Supporting Information

CdS/CeO_x heterostructured nanowires for photocatalytic hydrogen production

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EXPERIMENTAL SECTION

Preparation of the CdS/CeO_2 heterostructured nanowres: $Ce(NO_3)_3\ 6H_2O$, KCl, ammonium acetate(CH_3COONH_4), $Cd(NO_3)_2\ 6H_2O$ and thiourea were obtained from Sinopharm Chemical Reagent Co., Ltd., China. All reagents used were of analytical grade and were used directly without any purification. CeO_2 nanowires were prepared by a cathodic electrodeposition method. The electrodeposition was performed in a conventional three-electrode cell using a home-made HDV-7C potentiostatic apparatus with a current density of 1.0 mA cm^{-1} at 70 °C for 120 min. The working electrode was a Cu foil (1.5 cm × 3 cm). Before electrodeposition, the Cu foil was

cleaned ultrasonically in distilled water, ethanol, and acetone and then rinsed in distilled water again before electrodeposition. The counter electrode was a graphite rod and the reference electrode was a saturated Ag/AgCl electrode. A 25 mL aqueous solution containing 0.025 M $Ce(NO_3)_3$ $6H_2O$, 0.02 M CH_3COONH_4, and 0.05 M KCl was used as electrolyte. Then, CdS nanoparticles were deposited on the surface of CeO_2 nanowires through a successive electrodeposition in a solution containing 0.01 M $Cd(NO_3)_3$ and 0.01 M thiourea at 90 ^oC by using the obtained CeO_2 wires as working electrode. The current density is 0.5 mA cm^{-2} and the deposition time is 10 min.

Characterization: The surface morphology and the composition of the samples were analyzed by scanning electron microscope (SEM, Quanta 400). The structure of the samples were investigated via X-ray diffraction (XRD, Bruker, D8 ADVANCE) with Cu Kα radiation (λ=1.5418 Å), transmission electron microscopy (TEM, 200 KV, JEM2010-HR) and X-ray Photoelectron Spectroscopy (XPS, ESCALab250, Thermo VG) with 200 W Al KR radiation in twin anode. UV-visible absorption spectra of samples were recorded on a VARIAN CARY 5000 UV-Vis-NIR. Room temperature photoluminescence (PL) spectra were studied using a combined fluorescence lifetime and steady state spectrometer (FLS920, EDINBURGH). Nitrogen adsorption/desorption isotherms at 77 K were conducted on an ASAP 2020 V3.03 H instrument. All samples (powders) were outgassed at 100 ^oC for 300 min under flowing nitrogen before measurements.

Photocatalytic and electrochemical measurements: The photocatalytic H_2 evolution reaction was performed in a Pyrex reactor with an entry window of optical flat quartz glass. Typically, 50 mg powders were placed in the reaction cell with 100 ml of Na_2S (0.43 M)-Na_2SO_3 (0.5 M) solution. The light source was a 300-W Xe lamp (PLS-SXE-300UV, Beijing Changtuo) supplying the full wavelength (white) or visible light (with a UV-cutoff filter $\lambda \geq 420$ nm) illumination. The distance between the light and solution is about 10 cm. The amount of produced H_2 was analyzed using on-line gas chromatography with a thermal conductivity detector and an N_2 carrier.

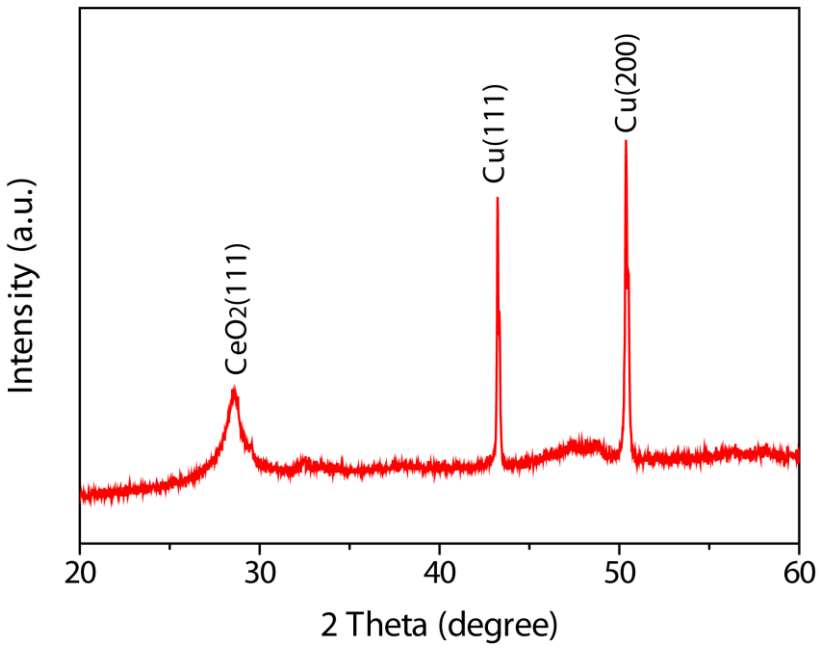

Figure S1. XRD spectrum of the CdS/CeO_2 heterostructured nanowires.

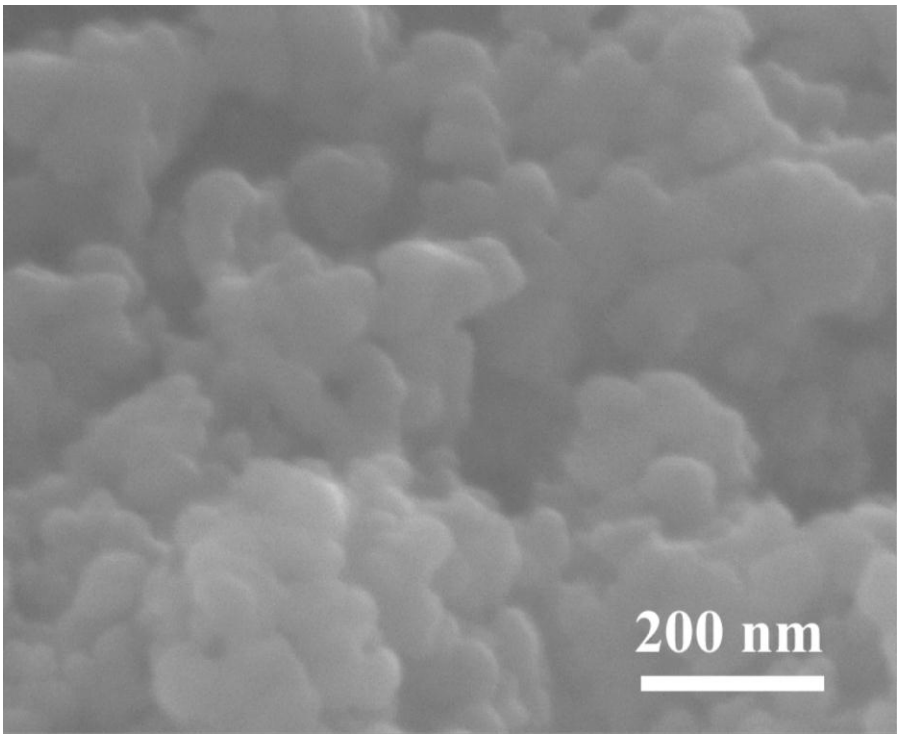

Figure S2. SEM image of commercial CdS nanoparticles.