Electronic Supplementary Information

'Nanoreactors' for photocatalytic H_2 evolution in oil-water biphase 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: dengwq@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, $Cd(OAc)_2 \cdot 2H_2O$ (2.00 mmol) was first added into deionized wate (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} Na_2S 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, H_2PtCl_6 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 spectroflurometer. UV-Vis absorption spectra were measured by a JASCO V-670 spectrophotometer. H_2 and Organic substances were analyzed with GC2014 and Agilent 6879N, respectively. N_2 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 Na_2S and 0.02 M Na_2SO_3 solution as the sacrificing agent. In oil/H_2O 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 Na_2S and 0.02 M Na_2SO_3 solution as the sacrificing agent. The systems are conducted under irradiation by simulated sunlight. The amount of H_2 produced was analyzed using a gas chromatography (GC2014). The average rates of H_2 evolution were recoded in the first 3 h.

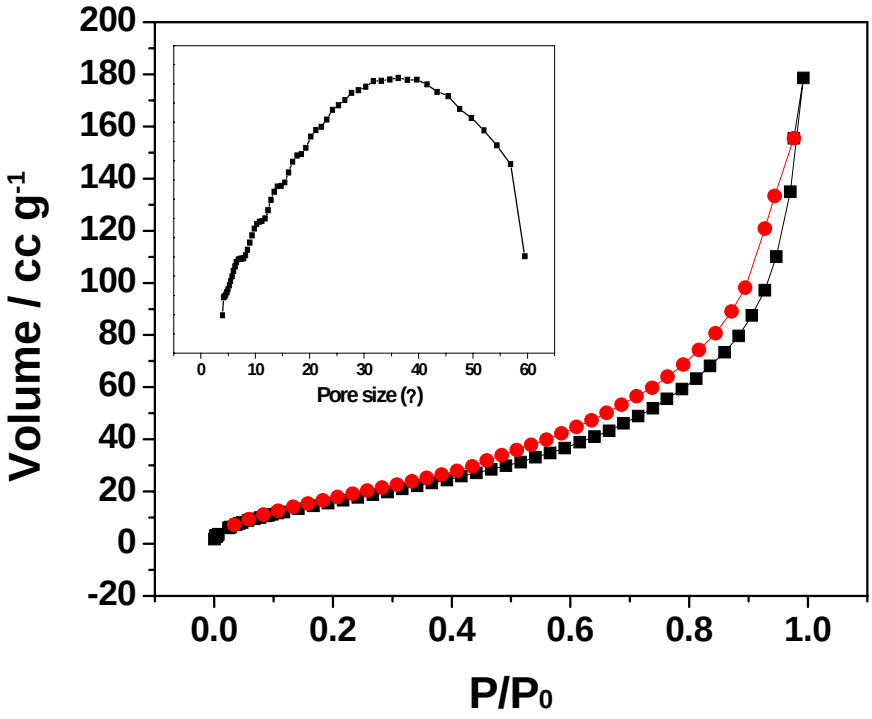

Figure S1: N_2 adsorption–desorption isotherms and nanopore size distribution of catalyst nanosheets.

