2D Phase masks

Square Lattice Pattern Generation

Enabling volume manufacturing of 2D gratings on planar wafers in a 1-step, large grating area, high accuracy process.

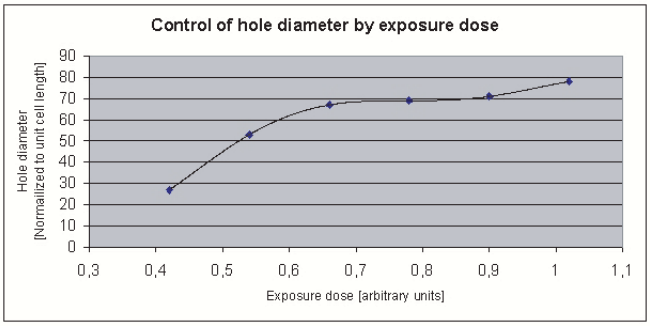
Holographically produced 2D Phase masks allow for production-friendly 1-step exposure of 2D grating structures over large grating areas. Ibsen's +/- 0.01 nm period accuracy further enhances customer manufacturing performance and yield. Phase masks can be used either with simple laser illumination or in a volume production oriented NFH mask aligner process. Clear on-mask identification of grating parameters including 2D grating orientation facilitates use.

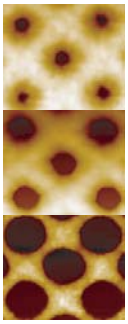
Features
Single exposure process for 2D square lattice grating structures
Square lattice periodicity possible down to 200 nm
Period accuracy and uniformity of +/- 0.01 nm
Hole diameter is controlled by exposure time
High contrast in interference pattern
Inherently free of stitching errors
Optimized to illumination wavelengths from 193-435 nm
2D Phase masks can be optimized to any polarization - including unpolarized
Phase mask parameters are specified on each Phase mask

Product range and specifications	
Grating periods	200 nm - 687 nm
Illumination	193 nm - 435 nm
Material	Fused silica
Period accuracy	+/- 0.01 nm
Grating and substrate sizes	
Grating size	Substrate size
ÿ2"	3" x 3" x 2 mm
100 mm x 100 mm	6" x 6" x 3.8 mm
Custom grating areas possible	

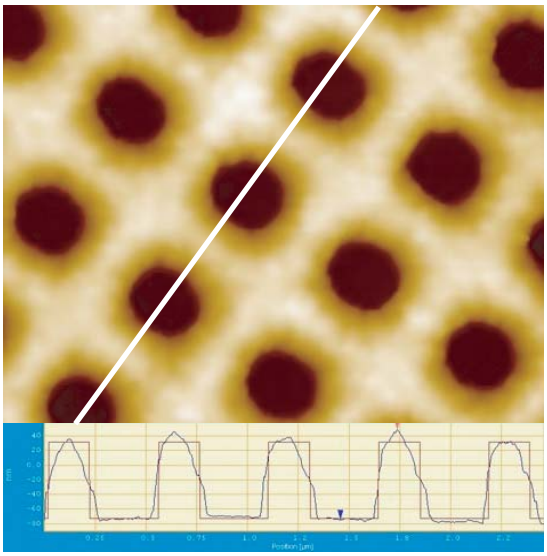
The principle

The 2D square lattice Phase mask is illuminated at the Bragg angle, similar to the well known 0/-1 order 1D Phase mask principle. The 2D Phase mask diffracts this illumination into multiple orders; the coherent interference pattern between these accurately creates the 2D periodicity. Our innovative production techniques allow us to manufacture 2D Phase masks with periodicities down to 200 nm, while the 2D Phase mask principle of operation limits the upper lattice periodicity to 687 nm (435 nm illumination).





Sample Applications
Display technology
Semiconductor applications
Solar cells
Photonic crystals
Biochip matrices



Criteria of suitability

The 2D Phase mask prinicple requires a certain relationship between the illumination wavelength and grating period. In other words, a given illumination λ can be used to expose a calculable range of grating periods Λ via the following equation:

$$\frac{2}{\sqrt{10}} \leq \frac{\lambda}{\Lambda} \leq \sqrt{2}$$

Calculation of Bragg angle

The Phase mask is optimized for illumination at the 2D Bragg angle, which can be calculated using the following equation:

$$Sin(\Theta_B) = \frac{\lambda}{\sqrt{2} \cdot \Lambda}$$

Ibsen photonics

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