# Electronic supplementary information

## Spatially-controlled Growth of Platinum on Gold Nanorods with Tailoring Plasmonic and Catalytic Properties

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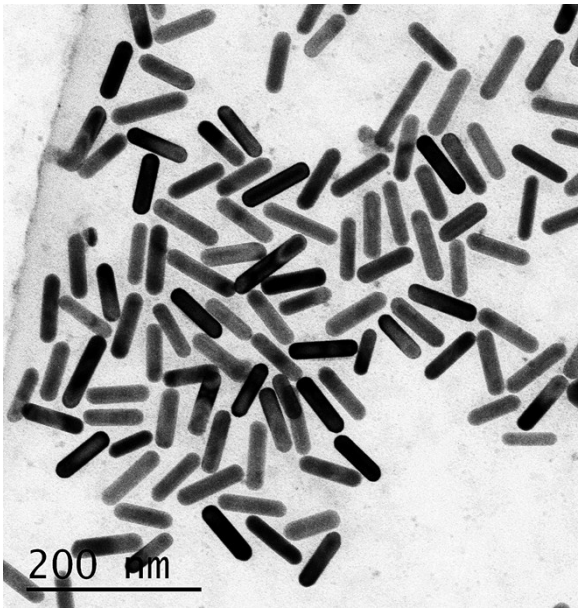