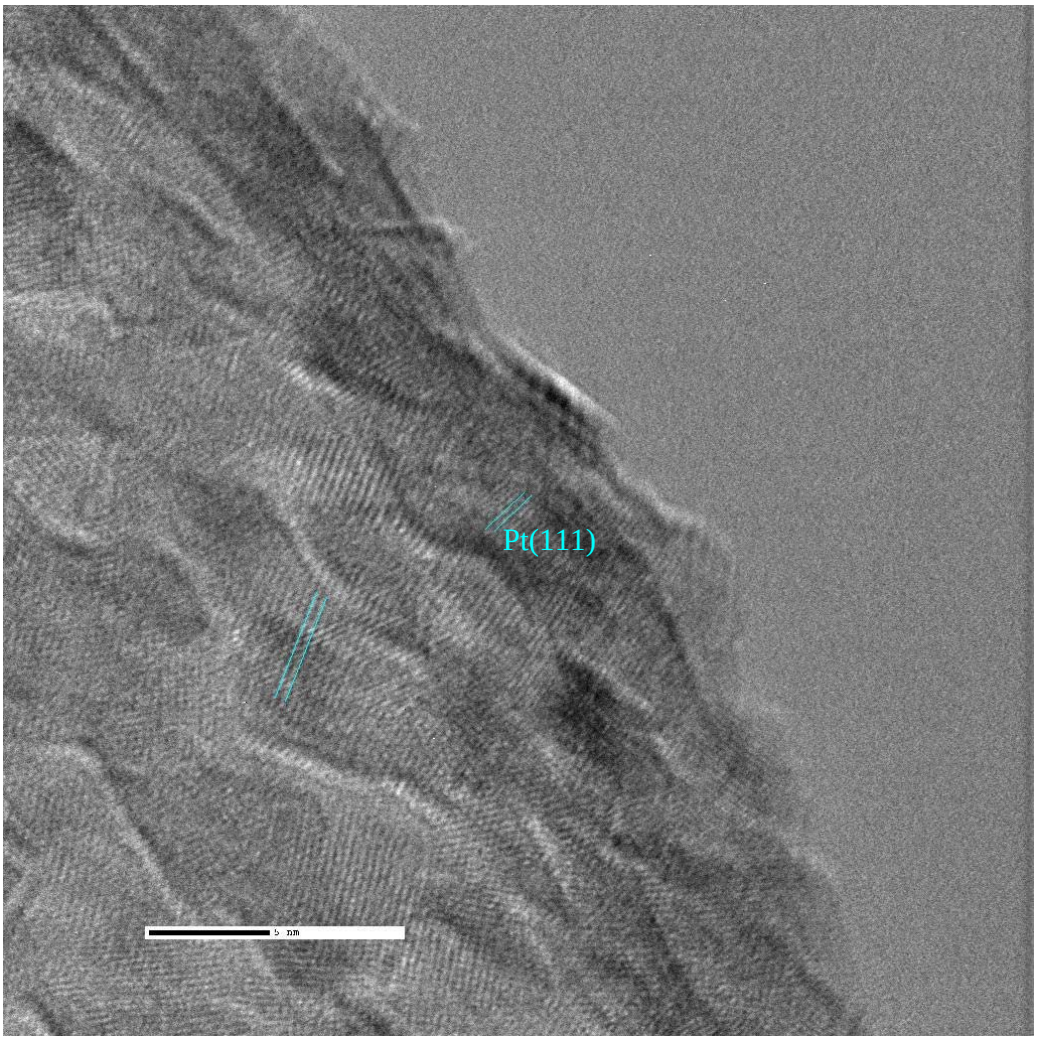

Figure S2: HRTEM image and EDX spectra of 1.0% Pt@CdS catalyst.

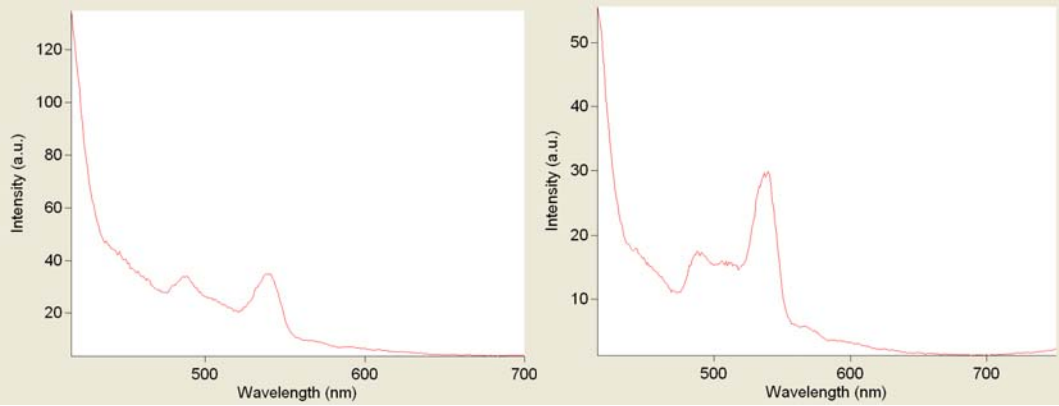

Figure S3: Fluorescence spectra of CdS and Pt@CdS nanocatalysts H_2O solution with 397 nm as the maximum excitation wavelength at room temperature.

