

## Supplementary Information

### Planar Ultraviolet Objective Lens for Optical Axis Free Imaging

### Nanolithography by Employing Optical Negative Refraction

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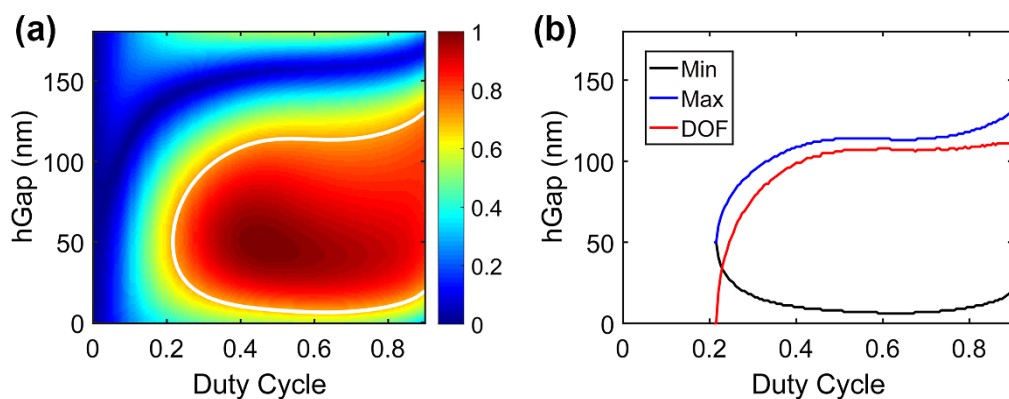


Fig. S1 Imaging simulation results for periodical dense lines. (a) Contrast of imaging field in the center depth of Pr layer for different working gaps and dense lines duty cycles in mask. The contrast contours of 0.7 are denoted by the white curves. (b) Maximum/Minimum gap and the corresponding DOF as a function of the dense lines duty cycle in mask. The pitch is 330 nm.

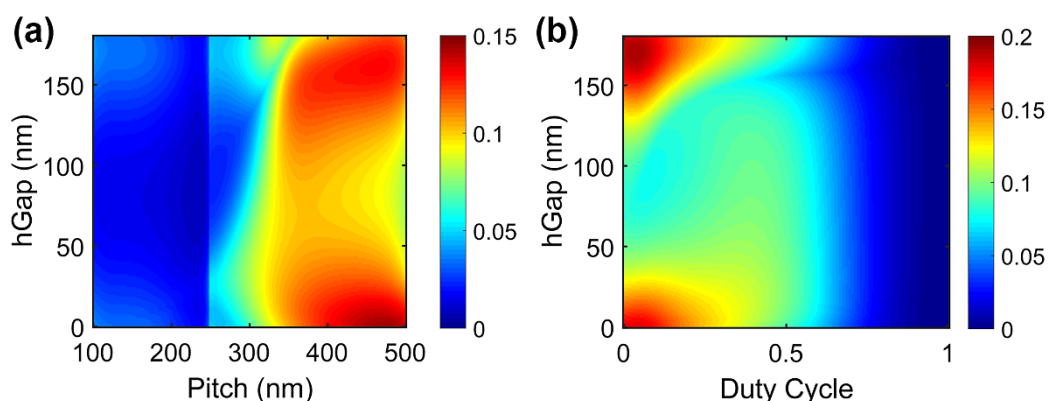


Fig. S2 Imaging simulation results for periodical dense lines. (a) Peak intensity of imaging field in the center depth of Pr layer for different working gaps and dense lines pitches in mask. The duty cycle in (a) is 0.5. The pitch in (b) 330 nm.