**Fig. S1.** TEM images of gold nanorods.

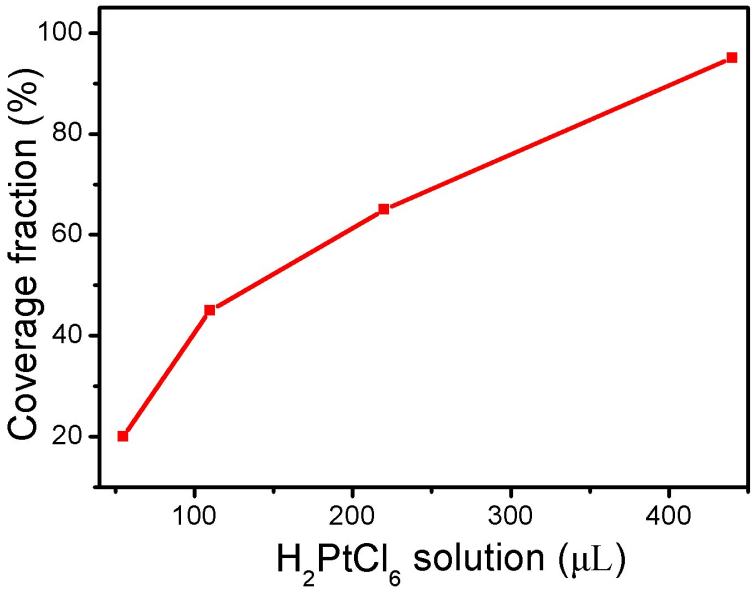


**Fig. S2.** The coverage fraction of dendritic Pt over the AuNRs as functions of the added $H_2PtCl_6$ (2 mM) volume.

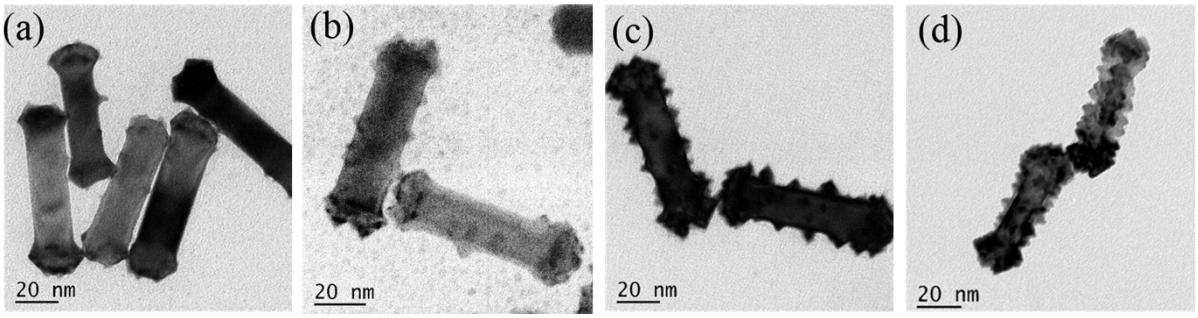


**Fig. S3** HRTEM images dendritic-Pt decorated AuNRs with varying volume fractions of dendritic platinum obtained by adding different amounts of 2 mM $H_2PtCl_6$ solution: (a) 55 μL, (b) 110 μL, (c) 220 μL and (d) 440 μL， respectively.

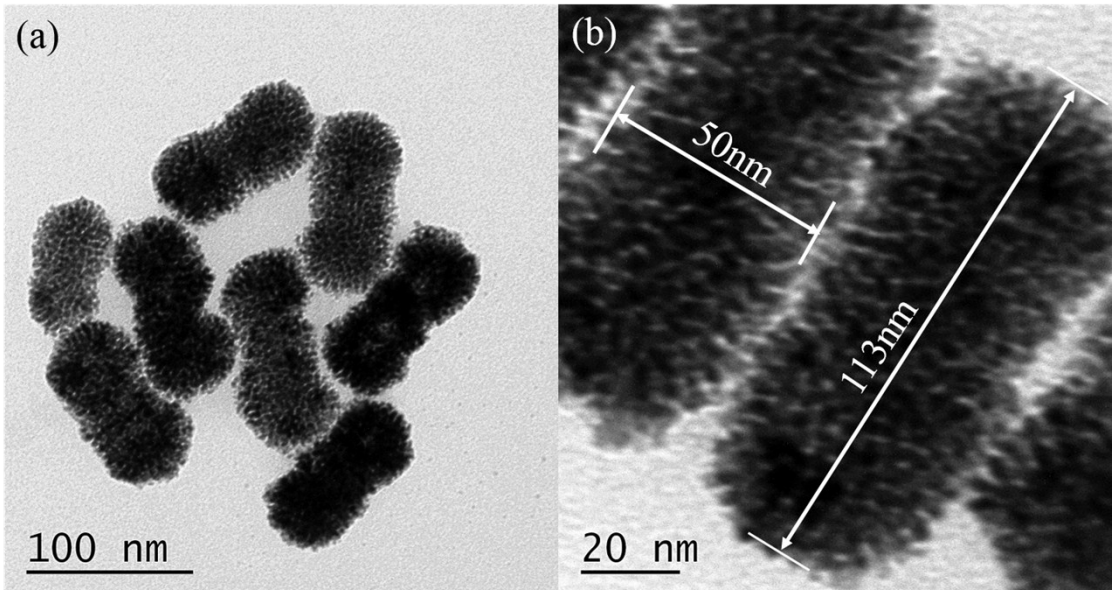


**Fig. S4**. TEM images of core-shell AuNRs@Pt nanostructures obtained by adding 5mL of 2 mM $H_2PtCl_6$ solution with low (a) and high (b) magnification.

