

Supporting Information

Enhanced triplet-triplet annihilation upconversion by photonic crystals and Au plasma resonance for efficient photocatalysis

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Synthesis of Au nanoparticles

Au nanoparticles (AuNPs) were prepared according to literature procedures.¹ 10 mL of tetralin, 10 mL of oleamide and 0.1 g of chloroauric acid were added to a flask and stirred magnetically for 10 min under nitrogen atmosphere. The solution containing TBAB (0.0435 g), tetralin (1 mL) and OAm (1 mL) was stirred evenly and then injected into the flask. The aforementioned solution was reacted at 20 °C for 1 h before adding 60 mL of acetone to precipitate the AuNPs. The obtained precipitate was centrifuged at 12000 rpm for 30 min. The final product was washed with acetone for several times and redispersed in xylene.

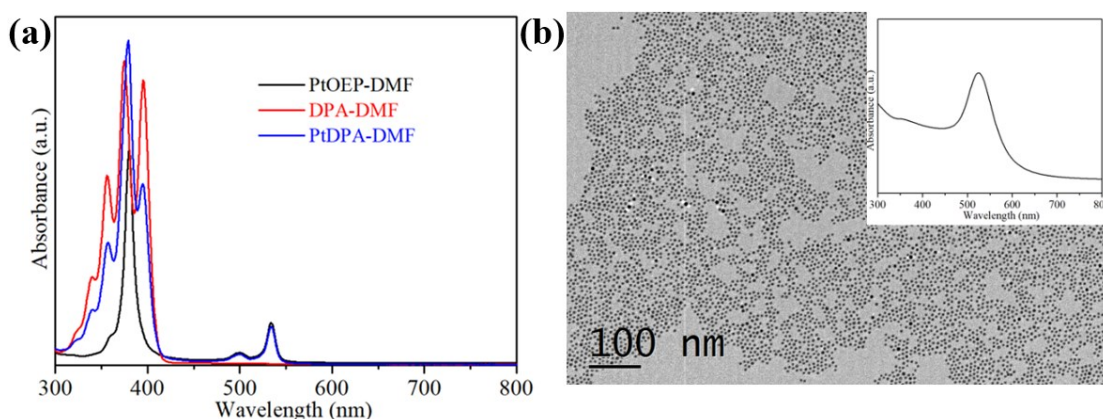


Fig. S1 (a) UV-vis absorption spectra of TTA-UCL chromophores and (b) TEM image of AuNPs.

The insert image is UV-vis absorption spectrum of AuNPs solution.

The absorption spectrum of PtOEP exhibited intense absorption bands at 350-420 nm and the characteristic absorption bands at 520 and 535 nm, respectively. DPA dissolved in DMF only had absorption bands at 300-420 nm. The physical mixture (PtDPA) displayed the similar absorption characteristics with PtOEP and DPA, which provided the foundation for the TTA-UCL process.

