Electronic Supplementary Material (ESI) for RSC Advances.

Photothermal response of the plasmonic nanoconglomerates in films assembled by electroless plating

Milana Lisunova,[1,*] Xingfei Wei,[1,*] Drew DeJarnette,[2] Gregory T. Forcherio,[2] Keith R. Berry,[1] Phillip Blake,[1] D. Keith Roper[1,2,†]

* The two authors contributed equally

[1] Ralph E. Martin Department of Chemical Engineering, 3202 Bell Engineering Center,

[2] MicroElectronics-Photonics Program, Institute for Nanoscience and Engineering,

University of Arkansas, Fayetteville, AR 72701

[†] To whom correspondence should be addressed.

Tel: +1 479 575 6691

Fax: +1 479 575 7926

e-mail: dkroper@uark.edu

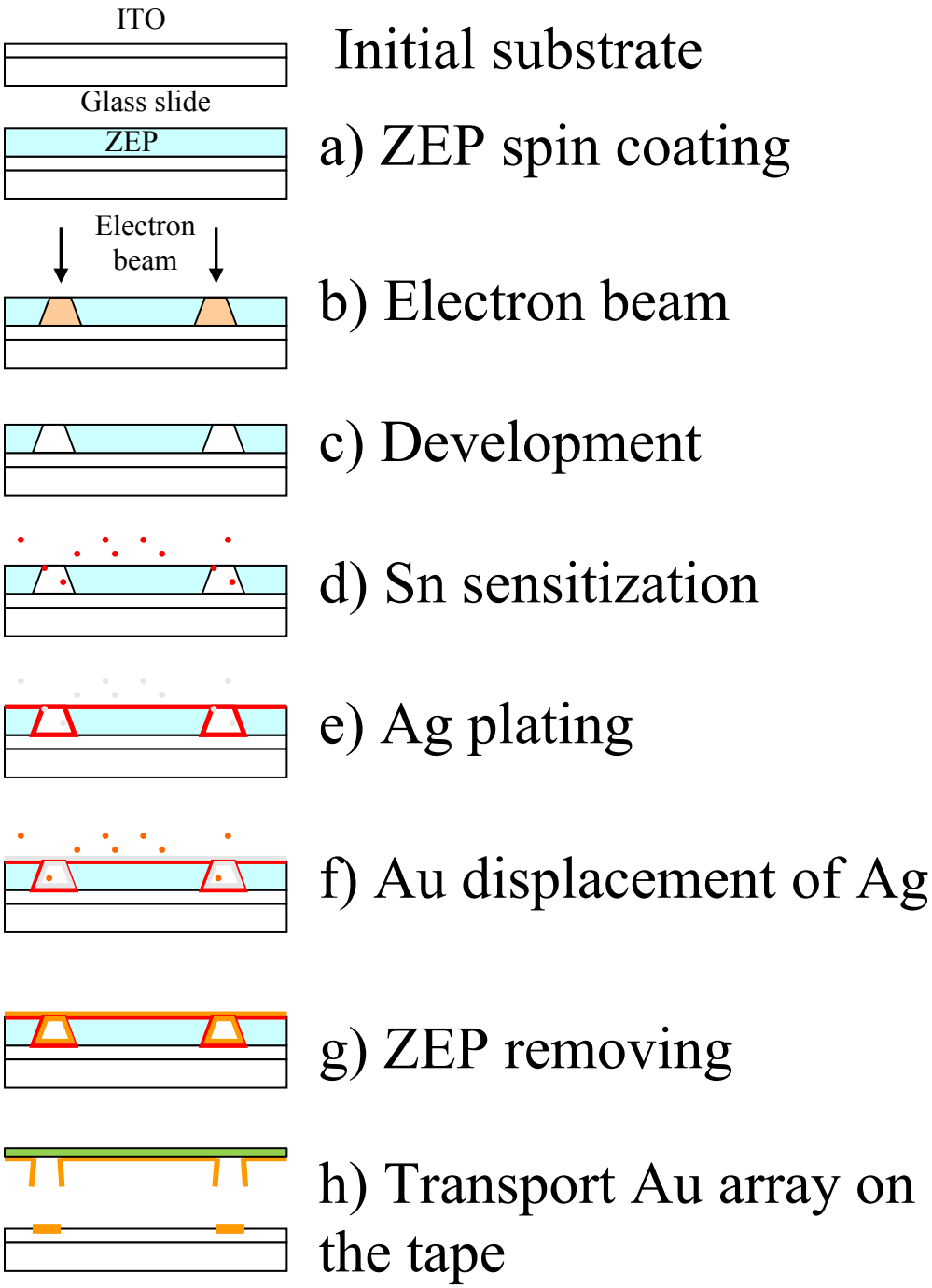


Fig. S1. Schematic representation of the gold deposition to the ordered arrays.