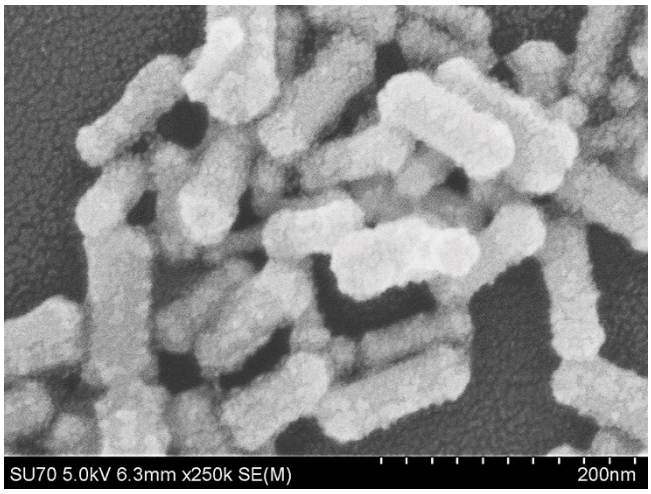


**Fig. S5.** SEM image of dendritic-Pt decorated AuNRs obtained by adding 220 μL of amounts 2 mM $H_2PtCl_6$ solution

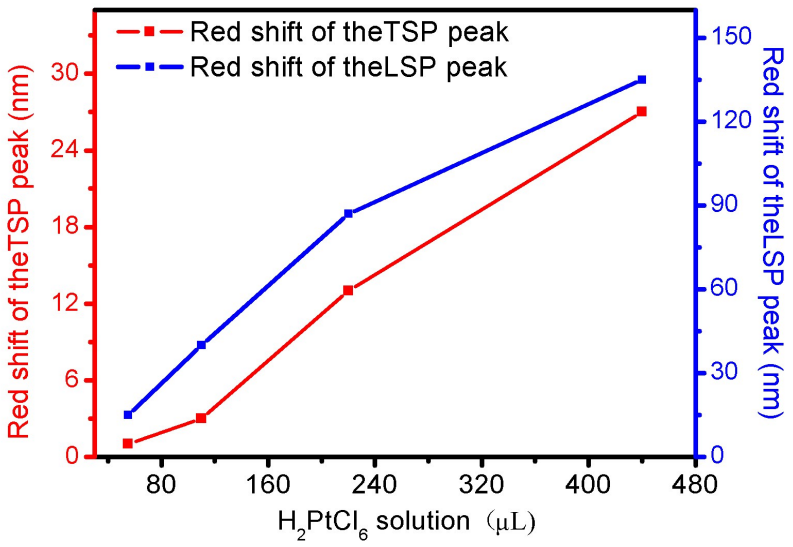


**Fig. S6**. The red shift of the transverse surface plasmon (TSP) peak and longitudinal surface plasmon(LSP) peak of the dendritic-Pt decorated AuNRs as functions of the added $H_2PtCl_6$ volume.

**Table S1. Catalytic activities of pure Au NR and dendritic-Pt decorated AuNRs:**

| Catalyst synthesized by using different amount of 2 mM $H_2PtCl_6$ solution (μL) | Weight（mg) | Rate constant（$s^{-1}$） | Activity parameter（$s^{-1}.g^{-1}$） |
|---|---|---|---|
| 0 | 0.0928 | 0.0046 | 49.583 |
| 55 | 0.03 | 0.0047 | 157.083 |
| 110 | 0.03 | 0.0053 | 177.783 |
| 220 | 0.03 | 0.0086 | 286.8 |
| 440 | 0.03 | 0.0107 | 357.333 |

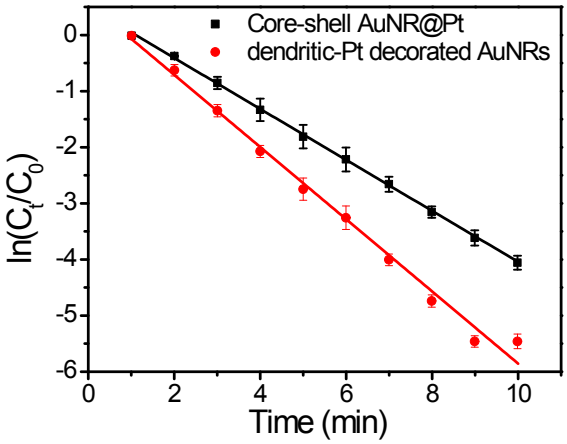


**Fig. S7**. The plot of $\ln(C_t/C_0)$ as a function of time using core-shell AuNR@Pt obtained by adding 5 mL of 2mM $H_2PtCl_6$ solution (black line) and dendritic-Pt decorated AuNRs obtained by adding 440 μL of 2mM $H_2PtCl_6$ solution (red line).

