Supplementary Information

In-situ Growth of Au Nanoparticles on Fe_2O_3 Nanocrystals for Catalytic Applications

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Preparation of compared sample i

In a typical procedure, the as-obtained α-Fe_2O_3 nanoparticles (20 mg) was dispersed in 20 mL ultrapure water to form a suspension, followed by the addition of $HAuCl_4$ aqueous solution (10 mL, 3 mM). After vigorous stirring for another 30 minutes, an aqueous solution of L-ascorbic acid (20 mL, 0.05M) was quickly added into the solution. The reaction was allowed for 3 h under rapid stirring. The products were separated via centrifugation and washed with water and ethanol repeatedly.

Preparation of compared sample ii and iii

The as-obtained α-Fe_2O_3 nanoparticles (with or without cysteine modification) (5 mg) and sodium dodecyl sulfate (SDS) (14.4 mg) were dispersed in a mixed solvent of 5 mL ultrapure water and 5 mL isopropanol. Then 5 mL $HAuCl_4$ (0.6 mM) aqueous solution was dropwise added into the suspension, under irradiation with a 150-W halogen lamp (Fiber-Lite MI-150, Dolan-Jenner Industries, USA). The halogen lamp was immediately turned off after the addition of $HAuCl_4$ solution. The products were separated and washed with water and ethanol repeatedly.

Preparation of compared sample □

The as-obtained 2-nm Au–α-Fe_2O_3 hetero-nanoparticles (5 mg) and sodium dodecyl sulfate (SDS) (14.4 mg) were dispersed in a mixed solvent of 5 mL ultrapure water and 5 mL isopropanol. Then the resultant suspension was irradiated for 30 min with a 150-W halogen lamp (Fiber-Lite MI-150, Dolan-Jenner Industries, USA). The products were separated and washed with water and ethanol repeatedly.

Preparation of compared sample v

Firstly, pure gold nanoparticles are prepared according to the literature[1]: briefly, a 20 mL aqueous solution containing 0.25 mM $HAuCl_4$ and 0.25 mM trisodium citrate was prepared. Then, 0.6 mL of ice-cold, freshly prepared 0.1 M $NaBH_4$ solution was added to the solution while stirring. The solution turned pink immediately after adding $NaBH_4$, indicating particle formation. The obtained gold nanoparticles were mixed with the suspension composed of α-Fe_2O_3 nanoparticles and L-cysteine, with a same ratio of Au: Fe_2O_3: L-cysteine as the condition for preparing 2-nm Au–α-Fe_2O_3 hetero-nanoparticles.

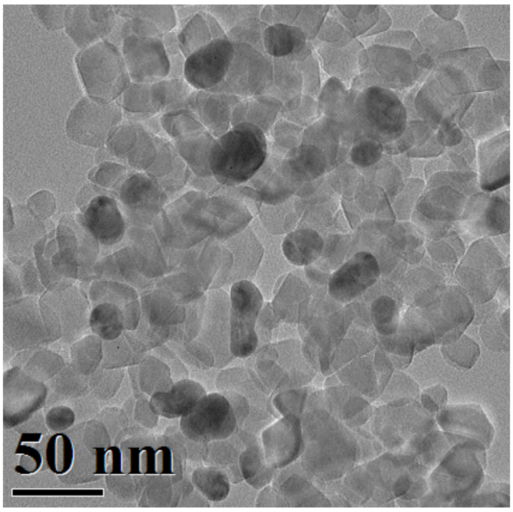

Fig. S1 TEM images of the compared sample i.