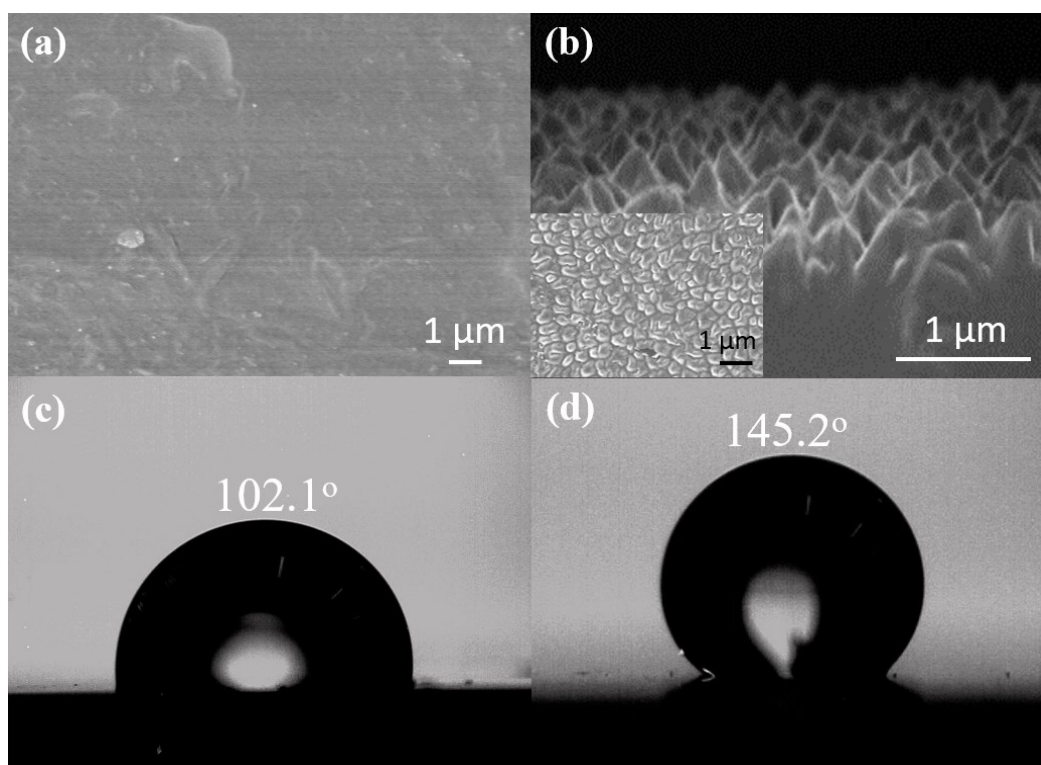


Fig. S2 FESEM image of (a) 0.3 AuNPs-PtDPAP and (b) AVS-0.3 AuNPs-PtDPAP. Contact angles of water droplets on the surface of (c) 0.3 AuNPs-PtDPAP and (d) AVS-0.3AuNPs-PtDPAP.

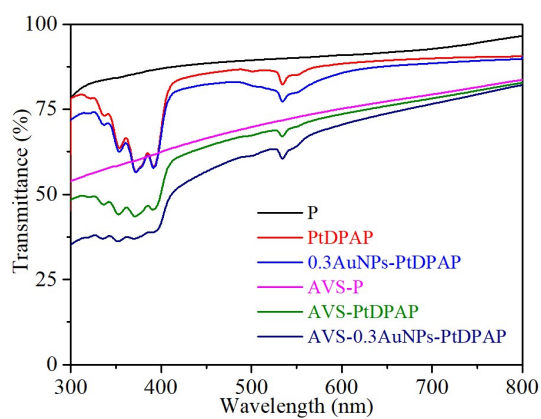


Fig. S3 Transmission spectra of films.

