Electronic Supplementary Material (ESI) for RSC Advances


# Controllable Orientation of Assembled Gold Nanorods on Unstructured Substrates

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## Supporting Information

## Sample preparation

The PDMS template with periodic grating structure has been fabricated by micropatterning technique. The basic principle of the micropatterning technique is to create a stamp having the patterns demanded. The structure of the stamp is derived as the "master". Here, the PDMS is the stamp and the DVD is the "master". The PDMS (Sylgard® 184 Silicone Elastomer) has been fabricated by mixing Part A/Part B in a 10:1 ratio by weight. Then we applied mixed PDMS on the periodic pattern side of DVD and keeping at room temperature for two days. The PDMS film was slowly peered off, which formed about 150 nm deep straight channeled structure as seen in Figure s1.

The AuNRs were prepared according to the seed-mediated growth method optimized by El-Sayed and co-workers. For the seed solution, 7.5 mL of 0.1 M cetyltrimethyl ammonium bromide ($C_{16}$TABr) solution was mixed with 0.25 mL of 0.01 M HAuCl4. 0.6 mL of 0.01 M NaBH4 was added into the above solution and kept stirring for 2 min. The growth solution contains 141 ml of 0.1 M $C_{16}$TABr, 1.5 ml of 0.01 M AgNO3, and 7.5 mL of 0.01 M HAuCl4. The 0.75 mL of 0.16 M ascorbic acid was added drop by drop. Then, 4.8 mL of seed solution was added into the growth solution. After mixing, the solution was aged at room temperature for at least 24 h. For purification, the solution was then taken in each centrifuge tube and centrifuged at 6000 rpm for 10 min. The brown supernatant containing rods was collected from each centrifuge tube. The pink precipitate containing large spheres was discarded. The brown supernatant containing rods was further centrifuged at 13000 rpm for 10 min. All the precipitates collected were dissolved in 0.01 M $C_{16}$TABr solution and the concentration of rods was tuned with the absorbance of longitudinal resonance to about 1 at 775 nm for the further process below.

To form the proper pattern in the channel, a reasonable high concentration of AuNRs solution was required. The concentration of $C_{16}$TABr is also important for assembly. For low concentration $C_{16}$TABr, the AuNRs can not assemble together with order. For high concentration $C_{16}$TABr, the formatting pattern is filled with $C_{16}$TABr. The optimization of AuNRs solution was achieved by the following process. The synthesized AuNRs solution was taken in each 1.5 mL centrifuge tube and centrifuged at 13000 rpm for 10 min. All the precipitates collected were dissolved in 1.5 mL 0.01 M $C_{16}$TABr solution and taken in a 1.5 mL centrifuge tube. Then it was centrifuged at 13000 rpm for 10 min. The precipitate was added 0.01 M $C_{16}$TABr solution up to 10 μL. In this procedure, the concentration of rods can be rather high and the concentration of $C_{16}$TABr can be tuned at 0.01 M. This solution

was used to make aligned AuNRs. We also made low concentration AuNRs solution by diluting the finished product with 0.01 M $C_{16}$TABr solution, and this diluted solution was used to find the preferential arrangement of AuNRs on substrates.

It is rather simple to guide the assembling of the AuNRs with PDMS grating template. The concentrated AuNRs solution (1 μL) was dropped on the silicon or ITO substrates. The AuNRs stain on substrate was immediately covered with the fabricated PDMS stamp. The covered PDMS stamp should seal all the solution stain between PDMS stamp and substrate. After 24 h, carefully peered off the stamp from the substrates, the assembled AuNRs patterns were left entirely on the substrates. Those patterned area can be as large as several $mm^2$. The AuNRs patterns on silicon and ITO substrates were used in the experiments of SEM and absorbance measurement.