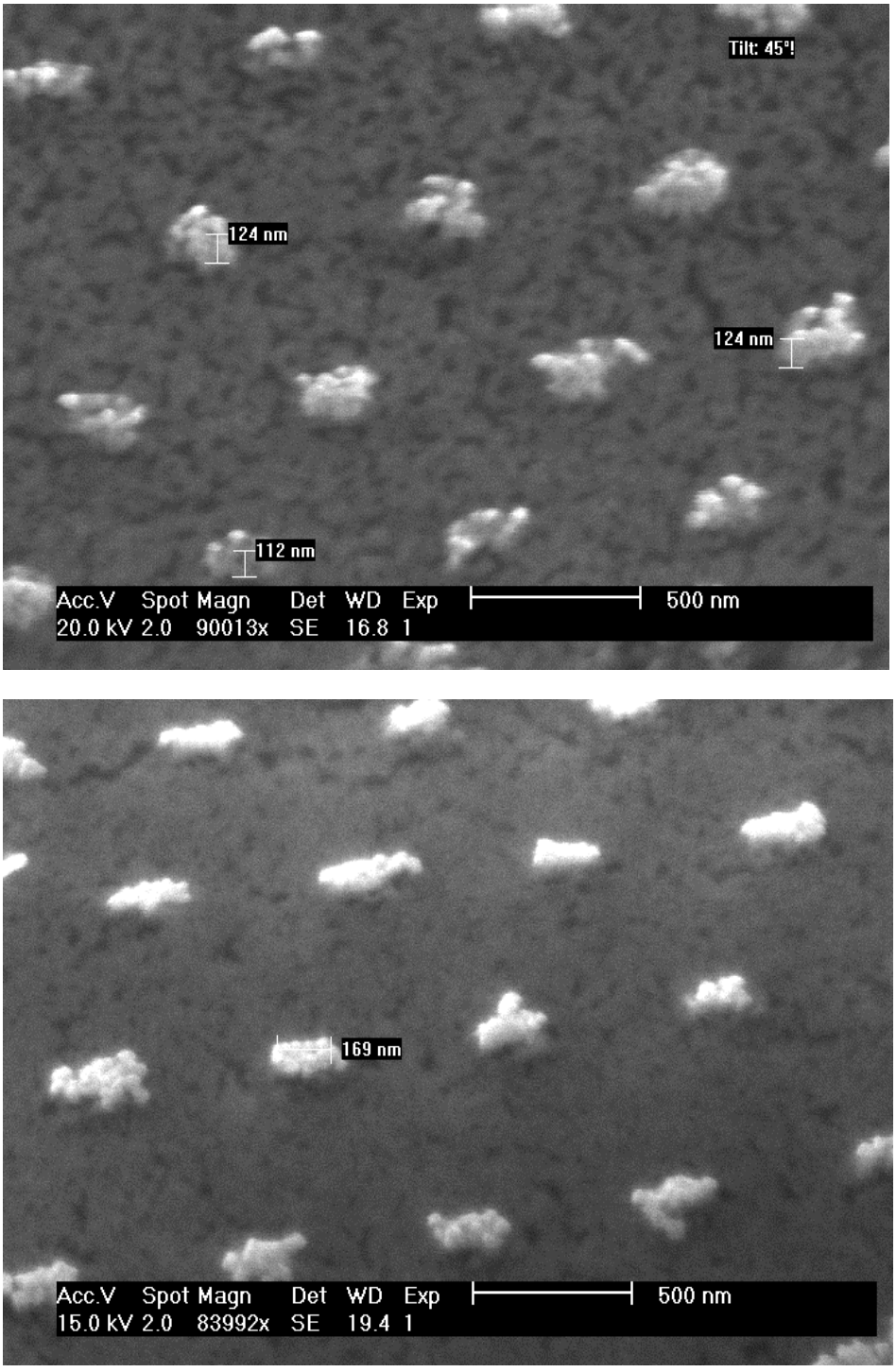
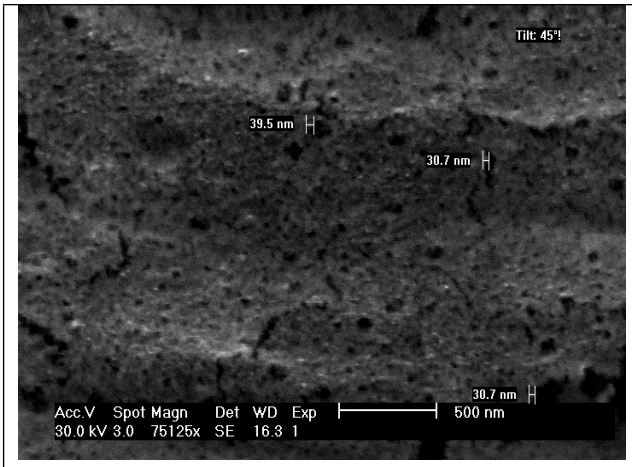
