Nanoobjects microscopy

Optimization of the parameters of digital holographic microscope

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Nowadays holographic interferometry is becoming more relevant for the study of micro- and nanoscale objects due to the development of nanotechnology, which requires designing new approaches and methods [1]. It is known that optical microscopy is a common method for solving such problems. However, there are problems of spatial resolution which connected with the diffraction phenomenon and the technical difficult of 3D visualization the phase microobjects. Combination of holographic interferometry and classical microscopy eliminates these problems. It allows enhance opportunities of the non-destructive and non-contact methods for qualitative and quantitative diagnostics of micro- and nanomedias [2]. In practice there are many factors that impose limitations on the technical capabilities of digital holographic interferometry methods. According to the Nyquist theorem, the maximum frequency of interference fringes of the hologram, which can be recorded on a CCD matrix with pixel size dx, equal to $f_{max}=1/dx$. Moreover, high frequency requires small size of speckles [3].

In this work, the digital holographic microscope based on classical interferometer Mach-Zehnder was developed. One interferometer arm is an optical system of the microscope, the second one form a reference wave for the hologram recording of the researched object. The software for recording and reconstructing digital hologram and formation of the digital interferogram was developed. Experimentally studied of the influence of optical parameters presented scheme (position and diameter of an output pupil, linear increase of the microscope system, frequency interference fringes) on the quality of digital holograms and interferograms.

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