Electronic Supplementary Information

'Nanoreactors' for photocatalytic H₂ evolution in oil-water biphasic systems

Jiehua Liu,*a Xiangfeng Wei,a Yaolun Yu,c Xin Wang,c Wei-Qiao Deng*b and Xue-Wei Liu*a
a School of Physical & Mathematical Sciences, Nanyang Technological University, 637371 Singapore
E-mail: xuewei@ntu.edu.sg and liuj0042@ntu.edu.sg
b Dalian Institute of Chemical Physics, Chinese Academy of Sciences, Dalian 116023 China; E-mail: dengwg@dicp.ac.cn;
c School of Chemical and Biomedical Engineering, Nanyang Technological University, 639798 Singapore
Experimental Section

In situ Preparation of CdS and Pt@CdS nanosheets

Nanoporous CdS nanosheets were synthesized by a facile method. In a typical route, Cd(OAc)₂·2H₂O (2.00 mmol) was first added into deionized water (10 mL) to get a clear solution; then milky emulsion was formed by the addition of N, N-Dimethylethanolamine (4 mL); after 0.2 mol L⁻¹ Na₂S solution (10 mL) was added and dispersed with aid of supersonic, the emulsion was placed in an oven for 12 hours at 70 ºC. The CdS nanosheets were formed in solution. To load Pt nanoparticles, H₂PtCl₆ solution and 1 mL methanol are added into CdS nanosheets aqueous solution and then irradiated it for 5 hours under simulated sunlight with strong stirring and. Finally, 68 g suspension of Pt@CdS catalyst (5.0 mg catalyst in 1 g suspension) was prepared to be directly used for photocatalytic reaction.

Characterizations

FESEM images, transmission electron micrographs (TEMs) and HRTEM were obtained with JEOL JSM 6700F, JEOL JEM-1400 and JEOL JEM-2100 respectively. Photoluminescence spectra were recorded by Steady-state Fluorescence spectrofluorometer. UV-Vis absorption spectra were measured by a JASCO V-670 spectrophotometer. H₂ and Organic substances were analyzed with GC2014 and Agilent 6879N, respectively. N₂ adsorption-desorption isotherms were conducted at 77 K on a Micromeritics Tristar 3000 analyzer. The BET surface areas and pore-size distribution curves were concluded using adsorption data.

Photocatalytic reaction
The photocatalytic reactions were carried out in a 600 mL cylindrical glass reactor with quartz top-window connected to a closed gas circulation. In single systems, 0.010 g of 1% Pt@CdS was suspended in 100 mL of aqueous solution containing 0.1 M Na₂S and 0.02 M Na₂SO₃ solution as the sacrificing agent. In oil/H₂O systems, 0.010 g of 1% Pt@CdS was suspended in 10-30 mL oil and 100 mL of aqueous solution containing 0.1 M Na₂S and 0.02 M Na₂SO₃ solution as the sacrificing agent. The systems are conducted under irradiation by simulated sunlight. The amount of H₂ produced was analyzed using a gas chromatography (GC2014). The average rates of H₂ evolution were recoded in the first 3 h.

Figure S1: N₂ adsorption–desorption isotherms and nanopore size distribution of catalyst nanosheets.
Figure S2: HRTEM image and EDX spectra of 1.0% Pt@CdS catalyst.
Figure S3: Fluorescence spectra of CdS and Pt@CdS nanocatalysts H₂O solution with 397 nm as the maximum excitation wavelength at room temperature.

Figure S4: UV-Visible spectra of 1.0%Pt@CdS in H₂O solution.
Figure S5: GC curves of the amount of H₂ evolution in hexane/water biphase system in different time.