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Supporting Information

Fabrication of resist pattern based on plasma-polystyrene interaction

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Experimental Section

Materials. The 600 nm PS spheres with less than 5% diameter variation were obtained from Sigma Aldrich. The ultrapure water (18.25MΩ.cm) comes from Millipore System, Marlborough, France. Silicon slides [n-type (100)] purchased from GRINM Advanced Materials Co. Ltd., China were used as the substrate. Hydrofluoric acid (HF), silver nitrate ($AgNO_3$), ethanol, chloroform, acetone, and toluene were purchased from commercial sources at the highest available purity and used without further purifications.

Fabrication of resist pattern. The monolayer of PS spheres was prepared on silicon slide as reported before.[1] Briefly, the PS spheres were spread on the surface of water to form a monolayer, and then the monolayer of PS spheres was transferred onto the silicon wafer. After drying, the silicon slides with PS

spheres were treated on a reactive ion etching (RIE) system, Plasmalab Oxford 80 plus (ICP 65) system (Oxford Instrument Co., UK). The parameters were setted as follows: the gas flow of oxygen was 50 sccm, the pressure was 30 mtorr, the radio frequency (RF) was 12 w, the ICP (Inductively Coupled Plasma) was 200 w, and the etching duration was 3 and 9 min. After the etching process, the samples were immersed into toluene with ultrasonic to remove the residual PS spheres, and then washed with acetone, ethanol, chloroform, and pure water in order.

Dry etching with the resist pattern as mask. With the resist pattern created by 9 min RIE as mask, the silicon slides were treated with RIE and the parameters were set as follows: the gas flow of SF_6 was 50 sccm, the pressure was 30 mtorr, the RF was 15 w, the ICP was 0 w and the etching duration was 60, 70, 80, 90 and 100 s.

Electroless deposition of silver nanoparticles. The aqueous solution of HF, $AgNO_3$ and H_2O with a (v/v) ratio of 1:3.5:175 was prepared and kept at the room temperature. The silicon slide with resist pattern created with 9 min RIE was immersed into the solution for 45 s, and then the silver nanoparticles were selectively formed on the area without resist.

Characterization of the resist pattern. The morphology was characterized with a scanning electron microscope (SEM, HITACHI SU8020 field emission scanning electron microscope) and an atomic microscope (AFM, Dimension 3100, Digital Instruments, Santa Babara, CA). The composition of the film was characterized with a X-ray photoelectron spectroscopy (XPS, PREVAC XPS/UPS System).

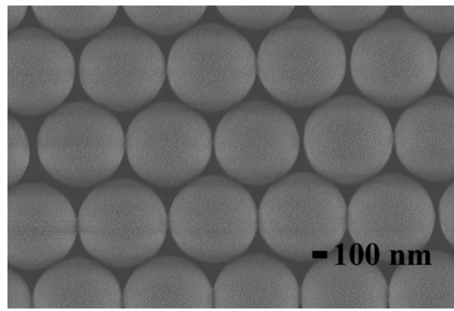

Fig. S1. SEM image of the monolayer of PS spheres with diameter of 600 nm.

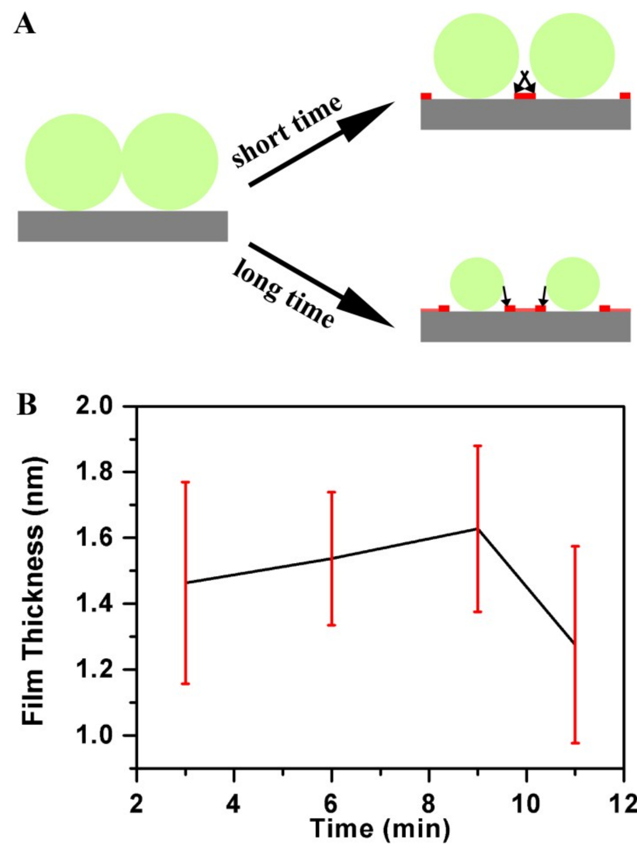

Fig. S2. (A) Schematic illustration of the deposition process and (B) Correlation of the UR thickness and the etching time.

