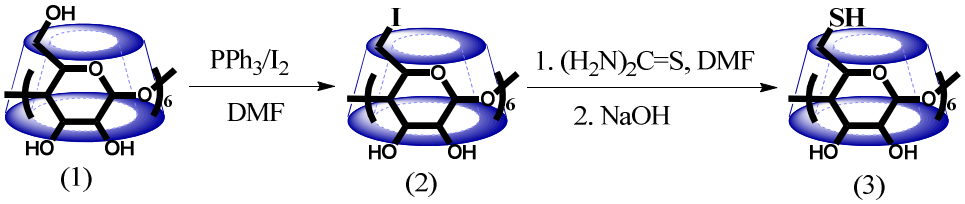
Supporting Information

Reversible Phase Transfer of Nanoparticles Based on Photoswitchable Host-Guest Chemistry

Lu Peng, Mingxu You, Cuichen Wu, Da Han, Ismail Öçsoy, Tao Chen, Zhuo Chen and Weihong Tan**

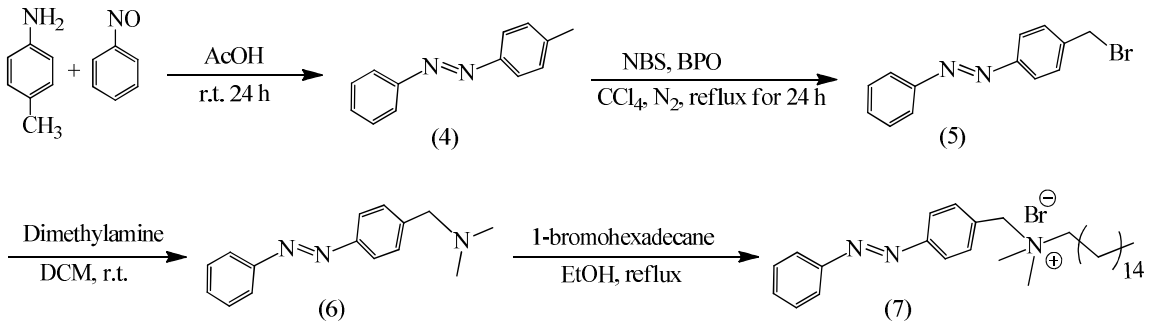
Experimental

1. Preparation of *per*-6-thiol-α-cyclodextrin-coated gold nanoparticles



(1) (2) (3)

2. Preparation of azo-ligand



Recycling of AuNPs in catalytic reaction

In the first cycle, 250 μL of an aqueous solution of α-CD-capped AuNPs was mix with 250 μL water solution of 4-NP and $NaBH_4$ (final concentration: 4-NP 0.3 mM, $NaBH_4$ 15 mM and α-CD-capped AuNPs 6.7 μg/mL). After the reduction of 4-NP, 500 μL toluene solution of trans-azo-ligand was added to extract α-CD-capped AuNPs. The water phase containing the product was replaced by 250 μL fresh water to start the second cycle. Upon irradiation of UV light, the AuNPs were transferred to the fresh water phase. An aqueous solution (250 μL) of 4-NP and $NaBH_4$ was then added for catalytic reaction, after which visible light was applied to transfer the AuNPs from water to toluene. The third and fourth cycle were performed in the same way as the second cycle. Therefore, the AuNPs were recycled by alternating UV and visible light irradiation. The absorbance (400 nm) of 4-NP water solution before and after AuNPs-catalyzed reduction in each cycle is plotted in Figure 6B with consideration of volume change. The product yields of the four cycles are calculated to be 100 %, 94 %, 88 % and 80 %.

Supplementary Figures

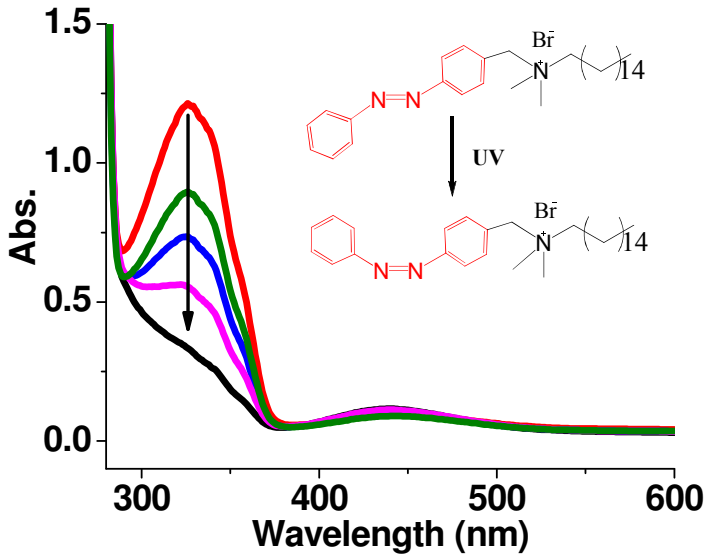


Figure S1. Absorption spectra of *trans*-azo-ligand upon irradiation with UV light at 0 min (red), 15 min (green), 30 min (blue), 45 min (pink) and 60 min (black).

