

Preliminary results in investigation of diffractive high-efficiency objectives

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Abstract

It has been shown that high-efficiency diffractive objectives are an alternative to their refractive counterparts for applications requiring high precision transformation of monochromatic light (for example in interferometers). A 80 mm diameter prototype (N.A. - 0.158; design wavelength - 632.8 nm) has been fabricated by direct laser writing on photoresist. It was manufactured on a polar coordinate laser writing system CLWS-300 that is able to write high precision DOEs up to a diameter of 300 mm. The blazed diffractive structures were written directly into a photoresist layer that was spinned on a high-precision substrate. The fabricated objective has rms wavefront error of less than $\lambda/20$ in single pass. The residual errors are predictable using manufacturing data that is recorded during the writing process for each element. This permits to provide each element with calibration data. Measurements of the fabricated DOEs show excellent agreement between the predicted and measured wavefront quality.

Keywords: diffractive high-efficiency, transformation of monochromatic light, design wavelength, direct laser, photoresist, DOE, high-precision substrate, rms wavefront error.

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