Supporting information

Improving Photoelectrochemical and Photocatalytic Performances of CdO Nanorods with CdS Decoration

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Experimental

Preparation of CdO nanorods (NRs): All reagents used were analytical grade and were used directly without any purification. All the electrodeposition experiments were carried out in a conventional three-electrode cell. The working electrode was an F-doped SnO_2 coated glass (FTO) with a sheet resistance of 14 Ω/cm^2. A graphite rod of about 4.0 cm^2 was used as the auxiliary electrode. An Ag/AgCl electrode was used as the reference electrode. The FTO glass was cleaned ultrasonically in distilled water, ethanol, and acetone and then rinsed in distilled water again before electrodeposition. Firstly, $Cd(OH)_2$ NRs were grown on FTO substrate in a solution of 0.02 M $Cd(NO_3)_2$ and 0.01 M ammonium chloride with a cathodic current density of 2.0 mA/cm^2 at

70 ^{o}C. After 30 min electrodeposition, a white film was obtained and washed by distilled water for several times. Then, CdO NRs was obtained by annealing the white film at 350 ^{o}C for 180 min in air. To obtain the CdO/CdS NRs, the prepared $Cd(OH)_2$ NRs were immersed into a 15 mL thioacetamide (0.01 M) aqueous solution for 15 and 30 min at room temperature and annealed at 350 ^{o}C in air for 180 min. the products were denoted as CdO/CdS-15min NRs and CdO/CdS-30min NRs, respectively.

Materials characterizations*:* The surface morphology, microstructure and the composition of the samples were analyzed by scanning electron microscope (SEM, Quanta 400), X-ray diffraction (XRD, Bruker, D8 ADVANCE) with Cu Kα radiation (λ = 1.5418 Å), transmission electron microscopy (TEM, JEM2010-HR) and X-ray Photoelectron Spectroscopy (XPS, ESCALab250). The optical properties of the samples were measured with a UV-Vis-NIR Spectrophotometer (UV, Shimadzu UV-3150).

Photoelectrochemical characterizations*:* PEC measurements were carried out in a three-electrode cell with a flat quartz window to facilitate illumination of the photoelectrode surface. The working electrode is the as-prepared film with a light irradiation area of 0.5 cm^2, while a Pt wire as the counter electrode and an Ag/AgCl electrode as the reference electrode. The electrolyte is a Na_2S-Na_2SO_3 (0.1 M: 0.1 M) mixed aqueous solution. Linear sweeps were measured by a CHI 660D electrochemical station under visible light irradiation ($\lambda \geq 420$ nm) that provided by a Xe lamp (500 W, Beijing Changtuo, PLSLAX500) with a UV-cutoff filter. The intensity of light is about 100 mW/cm^2.

Photocatalytic measurements: The photocatalytic degradation of methylene blue (MB) was carried out in an aqueous solution at room temperature. Typically, 50 mg of CdO or CdO@CdS

powder samples was suspended in 100 mL of 10 mg/L MB aqueous solution and magnetically stirred in the dark for 12 h to ensure establishment of an adsorption-desorption equilibrium before UV irradiation. Then, the powders were collected by filter and suspended in fresh MB solution (100 mL, 10 mg/L) for the photocatalytic degradation. The visible light source was provided by a 500 W Xe lamp (PLS-LAX500/1000, Beijing Changtuo) with UV-cutoff filter. The distance between the light and solution is about 5 cm. During irradiation process, constantly blowing air was necessary to ensure the system had enough oxygen. 3 mL of the suspensions was collected at different UV irradiation intervals and filtered through a 0.45 lm membrane, and finally analyzed by a UV-vis spectrophotometer (UV-2450, Shimadzu) immediately.

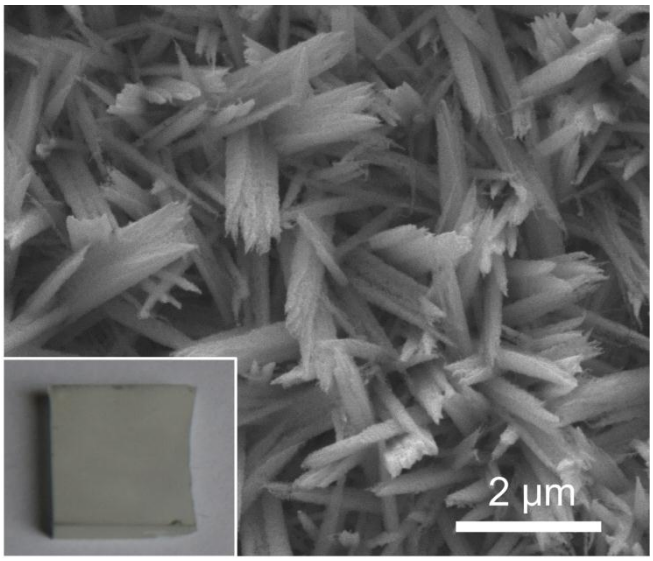

Fig. S1 SEM image of $Cd(OH)_2$ NRs on FTO substrate. Inset: optical image of $Cd(OH)_2$ NR film.

