with inclined walls in a sample of 5%MgO:LiNbO3 at different positions of the center of an elliptical probe laser beam with a waist size of about 25 μm along the polar Z axis. From the experiments it has been found that the diffraction efficiencies for different spatial harmonics of perturbations of the optical properties created by the walls of the RDS in the crystal are characterized by nonmonotonic behavior. Under theoretical analysis of the observed features of Bragg diffraction we have used an approach based on the Fourier decomposition of dielectric tensor perturbations created by inclined walls of the RDS in discrete spatial harmonics with coefficients determined by the components of the continuous angular spectrum.

Plasmon-Enhanced Optical Nanolithography

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In this report, we propose and investigate a scheme for optical nanolithography of the interference type based on the use of excitation of counter-propagating surface plasmon-polaritons at a flat interface of a metal-dielectric nanostructure. A detailed calculation of the optical nanolithography scheme designed to form sinusoidal diffraction gratings is performed. It is shown that the use of an input prism with a large refractive index allows increasing the gain of the field formed in the photoresist by more than an order of magnitude. The conditions are analyzed for which maximal gain of the field (the penetration depth into photoresist, respectively) and maximal resolution of created gratings are achieved. It is found that by changing the thickness of the layers of the metal-dielectric structure, it is possible to change the wave number at which the plasmon resonance condition is realized, and thereby to control the period of the formed gratings and the depth of field penetration into the photoresist.

The possibility of application of proposed scheme (with certain modifications) for creating two-dimensional and circular gratings, as well as gratings of arbitrary shape is discussed.

Transverse structure of interfering laser beams in canonically conjugate coordinates

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Analysis and control of the transverse structure of laser beams (LB) is an important task, new approaches to the implementation of which are opened by adaptive digital holography. Here, along with highly efficient optoelectronic devices, such as digital cameras and spatial light modulators, numerical methods for processing data on the transverse structure of interfering LB are widely used. The paper considers the implementation of an off-axis scheme for recording the interference pattern (IP) with subsequent discrete Fourier analysis in canonically conjugate coordinates, which allows the IP to be decomposed in the frequency representation into individual components, including those responsible for the formation of the object and phase-conjugate LB. It has been experimentally demonstrated that increasing the IP resolution in frequency coordinates by increasing the Fourier transform array ultimately reaches the resolution level in canonically conjugate spatial coordinates. In this case, decreasing the sampling step in the frequency representation allows resolving the spectral components of the speckle structure detuned from the spectrum of the original LB with greater reliability. It also significantly reduces the error in reconstructing the true phase of the original signal caused by the mismatch between the real value of the carrier frequency and the discrete detuning of the spectral components by ±1 orders, determined with an accuracy of up to one step. It has been shown that analysis and processing of a digital hologram with a high resolution in canonically conjugate coordinates allows reconstructing the wave front of the signal beam with a high degree of accuracy, correcting the interference introduced by both individual optical-electronic units of the holographic system and those formed by the speckle structure.