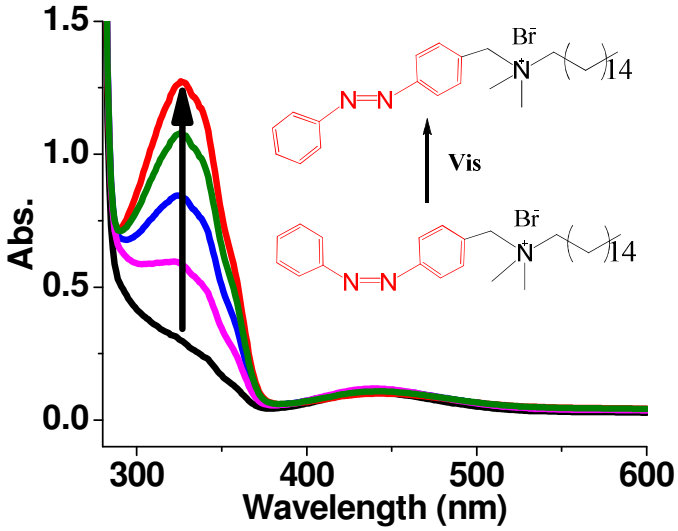


Figure S2. Absorption spectra of cis-azo-ligand upon irradiation with visible light at 0 min (black), 15 min (pink), 30 min (blue), 45 min (green) and 60 min (red).

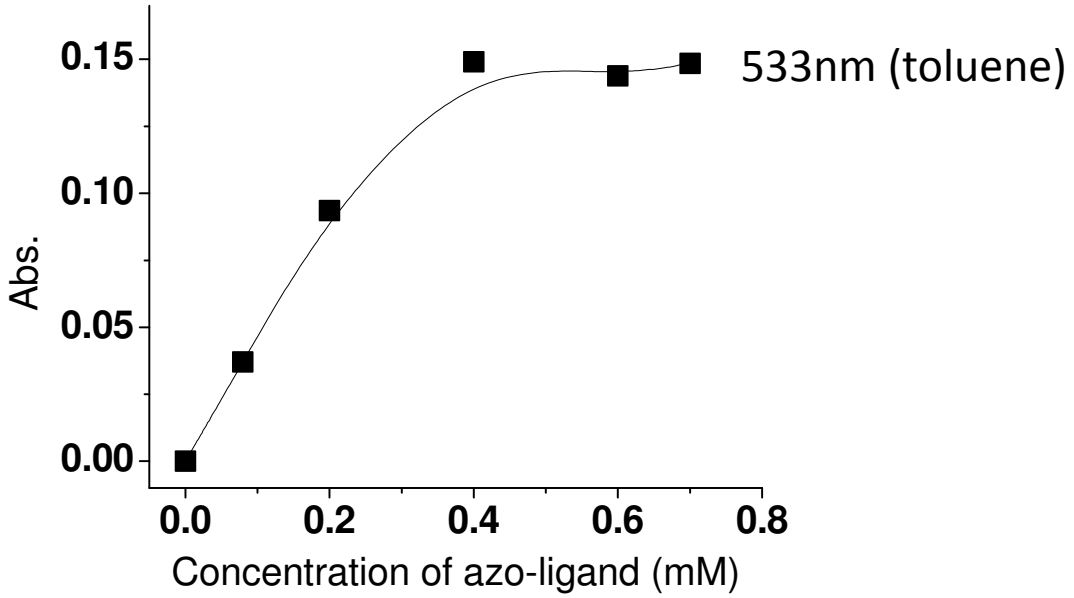


Figure S3. Absorbance (533 nm) of AuNPs transferred to toluene phase containing variable concentrations of azo-ligand after equilibrating with aqueous solution containing AuNPs of a fixed concentration (0.1 mg/mL).