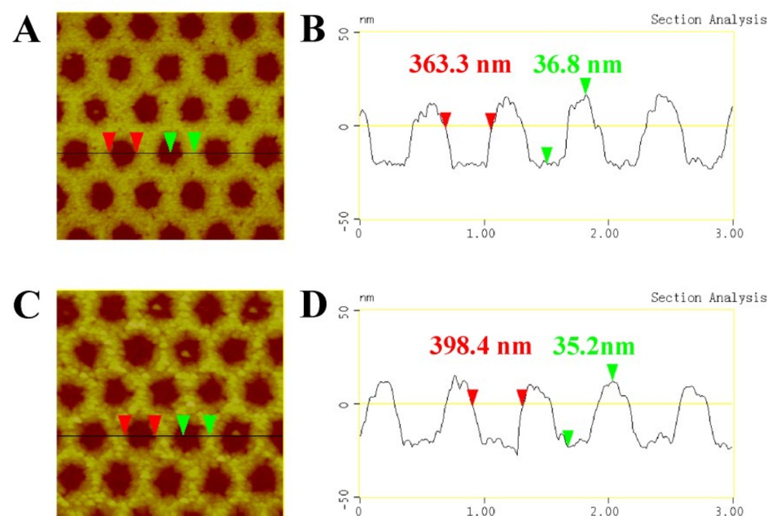

Fig. S3. (A, C) AFM topography and (B, D) section analysis of the silicon slides with resist pattern etched for 80 and 100 s respectively. Etching gas: SF_6

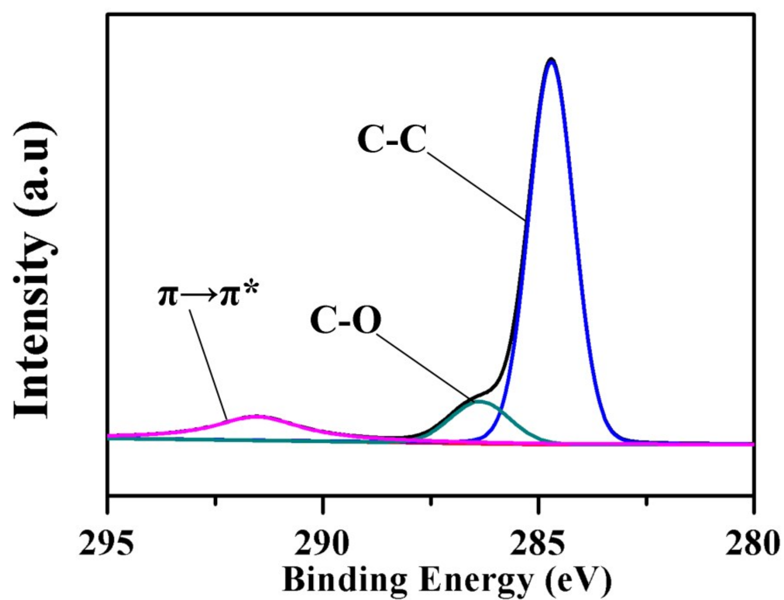

Fig. S4. XPS spectra of C1S region for the PS spheres.

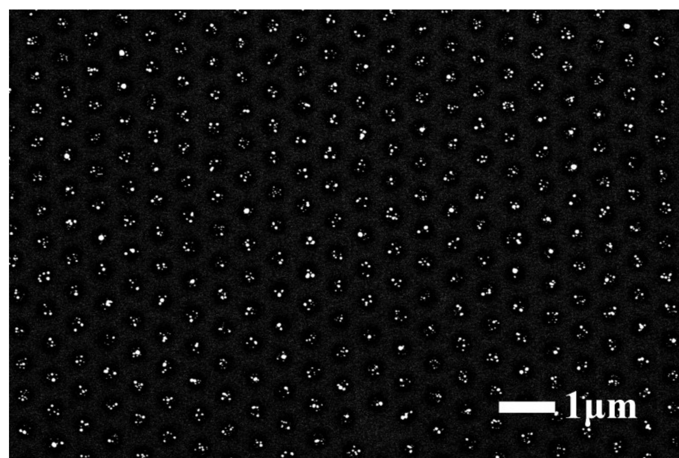

Fig. S5. SEM image of the silver nanoparticles formed on Si slide with resist pattern.

References

S1 Y. D. Wang, N. Lu, H. B. Xu, G. Shi, M. J. Xu, X. W. Lin, H. B. Li, W. T. Wang, D. P. Qi, Y. Q. Lu and L. F. Chi, *Nano Res.*, 2010, **3**, 520-527.