To prove the ability of the dendritic-Pt decorated AuNRs loaded PVDF membrane in oil/water separation, 0.6 g tween80 was added into 120 mL water, and then 4 mL toluene also added. The mixture was stirred for 3 h. The droplet size of the emulsion is in the range of 1~30 μm. The mixture was filtrated by the dendritic-Pt decorated AuNRs loaded PVDF membrane in the filtration system.[1]

Fig. S8b and 8c give the separating results of tween 80-stabilized toluene-in-water. The collected filtrate (Fig. S8c left) is transparent compared to the original milky white feed emulsion (Fig. S8b left). As revealed by the optical microscopy image shown in Fig. S8b right and Fig. S8c right, there is a significant difference in phase composition between the feed and the corresponding filtrate. For emulsion before filtration, densely-packed droplets flood the entire view, whereas no droplet is observed in the image of the filtrate at all, indicating that the toluene in toluene-in-water emulsion has been successfully removed.[2]

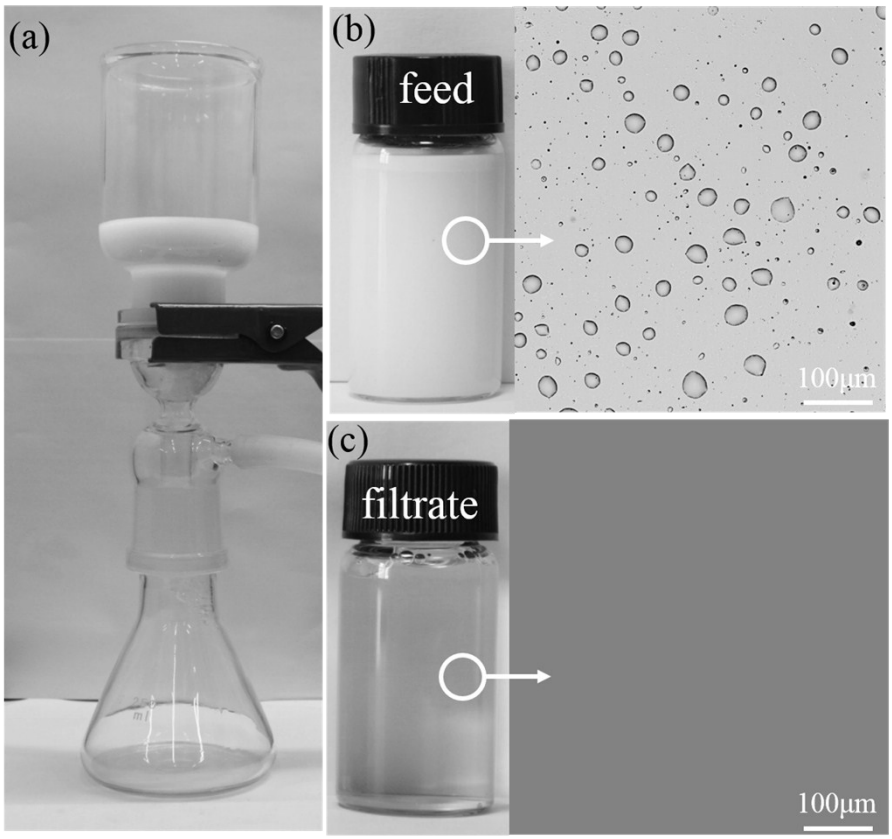


**Fig. S8.** (a) The vacuum driven filtration system used in this work. The photographs and optical microscopy images of toluene-in-water emulsion before (b) and after (c) filtration.

**References**

1. Tao, M.; Xue, L.; Liu, F.; Jiang, L. An intelligent superwetting PVDF membrane showing switchable transport performance for oil/water separation. *Advanced Materials* **2014,** *26* (18), 2943-2948.

2. Gu, J.; Xiao, P.; Huang, Y.; Zhang, J.; Chen, T. Controlled functionalization of carbon nanotubes as superhydrophobic material for adjustable oil/water separation. *Journal of Materials Chemistry A* **2015,** *3* (8), 4124-4128.