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Refined grating fabrication using Displacement Talbot Lithography

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Abstract: High-resolution grating areas with none stitching error are in demanding needs but usually expensive and hard to prepare. In this paper, we present a method of making refined grating areas from coarse photolithography mask using Displacement Talbot Lithography (DTL). DTL is relatively simple and low-cost system based on mask photolithography for high-resolution periodic structures over large areas. The grating periods on the ordinary coarse photolithography mask was designed as 3.552μ. By patterning gratings on Si_3N_4 film deposited on fused silica as intervening phase masks, the final prepared grating periods shrinks 8 times, down to 444nm. This technology is suitable for producing large area high resolution gratings to reduce the research cost, and can be applied to applications such as DFB laser production, LED substrates preparation and other relative fields.

1. Introduction

Gratings have an ever growing list of applications such as anti-reflection structures, sensor arrays, metamaterial applications, polarizers, plasmonic color filters, spectroscopy and so on[1-8]. The resolution for Bragg gratings in these applications, defined in terms of the lattice constant of the periodic structure, is generally in the 100 nm – 1 μm range. Even though projection optical lithography has been served the demands of industry for years, it is not always possible to reach such high resolution, especially considering the depth of focus limitation and high cost. Interference lithography [9,10] is able to break through the limitation of resolution, yet suffers from strict control and stabilization of optical system environment, and especially hard to modify when multiple grating