Laser photodeflection spectroscopy of the spatially non-homogeneous media

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An important and long-range direction in the development of modern systems of diagnostics and non-destructive control is working out of ways of non-contact, distant registration of mechanic strengths and defects appearing in the volume of solids. A series of methods is used for the solution of problems of such a type of complexity, among which it is necessary to single out ultrasound spectroscopy, methods of holographic interferometry and diffraction methods. Photothermal methods of investigation of condensed media have been widely used recently [1]. A distinctive peculiarity of photothermal methods used for studying solid objects is their universality and relative simplicity of measurement realization. One of the photothermal methods is the method of photodeflection spectroscopy [2], which is also successfully applied in the study of chiral media [3]. This paper theoretically investigates the process of the photodeflection response formation in the sample possessing non-homogeneities of the inner structure. The influence of subspatial defects on the amplitude and phase characteristics of the photodeflection response has been studied on the basis of analytical expressions, obtained by the authors for the description of processes of photothermal transformation in the volume of the media. It was shown that non- homogeneities of the inner structure of the investigated substance make a considerable contribution to the processes accompanying photothermal transformation of energy. As a result the characteristics of the photodeflection response of the sample possessing non-homogeneities of the inner structure change. The paper shows the possibility of using the method of photodeflection spectroscopy for detecting and visualizing defects and local non-homogeneities of the inner structure of the substance. There has been carried out a comparative analysis of the accuracy of information about inner defects of a non-homogeneous object during photodeflection and photoacoustic ways of registration of the resulting signal.

References

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