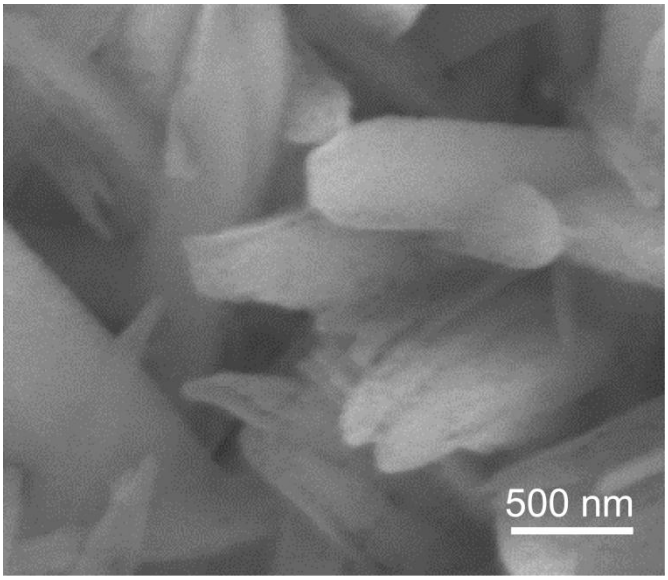

Fig. S2 SEM image of CdO/CdS-15min NRs on FTO substrate.

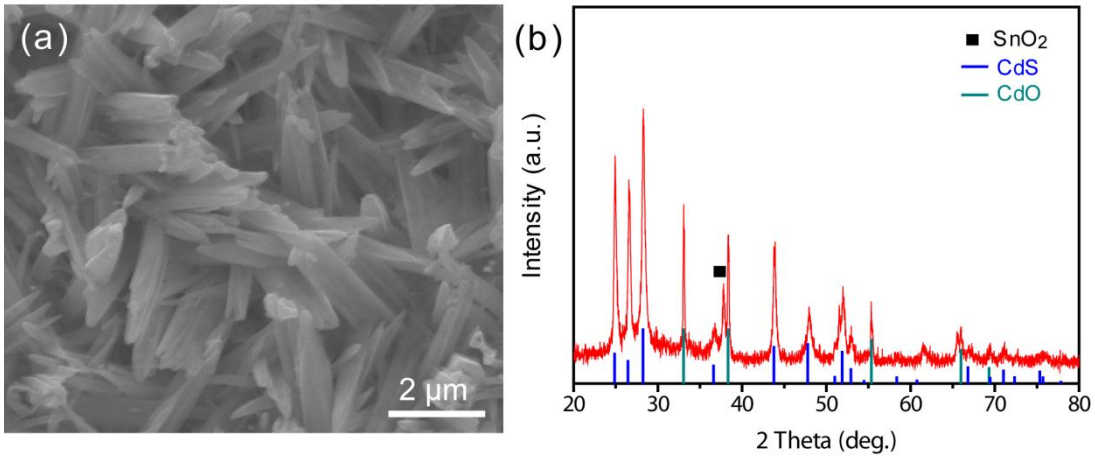

Fig. S3 (a) SEM image and (b) XRD spectrum of CdO/CdS-30min NRs on FTO substrate.

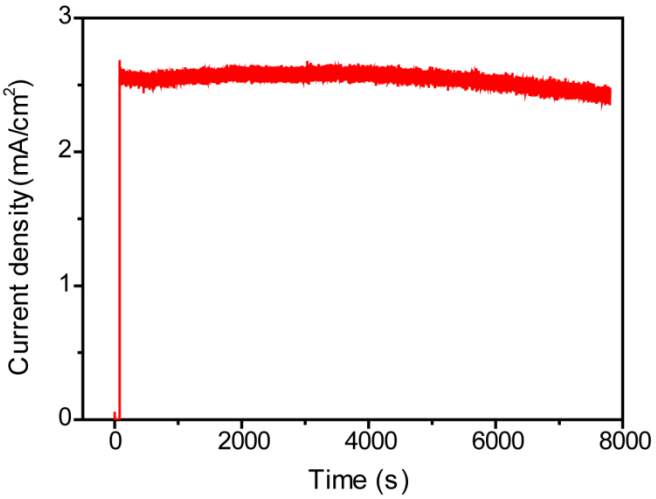

Fig. S4 Photocurrent–time response curve of CdO/CdS heterostructured NRs collected at -0.4 V vs. Ag/AgCl in a Na_2S (0.1 M) -Na_2SO_3 (0.1 M) mixed solution under visible light irradiation (with a UV-cutoff filter, $\lambda \geq 420$ nm).