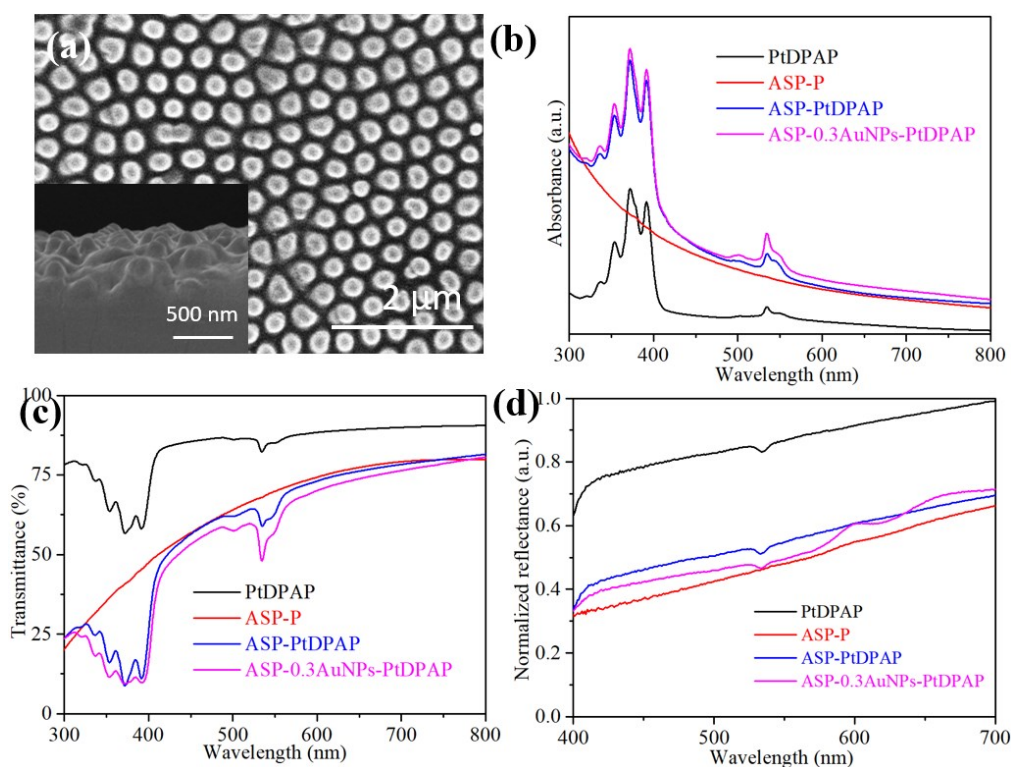


Fig. S4 (a) FESEM image of ASP-PDMS film. The insert image of is the cross section FESEM image of films. (b) UV-vis absorption spectra, (c) Transmission spectra and (d) Reflectance spectra of films.

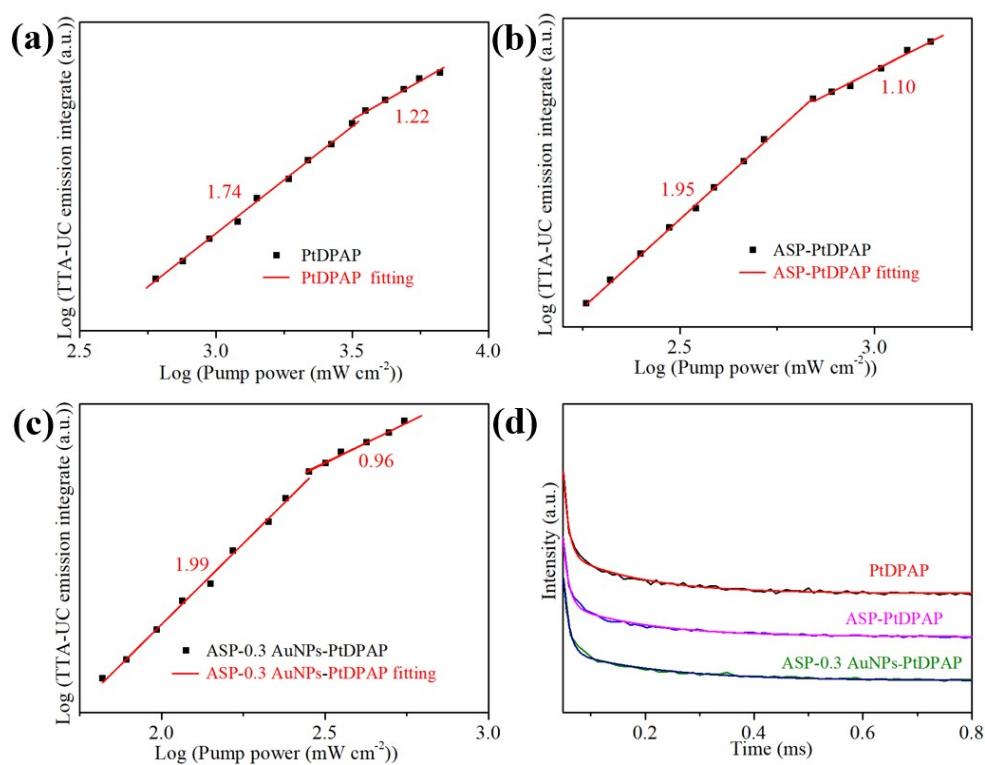


Fig. S5 Integrated fluorescence intensity of (a) PtDPAP, (b) ASP-PtDPAP and (c) ASP-0.3AuNPs-

PtDPAP, plotted as a function of the pump power density of 535 nm light. (d) Fluorescence
fluorescence lifetime spectra at 425 nm of films.