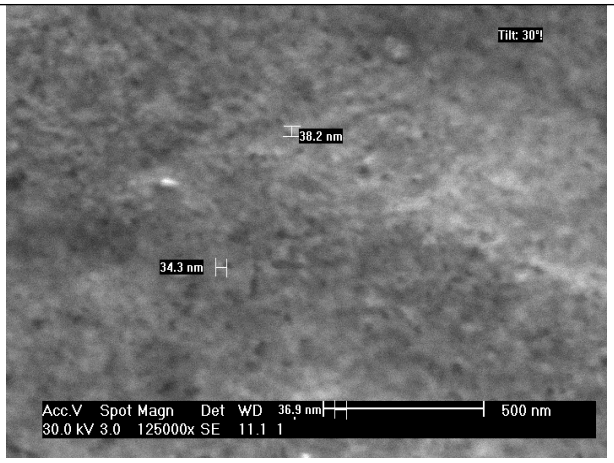
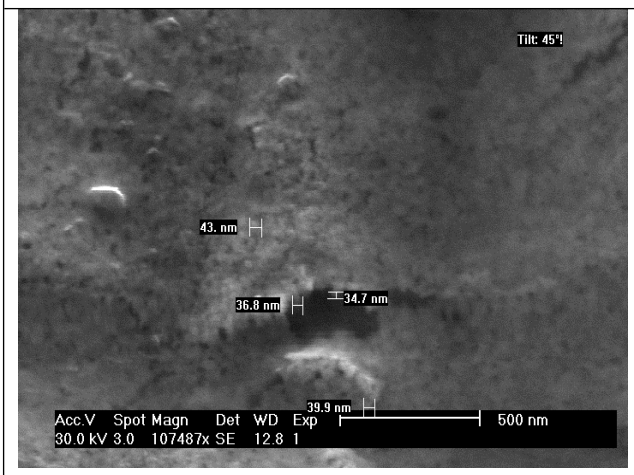