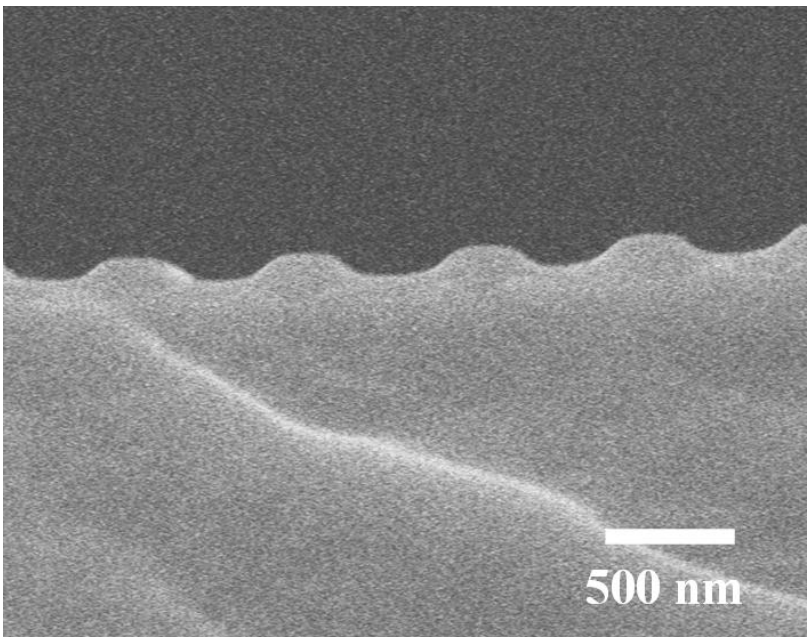


Figure S1. SEM cross section image of the PMDS stamp with DVD periodic pattern

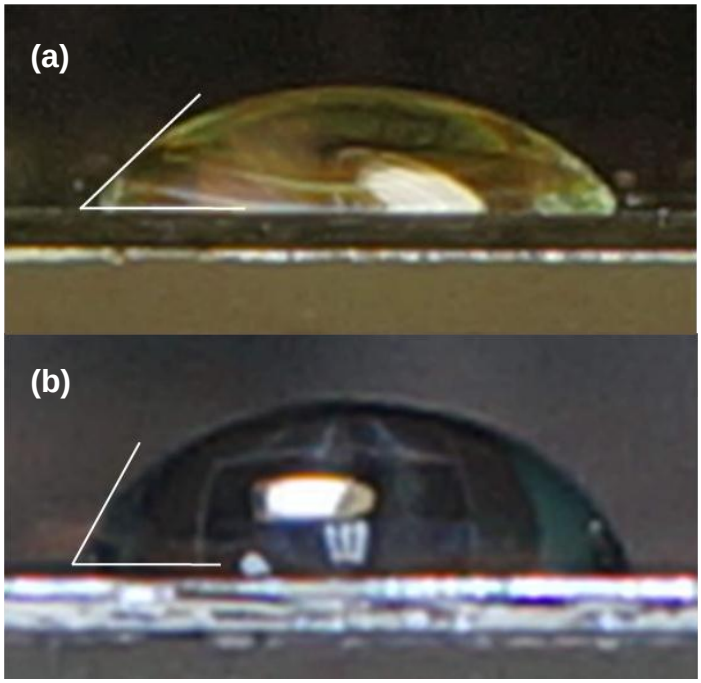


Figure S2. Contact angle images of water droplet on (a) ITO substrate (b) silicon substrate

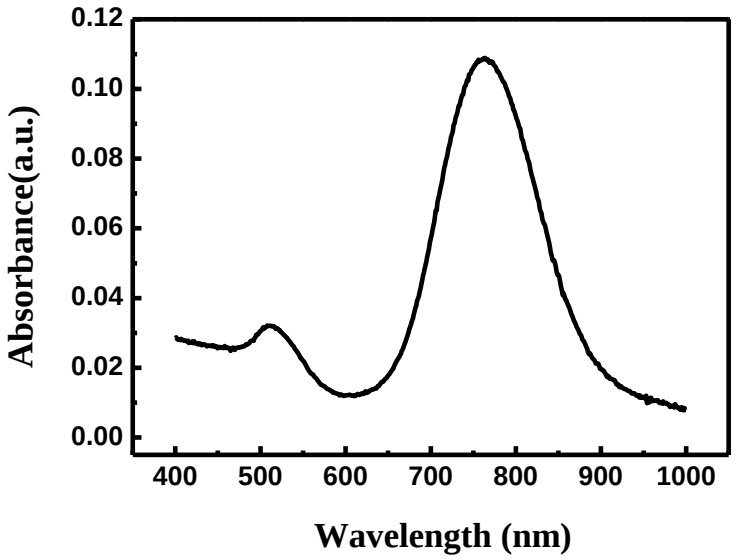


Figure S3. Absorbance of AuNRs solution