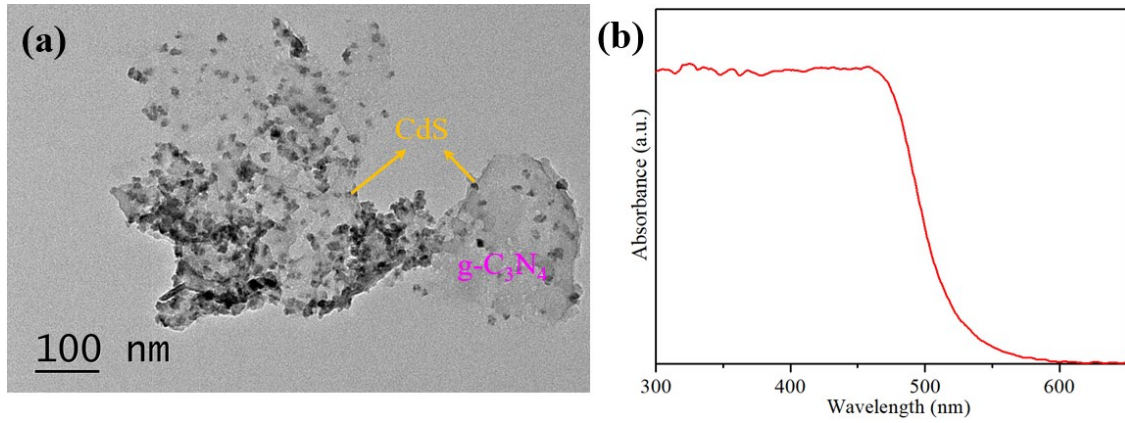


Fig. S6 (a) TEM image and (b) UV-vis absorption spectrum of g-C₃N₄@CdS.

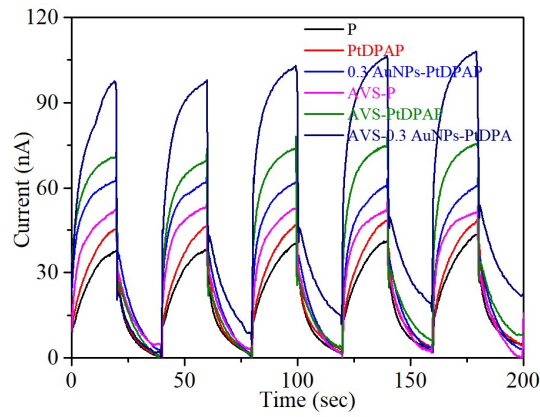


Fig. S7 Photocurrent response curves of different films systems with g-C₃N₄@CdS film under visible light.

