Example of Poster for ITNT-2018

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Simulation

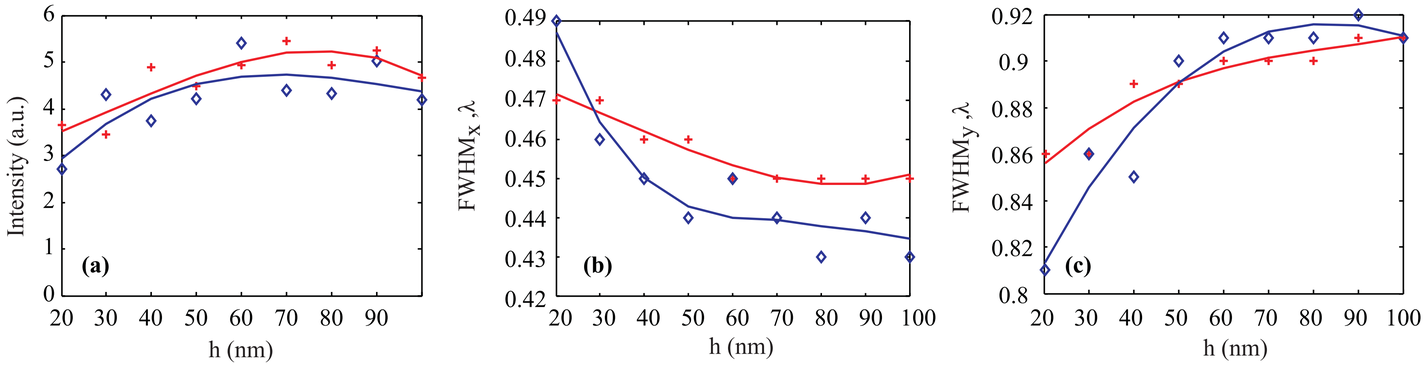

Fig. 2. Focal spot parameters versus the height of chromium (red lines) and silver (blue lines) zone plates: the maximum intensity (a), full width at half maximum of focal spot on X (b) and Y (c) direction. Red crosses mark and blue rhombus mark experimental values and curve presents a cubic spline interpolation. The height of the relief of 70 nm allows to achieve an optimum ratio of the width and the intensity of the focal spot.