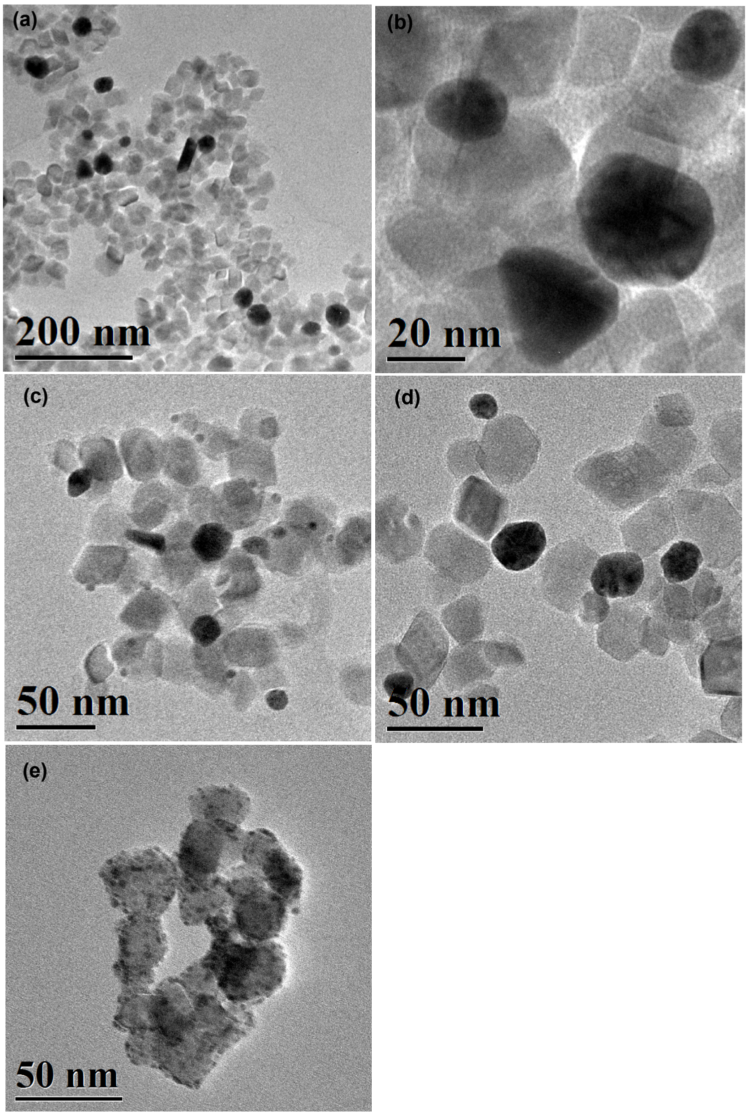

Fig. S2 TEM images of the compared sample ii (a, b) (α-Fe_2O_3 nanoparticles without cysteine modification), compared sample iii (c, d) (α-Fe_2O_3 nanoparticles with cysteine modification), and compared sample □ (e)

