

Exploration of Second Harmonic Generation in KDP-Based Crystalline Nanocomposites

B. Kulyk¹, N. Andrushchak², A. Andrushchak², B. Sahraoui³

¹Research and Educational Center “Fractal”, Department of Physics, Ivan Franko National University of Lviv, 50 Dragomanova Str., 79005 Lviv, Ukraine

²Lviv National Polytechnic University, 12 S. Bandery Str., 79013 Lviv, Ukraine

³University of Angers, MOLTECH-Anjou Laboratory, UMR CNRS 6200, 2 bd Lavoisier, 49045 Angers, France

In recent years, nanomaterials have been in a primary focus of science and technology with their rigorous research and development. Nanoporous materials as a subset of nanostructured materials possess unique structural-surface properties that underline their importance in various fields of human activity. They offer new opportunities in areas of inclusion chemistry, guest-host synthesis and molecular manipulations and reaction in the nanoscale range.

The exploration of quadratic nonlinear optical response in nanocomposites based on KDP nanocrystallites grown inside nanopores of aluminium oxide Al_2O_3 (Fig.1) has been performed. Growing the KDP nanocrystallites inside these nanopores has been recently confirmed by X-ray analysis [1]. The rotational Maker fringe technique [2] in the transmission scheme has been used for second harmonic generation (Fig.2) measurements employing *s*- and *p*-polarized fundamental 1064 nm laser beam.

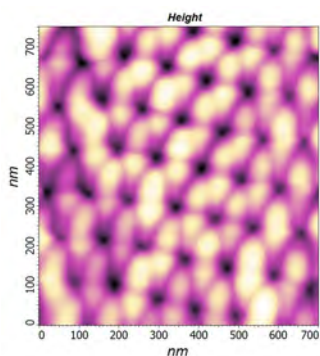


Fig. 1. AFM image of alumina nanoporous matrix

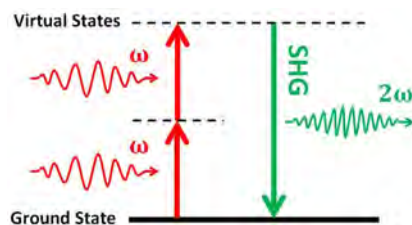


Fig. 2. Schematic energy-level diagram of SHG process

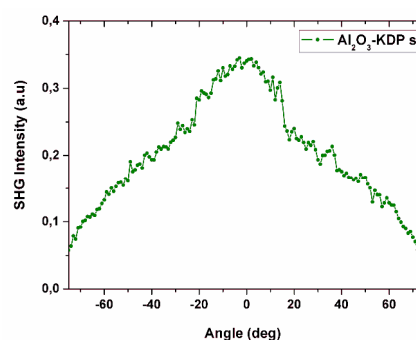


Fig. 3. Angular dependence of SHG in KDP nanocomposite

The second order nonlinear optical response of studied nanocomposites (see Fig.3) again confirms the presence of noncentrosymmetric filler (nanocrystallites of KDP) inside nanopores of Al_2O_3 . Furthermore, the polarization dependent intensity of nonlinear response suggests the macroscopic anisotropy of grown KDP nanocrystallites. Thus, second harmonic generation technique may serve as a sensitive tool for diagnostics of crystalline fillers inside nanoporous matrices.

- [1] N.A. Andrushchak, O.A. Buryy, V.T. Adamiv, I.M. Teslyuk, A.S. Andrushchak, A.V. Kityk, Development of crystalline nanocomposites with KDP crystals as nanofiller, *Proceedings of the International Conference on Nanomaterials: Applications and Properties*, Lviv, Ukraine, 2016, Vol. 5, No.2, 02NNSA10(3 pp.).
- [2] B. Kulyk, A.P. Kerasidou, L. Soumahoro, C. Moussallem, F. Gohier, P. Frère, B. Sahraoui, Optimization and diagnostic of nonlinear optical features of π -conjugated benzodifuran-based derivatives, *RSC Adv.* **6** (2016) 14439-14447.