

Electronic Supplementary Material

Proximity correction and resolution enhancement of plasmonic lens

lithography far beyond near field diffraction limit

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1. Simulation and optimization the period and pairs of grooves

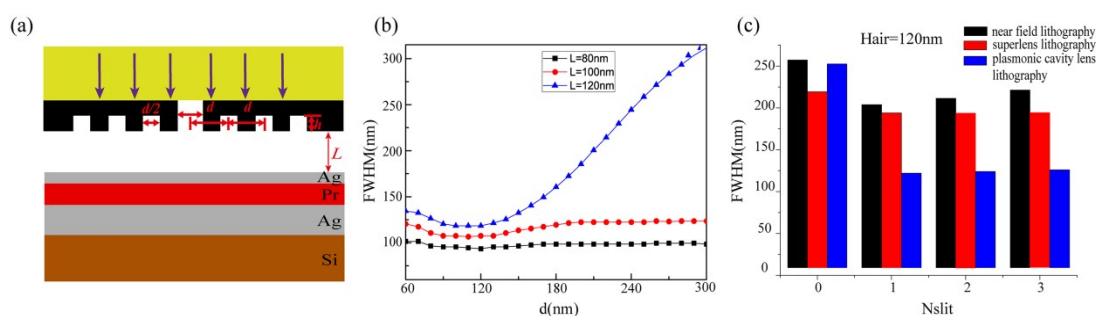


Figure S1 (a) Schematic configuration of noncontact NI illumination plasmonic lithography. (b) FWHM of a single slit pattern as a function of period of grooves under various air working distances for the configuration in (a). (c) FWHM of slit at the central of Pr layer versus pairs of grooves at the exit side of mask. The air working distance is 120nm.

The three curves in Fig. S1 (b) corresponds to the calculated FWHM of slit with one pair grooves with different period under the air working distance of 80 nm, 100 nm and 120 nm, respectively. The period "d" of approximately 120 nm has best effect for confining the FWHM of slit. Figure S1 (c) depicts the calculated FWHM of slit for variant groove pairs. The reduction of FWHM is already apparent for one pair of grooves and holds coherence as increasing the number of grooves.

2. The surface roughness of the plasmonic cavity lens

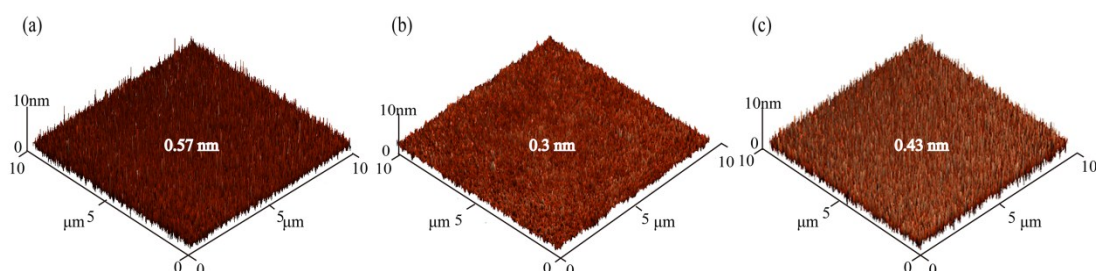


Figure S2 Surface topographies of (a) the bottom Ag layer, (b) the photoresist layer and (c) the top Ag layer.

Figure S2 shows the surface roughness (root-mean-square) of the bottom Ag layer, the photoresist layer and the top Ag layer. The surface roughness are about 0.57 nm, 0.3 nm and 0.43 nm , respectively.

3. The cross-sectional view of the fabricated groove-assisted masks and Ag-PR-Ag cavity len.

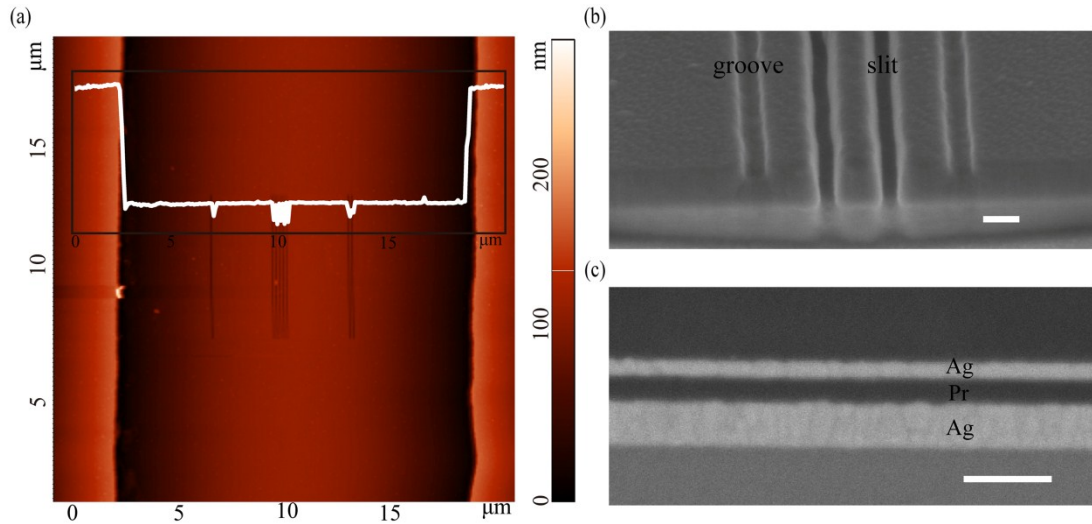


Figure S3 (a) AFM image of the Cr mask with a 120-nm air distance and a 60nm feature-size mask patterns. (b)The SEM of the cross-sectional view of the fabricated groove-assisted masks and (c) Ag-PR-Ag cavity len (scale bar, 100 nm).

Figure S3 exhibits AFM and SEM image of the Cr mask with 120 nm air imaging distance. We could observe clearly the air distance of 120 nm on the Cr mask. Further, from the Fig. S3 (b), a pair of assistant grooves with 60 nm width, 90 nm thickness is added to the slit pattern on the both sides. The Ag-PR-Ag cavity len is formed by the bottom Ag layer, the photoresist layer and the top Ag layer, the thickness of 50 nm, 30 nm and 20 nm respectively (Fig. S3 (c)).