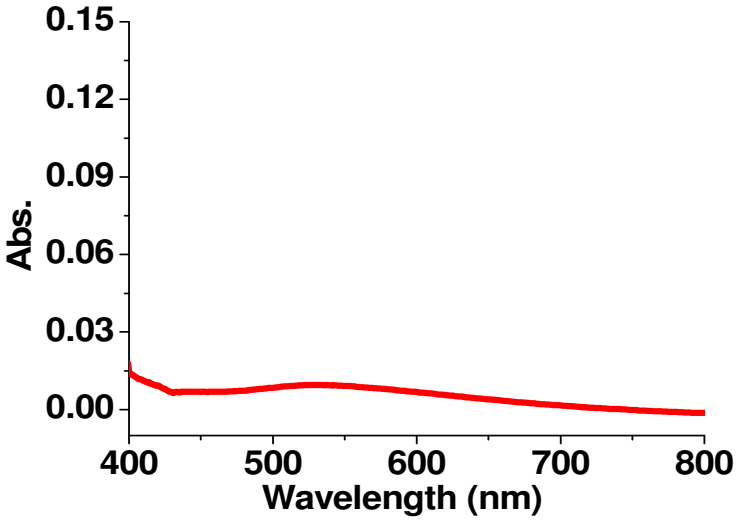


Figure S4. Absorption spectrum of AuNPs transferred to the toluene phase by cis-azo-ligand.

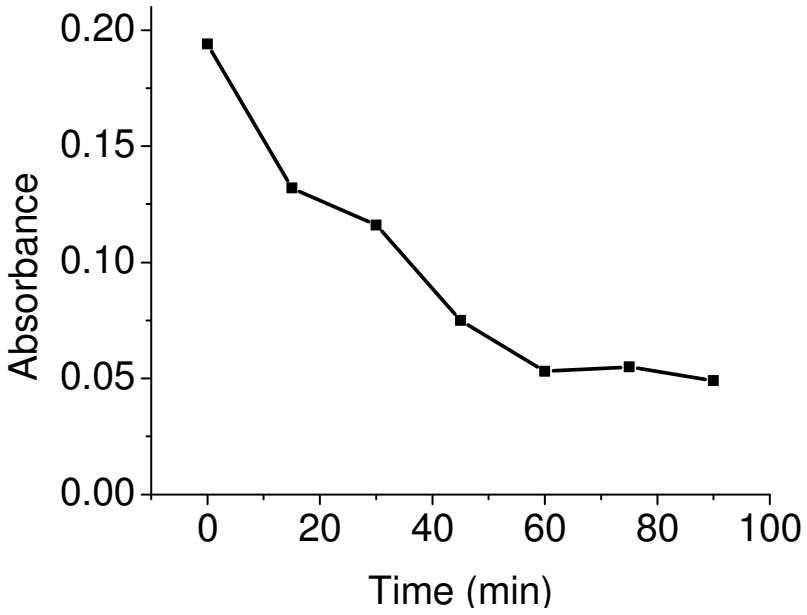


Figure S5. AuNPs with absorbance at 533 nm in toluene phase transferred to water phase from toluene phase upon irradiation with UV light at different times.

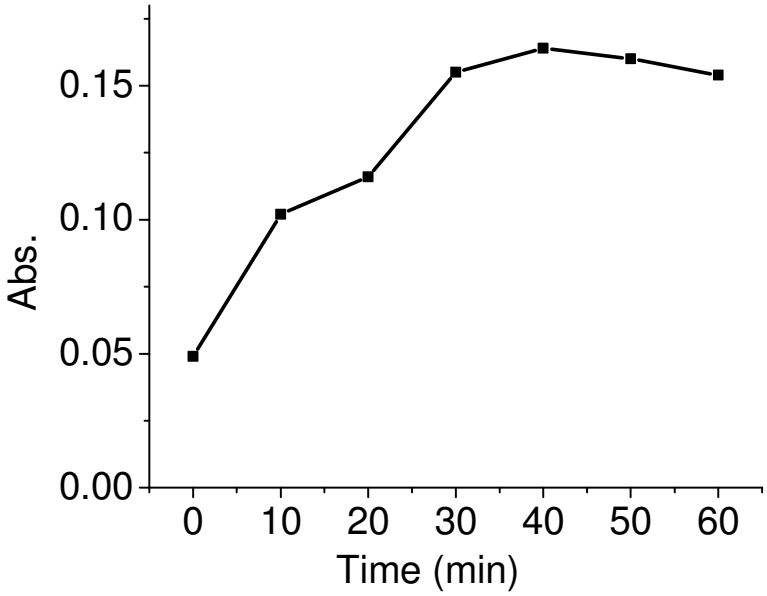


Figure S6. AuNPs with absorbance at 533 nm in toluene phase transferred to toluene phase from water phase upon irradiation with visible light at different times.

