

Nanooptics and nanophotonics

Self-action effects manifestation in harmonic nanoparticles colloids

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Harmonic Nanoparticles (HNPs) are a new family of bio-markers for multiphoton imaging exerting the optical contrast by the second and the third harmonics generation [1]. Considering the growing interest the express methods of the HNPs nonlinear optical (NLO) characterization are required. In this work the photoinduced variations of the refractive index under the irradiation of picosecond laser pulses at 1064 nm (1.17 eV) and elastic optical scattering were used for HNPs diagnostics [2]. The linear and NLO responses comparison of the KNbO₃, KTP and LiNbO₃ HNPs colloids were done. In the case of LiNbO₃ HNPs the impact of HNPs shape (spherical and cubic) was studied.

It was shown that both types of LiNbO₃ HNPs colloids manifest more efficient scattering in backward hemisphere versus the KNbO₃. The scattering of the spherical HNPs is less versus the cubic one. More efficient scattering in forward hemisphere was observed for the KNbO₃ HNPs colloid. The NLO response analysis showed that the last colloid demonstrates the self-focusing effect - positive photoinduced refractive index variations $\Delta n > 0$. Up to 50% enhancement of self-focusing efficiency was observed for KTP HNPs colloid versus KNbO₃ HNPs one. Only the LiNbO₃ colloids exhibit the self-defocusing effect ($\Delta n < 0$), its efficiency is sensitive to the HNPs shape.

The obtained results indicate that the applied approaches are promising for the comprehensive HNPs colloids characterization.

1. Joulaud C., Mugnier Ya., Djanta G., Dubled M., Marty J.-K., Galez Ch., Wolf J.-P., Bonacina L., Le Dantec R. Characterization of the nonlinear optical properties of nanocrystals by Hyper Rayleigh Scattering. *J. Nanobiotechnology*. –2013.–**11**, S8 (6 pp.).

2. Gayvoronsky V.Ya., Kopylovsky M., Brodyn M., Popov A., Yatsyna V., Pritula I. Interplay of quadratic and cubic nonlinear optical responses in KDP single crystals with incorporated TiO₂ nanoparticles. In: *Nanomaterials Imaging Techniques, Surface Studies, and Applications*. Eds: Fesenko O., Yatsenko L., Brodyn M. - Springer Proc. in Phys. 146, Springer

Science+Business Media, New York 2013, 349-365.