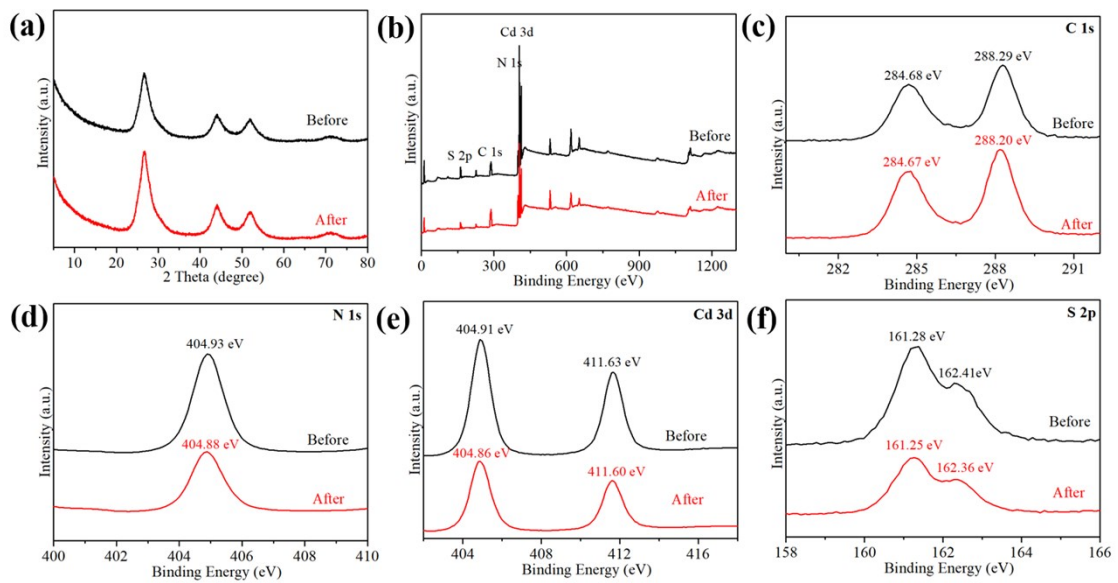


Fig. S8 (a) XRD patterns, (b) XPS spectra, (c) C 1s, (d) N 1s, (e) Cd 3d and (f) S 2p spectra of g-C₃N₄@CdS before and after cyclic photoreactions.

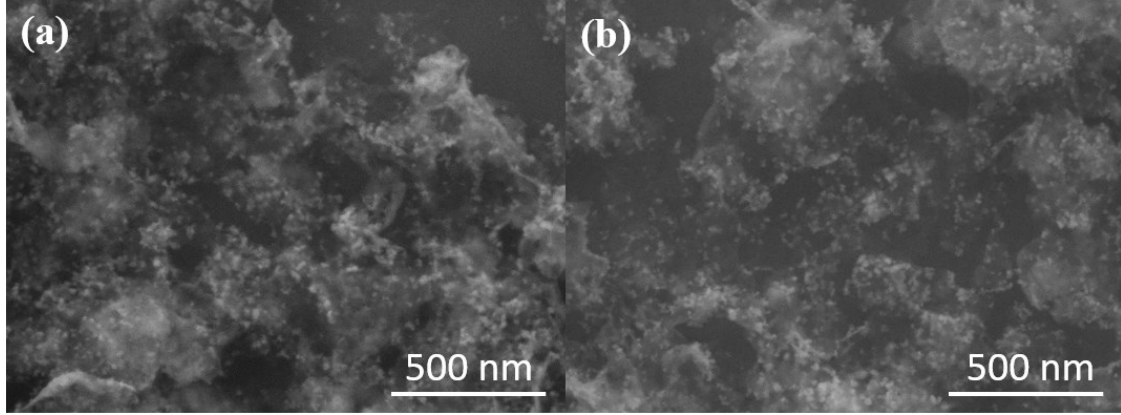


Fig. S9 SEM images of g-C₃N₄@CdS tested (a) before and (b) after cyclic photoreactions.

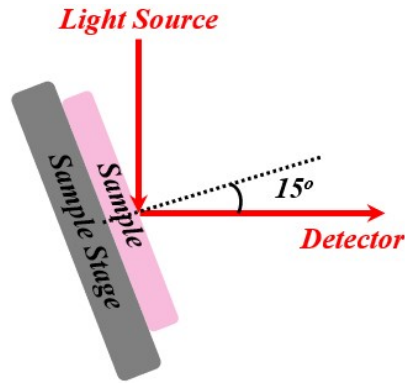


Fig. S10 Schematic diagram of position for samples with the fluorometric analyzer.

The upconversion quantum yield (Φ_{UC}) is calculated by as follow:

$$\Phi_{UCs} = 2\Phi_{UCb} \left(\frac{A_b}{A_s} \right) \left(\frac{I_s}{I_b} \right) \left(\frac{\eta_s}{\eta_b} \right)^2$$

where Φ_{UC} , A, I and η are the quantum yield, absorbance, integrated upconversion intensity and the refractive index, respectively. s and b are the untested sample and blank sample.

References

1. S. Peng, Y. Lee, C. Wang, H. Yin, S. Dai and S. Sun, *Nano Res.*, 2008, **1**, 229-234.