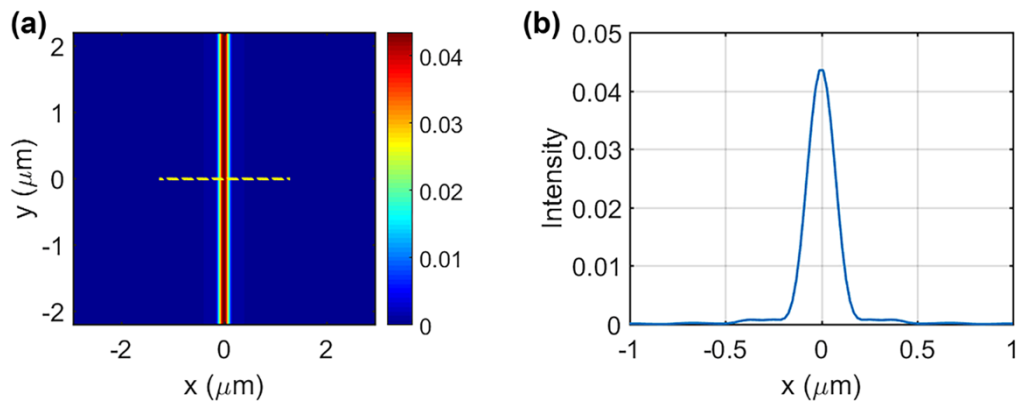


Fig. S3 Simulated imaging result for single line mask with slit aperture of 180 nm. (a) Image field intensity distribution and (b) the intensity profile along cut line through center. The air gap is 100 nm.

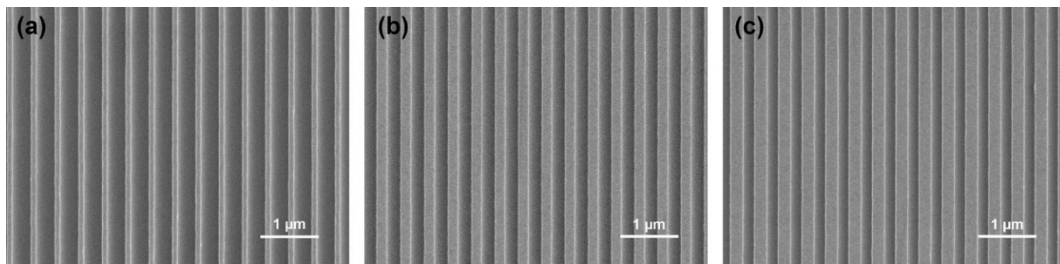


Fig. S4 SEM of dense lines mask with the nominal same pitch of 410 nm and different duty cycles of (a) 0.30, (b) 0.46 and (c) 0.55, respectively.

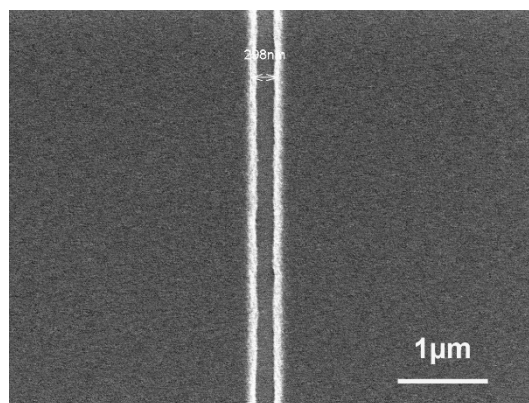


Fig. S5 Exposure result in Pr layer for single line mask with slit aperture of 180 nm.

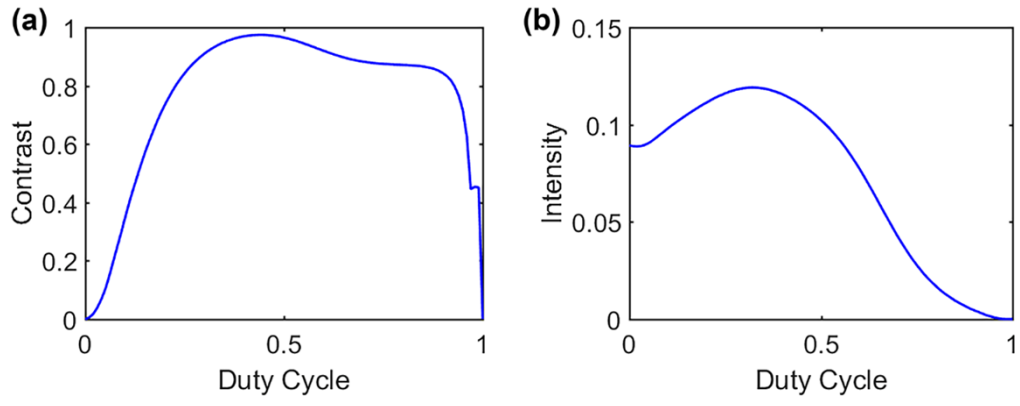


Fig. S6 (a) Contrast and (b) peak intensity of imaging field for dense lines mask with different lines duty cycle and identical pitch of 410 nm. The air gap is 100 nm.