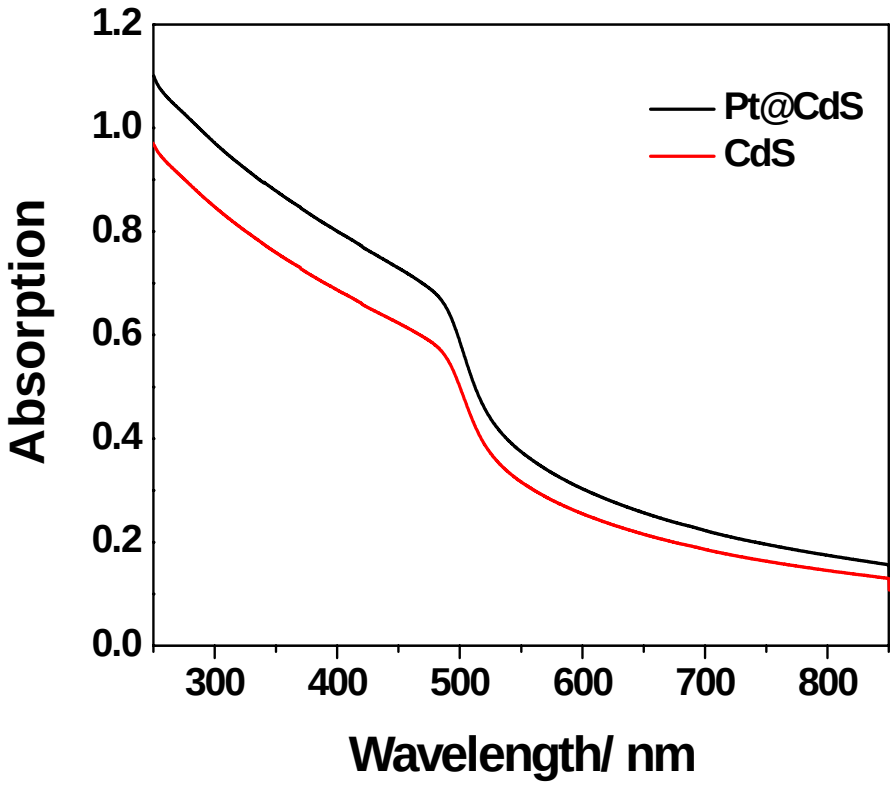

Figure S4: UV-Visible spectra of 1.0%Pt@CdS in H_2O solution.

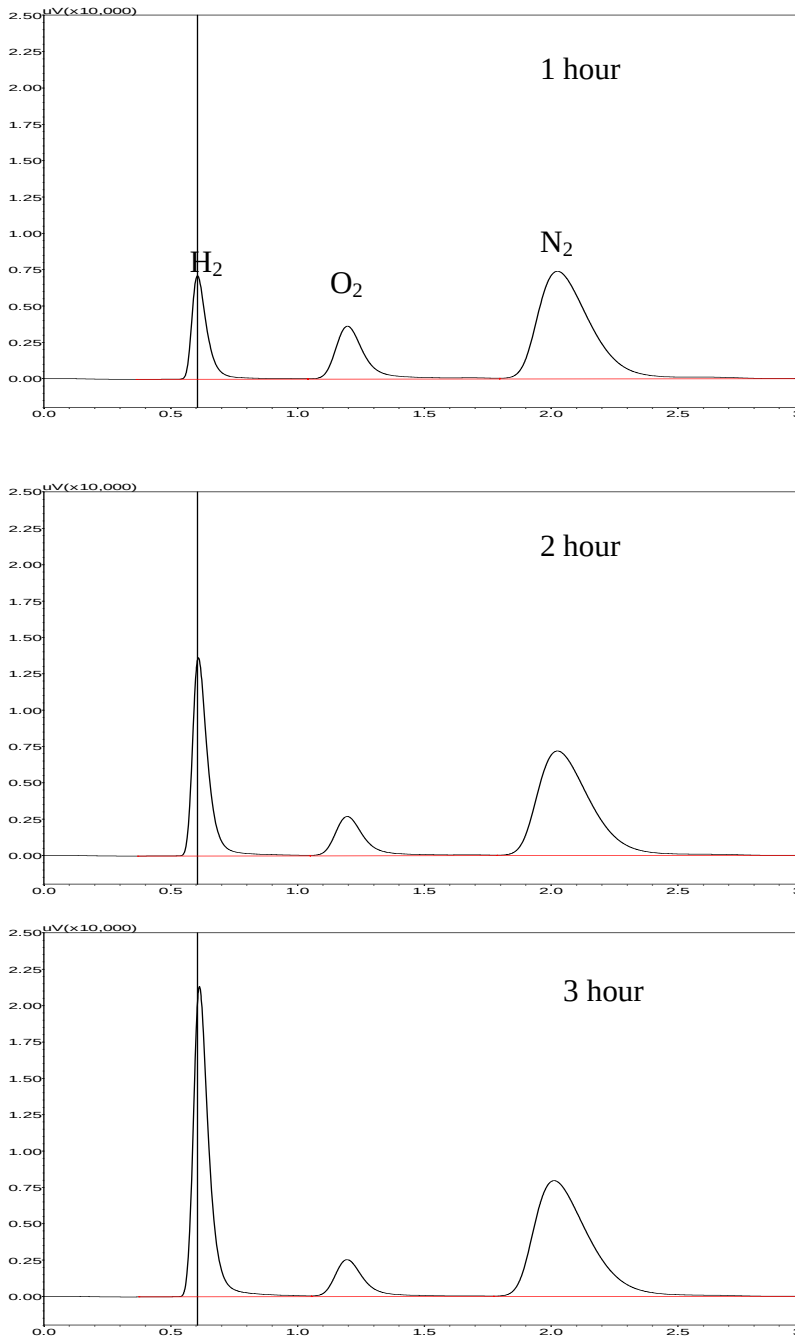

Figure S5: GC curves of the amount of H_2 evolution in hexane/water biphase system in different time.