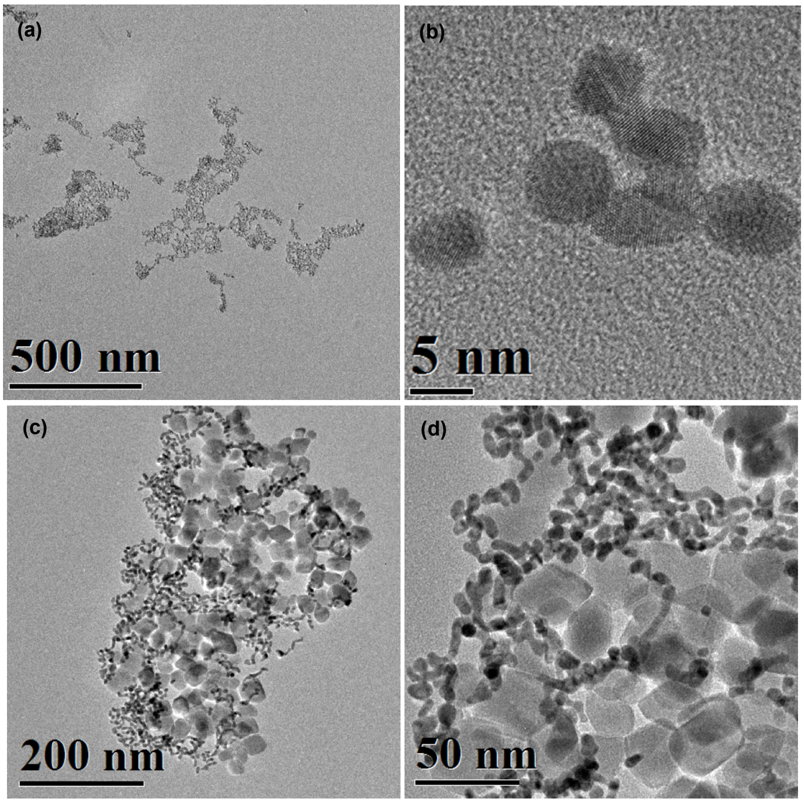

Fig. S3 (a, b) TEM images of gold nanoparticles used for preparing the compared sample Ⅴ; (c, d) TEM images of the compared sample Ⅴ.

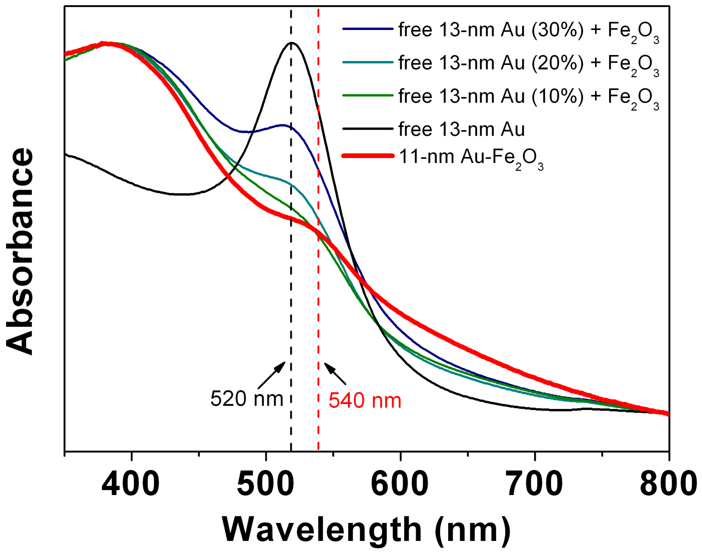

Fig. S4 UV-vis spectra of 11 nm Au–α-Fe_2O_3 hetero-nanoparticles (red line) and simple mixture of Fe_2O_3 nanocrystals with 13 nm gold nanoparticles at different weight percentages. It clearly shows a relative red-shift of SPR peak for the 11 nm Au nanoparticles (~540 nm) on Fe_2O_3 as compared to that of free gold nanoparticles (~520 nm). The gold nanoparticles are synthesized through the conventional citrate reduction method.[2]

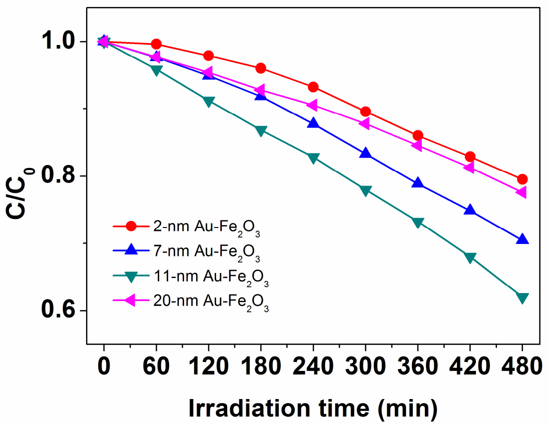

Fig. S5 Photocatalytic degradation ratio of RhB versus irradiation time by using various photocatalysts normalized on Au loading basis (1 mg).

References:

1. N. R. Jana, L. Gearheart and C. J. Murphy, *Langmuir*, 2001, **17**, 6782.

2. G. Frens, *Nature-Phys. Sci.*, 1973, **241**, 20.