser light [2].

1. Kulyk B., Kapustianyk V., Tsybulskyy V., Krupka O., Sahraoui B. Optical properties of ZnO/PMMA nanocomposite films // J Alloy Compd. – 2010. – 502, – P. 24-27.
2. Kulyk B., Sahraoui B., Krupka O., Kapustianyk V., Rudyk V., Tkaczyk S., Berdowska E., Kityk I. Linear and nonlinear optical properties of ZnO/PMMA nanocomposite films // J Appl Phys. – 2009. – 106, – P. 093102(1-6).