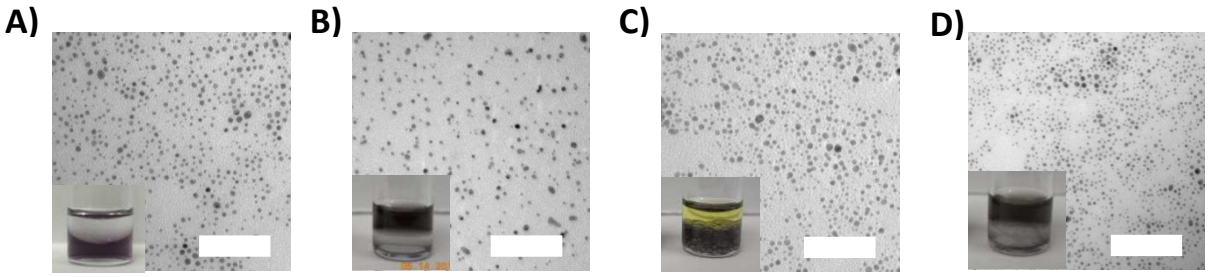


Figure S7. TEM images of AuNPs during reversible phase transfer. A) AuNPs in water phase after synthesis. B) AuNPs transferred to toluene by *trans*-azo-ligand. C) AuNPs transferred to water by UV light irradiation. D) AuNPs transferred back to toluene by visible light irradiation.

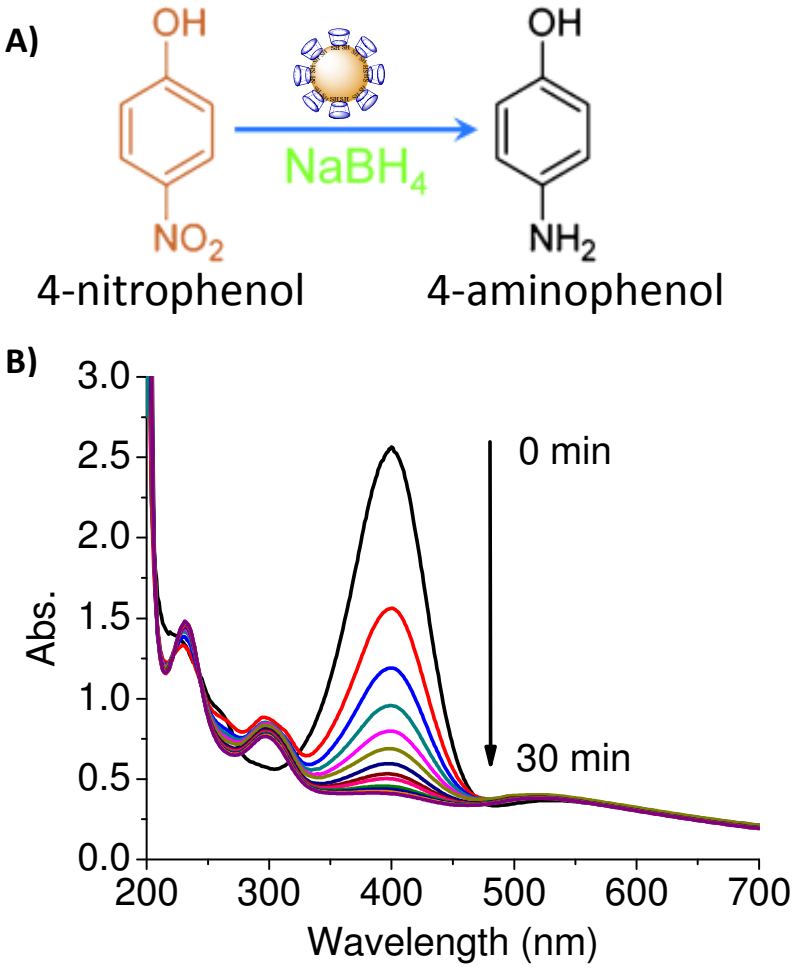


Figure S8. A) Reduction of 4-NP in the presence of $NaBH_4$ and α-CD-capped AuNPs. B) Conversion of 4-NP to 4-AP monitored by absorption measurement. (0.3 mM 4-NP, 15 mM $NaBH_4$, 25 µg/mL α-CD-capped AuNPs).

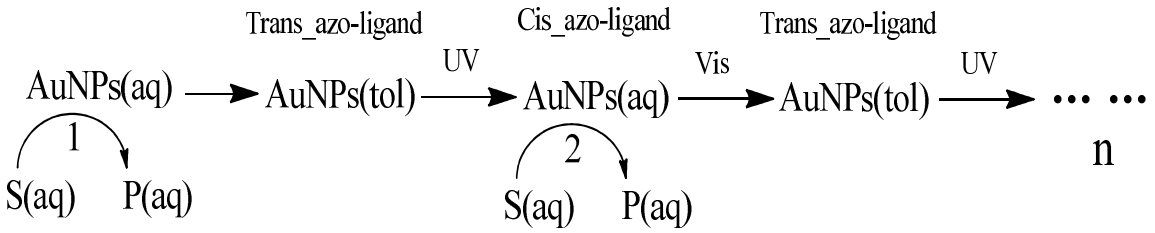


Figure S9. Scheme of recovery and recycling of α-CD-capped AuNPs for the reduction of 4-NP by photoreversible phase transfer.