Supporting Information

Self-organized conductive gratings of Au nanostripe dimers enable tunable plasmonic activity

Maria Caterina Giordano[1], Matteo Barelli[1], Giuseppe Della Valle[2] and Francesco Buatier de Mongeot[1]

[1]Dipartimento di Fisica, Università di Genova, Via Dodecaneso, 33 - 16146 Genova, ITALY
[2]Dipartimento di Fisica and INFN-CNR, Politecnico di Milano, Piazza Leonardo da Vinci, 32 - 20133 Milano, ITALY

Self-organized Au nanostripe arrays are homogeneusly fabricated over large area samples (cm^2) via defocused ion induced wrinkling on glass substrates and following Au depositions at glancing angle.

The self-organized defocused ion beam sputtering has been exploited for large-area nanopatterning of conventional soda lime glass substrates (microscope slides - Knittel glass). The ion beam irradiation has been performed at the tilted angle $\theta = 30°$ with respect to the surface normal by exploiting a defocused ion source (diameter of the ion beam ≈ 3 cm). In particular the glass surface has been irradiated with Ar+ ion beam of 800 eV energy with the extractor grid potential difference set at -200 V with respect to the plasma grid. In order to avoid charging effects on the dielectric substrate a tungsten filament biased at -13 V provides electrons via thermoionic emission.

Under these condition quasi -1D rippled template are homogeneusly fabricated over large area and can induce subwavelength confinement of AU nanostripe arrays, as demonstrated in Fig.1 of the manuscript.

In order to demonstrate the homogeneity of the pattern over large area we performed detailed AFM and SEM characterization a typical nanostripe sample. The morphology has been acquired in different regions that are shifted 5 mm - 7 mm apart one with respect to the other, as sketched in Figure SI2a.

The AFM topographies of the bare rippled glass template allowed to evaluate (i)the characteristic periodicityof the pattern via the 2D self-correlation, (ii) the vertical amplitude of the pattern via RMS roughness and, (iii) the slope of the characteristic facets evaluated from the histogram of the slopes. Indeed, a characteristic peak in the histogram of the slope distribution is observed as shown in Fig. SI 1, referred to a characteristic AFM image of the rippled glass template. The presence of these peculiar facets has been demonstrated in Refs. [1,2].

The table of Fig SI2 shows the values obtained in different positions (P1, P2, P3) on the same sample as sketched in Fig. SI2a.

After the ion induced nanopatterning of the glass templates metal nanostripe arrays are confined via glancing angle Au evaporation with a macroscopic aligned with respect to the sample. Under this condition the degree of homogeneity detected on the glass template is reflected in the plasmonic gratings as shown by the SEM images of Fig. SI2 b), c), d) corresponding to position P1, P2 and P3 respectively.

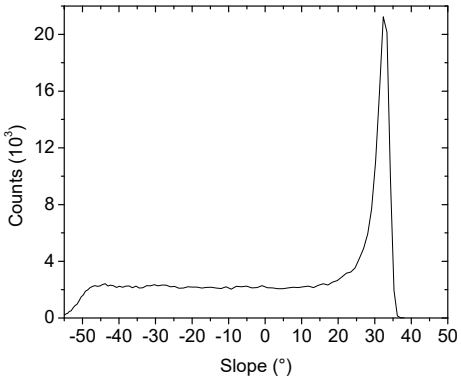
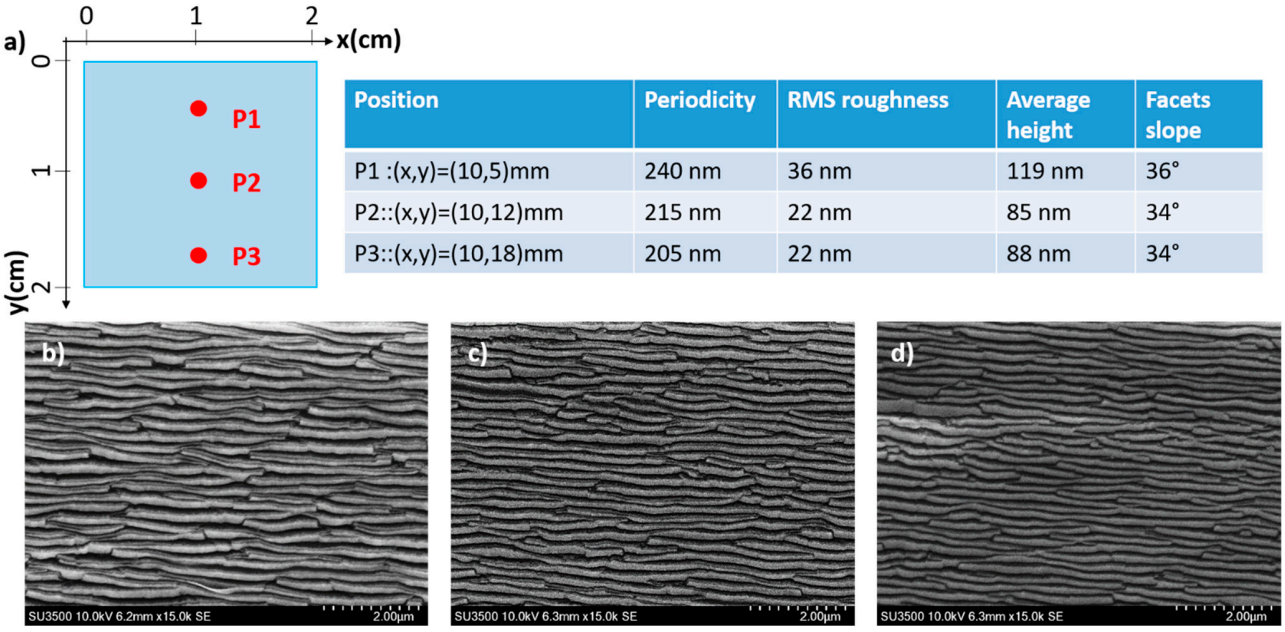


Figure SI1 Histogram of the slope distribution of a typical rippled glass template.



Position	Periodicity	RMS roughness	Average height	Facets slope
P1 :(x,y)=(10,5)mm	240 nm	36 nm	119 nm	36°
P2::(x,y)=(10,12)mm	215 nm	22 nm	85 nm	34°
P3::(x,y)=(10,18)mm	205 nm	22 nm	88 nm	34°

Figure SI2 (a) Sketch of the sample where are highlighted the regions P1, P2 and P3 characterized by AFM microscopy (see characteristic parameters in the table. **(b-d)** SEM images of Au nanostripe arrays confined in region P1, P2 and P3 respectively. The images clearly highlight the large area homogeneity of these plasmonic templates.

References

[1] Giordano, M.C. and Buatier de Mongeot, F. Anisotropic Nanoscale Wrinkling in Solid-State Substrates. *Advanced Materials* **2018**, *30*(30), 1801840.

[2] Giordano, M.C.; Longhi, S.; Barelli, M.; Mazzanti, A.; Buatier de Mongeot, F.; and Della Valle, G. Plasmon hybridization engineering in self-organized anisotropic metasurfaces. *Nano Research* **2018**, 11(7), 3943-3956.