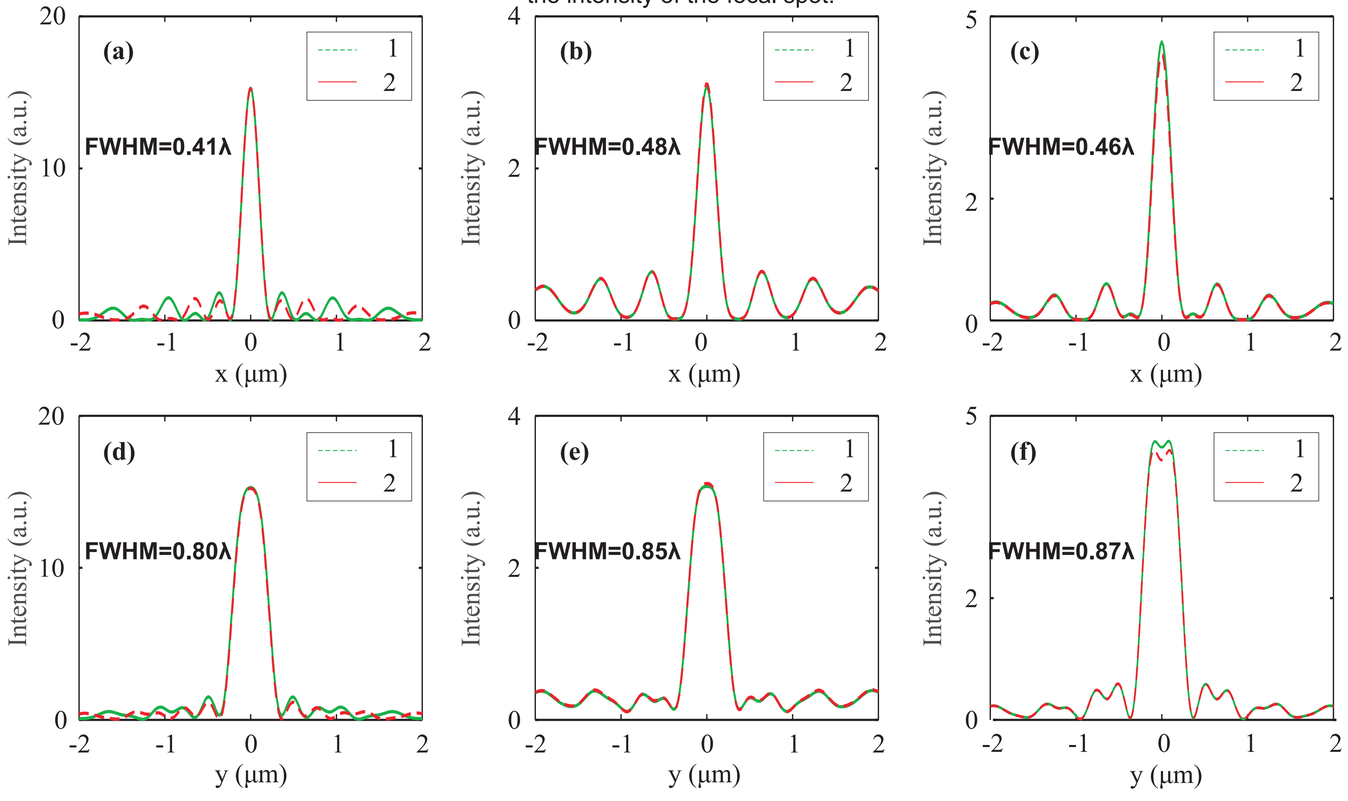

Fig. 3. Distribution of intensity in the focus for phase (a,d), silver (b,e) and chromium (c,f) ZPs along x (a-c) and y (d-f) axis calculated by FDTD method (line 1) and by (FD)2TD method (line 2)

Fabrication and Experiment

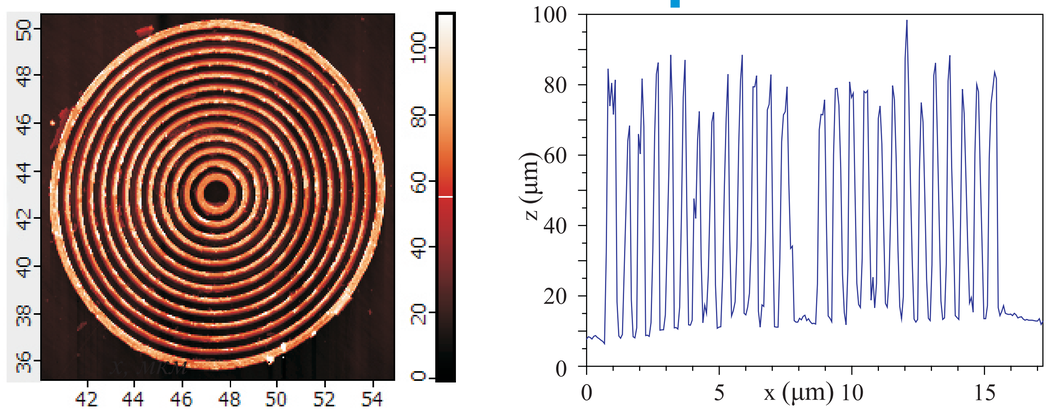

Fig. 4. Chromium ZP: surface relief and y-axis profile measured on an atomic force microscope. The 15-μm ZP composed of 13 rings fabricated in a 70-nm chromium film was designed for a wavelength of 532 nm and had a wavelength focal length. Then, the ZP relief features were measured on an atomic force microscope Solver Pro P7 (NT-MDT, Russia).

Fig. 8. Measured intensity profiles of the focal spot (Fig. 3) along x- (a) and y-axis (b). Red crosses mark experimental values and black curve presents a cubic spline interpolation

Conclusion

In this paper amplitude Fresnel zone plates (ZPs) with silver and chromium relief on silica glass are theoretically and experimentally investigated. Study of the focal spot characteristics versus the height of chromium and silver ring of ZP was carried out. It showed that the height of the relief of 70 nm allows to achieve an optimum ratio of the width and the intensity of the focal spot. Also, the results of a numerical experiment on focusing radiation with the help of a fabricated ZP, the relief height of which was 70 nm are presented. Using a scanning near-field optical microscope (SNOM) with a small-aperture metal probe, we show that a chromium ZP with relief of height equal to 70 nm, diameter of 5.2 μm and focal length of λ=532 nm focuses a linearly polarized Gaussian beam into an ellipse with the Cartesian axis diameters FWHMx=0.42λ and FWHMy=0.64λ.

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