Fig. S2 SEM images of the ordered arrays of the gold amorohus cylinders tilted to 45^0 (top) and tilted to 30^0 (bottom).







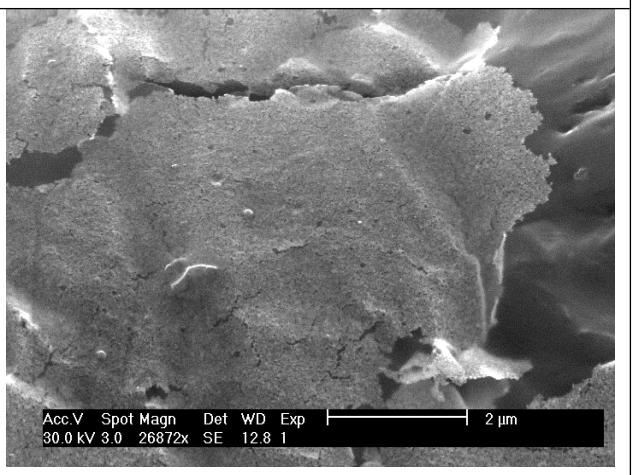


Fig. S3 SEM image of the ELP grainy film

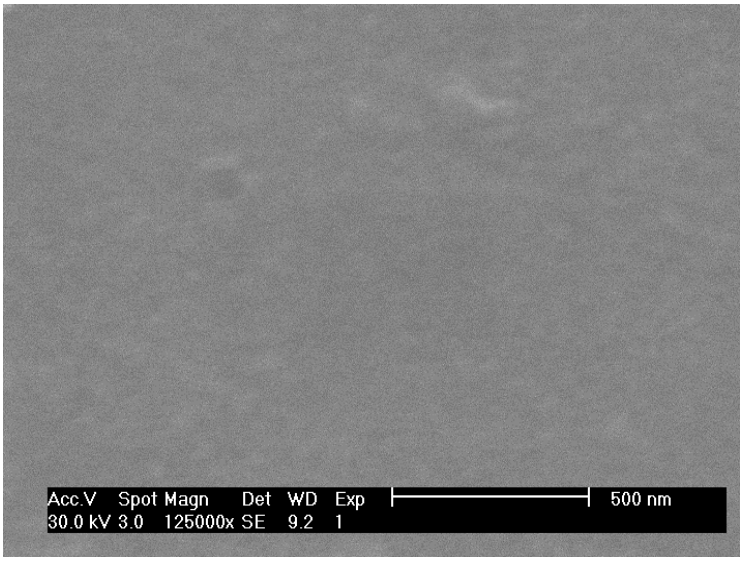


Fig. S4 SEM image of the gold film by metal evaporation technique.

1) The laser beam of the green laser in 2 mm in diameter for the attenuation/transmission/ reflection studies

The volume of Au in laser beam had been calculated as

$V_{grainy\ array} = S \times h$; $S = \pi R^2 = 3.14 \times 1000 \times 1000\ (\mu m^2)$; $h_{background} = 0.04\ (\mu m)$

$V_{grainy\ array} = 125663.7\ (\mu m)^3$

$V_{1cylinder} = \pi \times h_{cylinder} \times [R_{outer}^2 - R_{inner}^2] = 3.14 \times 0.12 \times [0.08^2 - 0.04^2] = 0.0018\ (\mu m)^3$

Assume 7000 cylinders in 1mm radius disk

$V_{grainy\ background+cylinders} = h_{background} \times (\pi R^2 - N\pi R_{outer}^2) + N \times V_{1cylinder} = 0.04 \times (3.14 \times 1000 \times 1000 - 7000 \times 3.14 \times 0.08 \times 0.08) + 7000 \times 0.0018 = 125606.9\ (\mu m)^3$

Therefore it is 0.045 % of the difference between the continuous Au grainy film and hexagonal array of the hollow cylinders on the Au grainy background.

2) The laser beam of the green laser in 1.2 mm in diameter for the photo-thermal studies

$V_{grainy\ array} = S \times h$; $S = \pi R^2 = 3.14 \times 600 \times 600\ (\mu m^2)$; $h_{background} = 0.04\ (\mu m)$

$V_{grainy\ array} = 45216\ (\mu m)^3$

$V_{1cylinder} = \pi \times h_{cylinder} \times [R_{outer}^2 - R_{inner}^2] = 3.14 \times 0.12 \times [0.08^2 - 0.04^2] = 0.0018\ (\mu m)^3$

Assume 4200 cylinders in 0.6 mm radius disk

$V_{grainy\ background+cylinders} = h_{background} \times (\pi R^2 - N\pi R_{outer}^2) + N \times V_{1cylinder} = 0.04 \times (3.14 \times 600 \times 600 - 4200 \times 3.14 \times 0.08 \times 0.08) + 4200 \times 0.0018 = 45220\ (\mu m)^3$

Therefore it is 0.009% of the difference between the continuous Au grainy film and hexagonal array of the hollow cylinders on the Au grainy background.

Based on the calculations mentioned above, we may conclude that continuous Au grainy film and hexagonal array of the hollow cylinders on the Au grainy background possess similar volume and mass.