PI-36

PHASE TRANSFORMATIONS OF LIGHT BEAMS IN PHOTOREFRACTIVE CRYSTALS OF BISMUTH SILICATE

A.L.Tolstik, I.G.Dadenkov, E.A.Melnikova

Belarusian State University, Nezavisimosti Ave. 4, Minsk, Belarus

E-mail: *tolstik@bsu.by*

Abstract. Photorefractive crystals of bismuth silicate $Bi_{12}SiO_{20}$ are semiconductors with a broad forbidden band, which still are highly sensitive to radiation in the visible spectral region due to numerous impurity and defect centers in sillenites [1]. Crystals of the sillenite family enable fast recording and erasure of information, dynamic gratings including. These crystals are extensively used in systems of real-time optical processing of the light fields, in systems for data storage and transmission in the process of designing the controlled elements of adaptive and wave-guide optics, in holographic interferometry inclusive of the vibrational amplitude measurements in the subnanometer range [2, 3].

This paper presents realization of a pulsed recording of singular dynamic holograms [4] with the use of Gaussian and singular beams in photorefractive crystals of bismuth silicate. At the first stage volume holograms have been recorded in a photopolymer characterized by high resistance to radiation damage to enable the formation of singular beams (optical vortices). On reconstruction of the holograms recorded in the photorefractive crystal, the Gaussian beam propagation was in zero diffraction order and a singular beam was propagating in the first diffraction order. This scheme is distinguished by the use of the transmitted and of the diffracted beams for interference analysis of the topological charge of an optical vortex. Owing to two transmitted beams, one can compensate for the effect of optical activity and obtain a high-quality interference pattern with high visibility.

Moreover, the use of four-wave interaction scheme to record dynamic holograms has permitted realization of the wavefront conjugation effect. In this case the recorded hologram is read out by the laser pulse counterpropagating to the reference wave. The diffracted wave is counterpropagating to the signal wave, with the same spatial distribution of the amplitude and phase. Compensation for the phase distortions on return propagation of the diffracted wave has been demonstrated.

As shown by analysis of dynamic recording and relaxation of dynamic gratings in crystals of bismuth silicate, the formed gratings of two types were different as to the formation mechanisms and recording or relaxation times. The conditions of recording the short-lived (a few hundreds of microseconds) and long-lived (several seconds) dynamic gratings effective in systems of adaptive interferometry have been determined.

REFERENCES

1. I.G. Dadenkov, A.L. Tolstik, Yu.I. Miksiuk, K.A. Saechnikov, *Scientific and Technical Journal of Information Technologies, Mechanics and Optics,* **22**, 2022, pp. 1025-1030.
2. A.A. Kamshilin, R.V.Romashko, Y.N. Kulchin, *J. Appl. Phys.* **105**, 2009, pp. 031101.
3. R.V.Romashko, *Vestnik of Far Eastern Branch of Russian Academy of Sciences*, **4**, 2021 pp. 40–47.
4. A.L. Tolstik, *Russian Physics Journal*, **58**, 2016, pp. 1431–1440.