RESONANCE PHOTOACOUSTIC TRANSFORMATION OF BESSEL LIGHT BEAMS IN LOW-DIMENSIONAL STRUCTURES

G.S. Mityurich[1], M. Aleksiejuk[2], E.V. Lebedeva[3], A.N. Serdyukov[1]

[1]Gomel State University, 246019, Gomel, Belarus
[2]Institute of Fundamental Technological Research Polish Academy of Sciences, 02-106, Warszawa, Poland
[3]Belarusian Trade and Economics University of Consumer Cooperatives, 246029, Gomel, Belarus

email: maleks@ippt.pan.pl

The work is devoted to the construction of a model of resonance photoacoustic (PA) transformation of Bessel light beams (BLB) modes in a layer of chiral carbon nanotubes (CNTs).The BLB is used in laser PA diagnostics methods by way of sound excitation sources in low-dimensional structures [1–2]. The use of BLB in optical-acoustic microscopy makes it possible to effectively increase the focal depth of the resulting photoacoustic image in comparison with the ordinary Gaussian light beam.

The results obtained in the experimental photoacoustics of low-dimensional structures have shown the need to create new theoretical approaches and models for laser photoacoustic transformation in the field of nanoobjects and to develop methods for determining the dissipative, dielectric, gyrotropic, thermophysical, and geometric parameters of media with reduced dimensionality.

A theoretical model of the PA transformation of the BLB layer of chiral CNTs is constructed for the cases of free boundaries and alternately loaded boundaries of the "sample-piezotransducer" system.The analysis of the expressions for the amplitude of the photoacoustic response showed that a resonant increase in the resulting signal occurs in the megahertz frequency range.It is established that the magnitude and frequency of manifestation of resonant peaks depends on the parameters of the sample, on the choice of boundary conditions, on the angle of conicity and the modulation frequency of the BLB.

Keywords: photoacoustic transformation, Bessel light beams, chiral carbon nanotubes, low-dimensional structures