Electronic Supplementary Information

High efficient visible light-driven hydrogen production of the precious metal-free hybrid photocatalyst: CdS@NiMoS core-shell nanorods

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Experimental section

1. The preparation of 3wt% CdS@MoS_2

Just like the procedure of the preparation of CdS@NiMoS, the prepared CdS NRs sample (0.2 g), $Na_2MoO_4 \cdot 2H_2O$ (9 mg) and L-cystiene (12 mg) were dispersed into 30 mL distilled water by sonication for 10 min. After stirring for another 30 min, the obtained mixture was transferred to a 50 mL Teflon-lined stainless steel autoclave, and reacted at 200 ^oC for 24 hours. The as-prepared products were separated by centrifugation, followed by washing with distilled water and ethanol several times. After being dried at 60 °C overnight in a vacuum, the yellow green CdS@NiMoS products were obtained.

2. The preparation of 3wt% CdS@NiS

To keep the same prepared conditions of all samples, the synthesis of 3wt% CdS@NiS like the ways above. The pure as-prepared CdS nanorods (0.2g), $NiCl_2 \cdot 6H_2O$ (16 mg) and L-cystiene (12 mg) were dispersed into 30 mL distilled water by sonication for 10 min. After stirring for another 30 min, the obtained mixture was transferred to a 50 mL Teflon-lined stainless steel autoclave, and reacted at 200 ^oC for 24 hours. The as-prepared products were separated by centrifugation, followed by washing with distilled water and ethanol several times. The products were obtained after being dried at 60 °C overnight in a vacuum.

3. The preparation of NiMoS

$NiCl_2 \cdot 6H_2O$ (60 mg), $Na_2MoO_4 \cdot 2H_2O$ (45 mg) and L-cystiene (0.3 g) were dispersed into 30 mL distilled water by sonication for 10 min. After stirring for another 30 min, the obtained mixture was transferred to a 50 mL Teflon-lined stainless steel autoclave, and reacted at 200 ^oC for 24 hours. The as-prepared products were separated by centrifugation, followed by washing with distilled water and ethanol several times. After being dried at 60 °C overnight in a vacuum, the black NiMoS products were obtained.

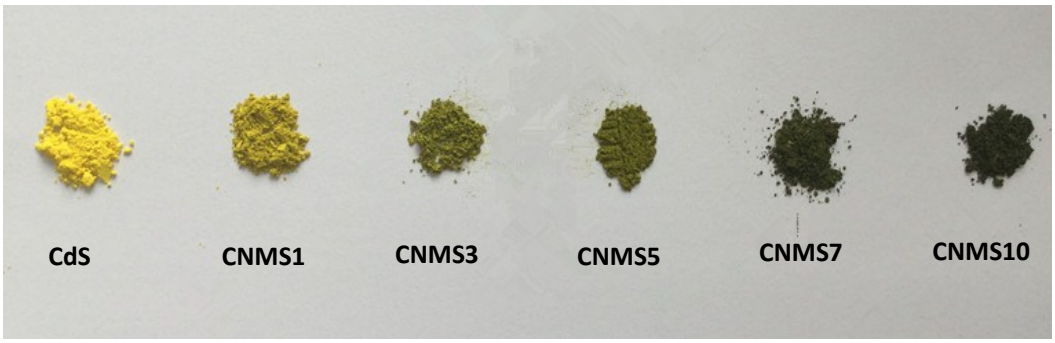

Fig. S1 Digital photographs of CdS nanorods and 1D CdS@NiMoS core-shell nanorods loading with various amounts of NiMoS.

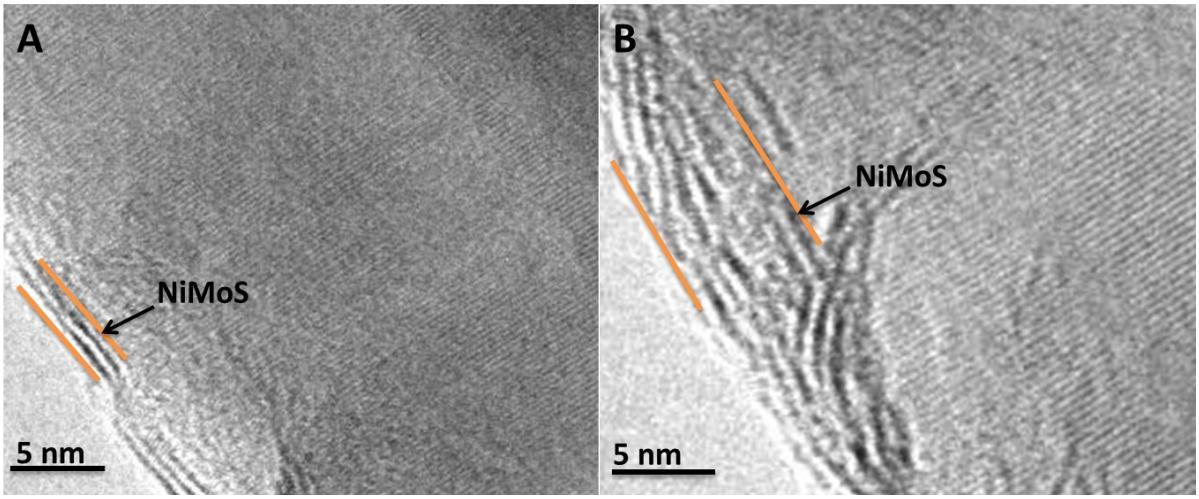

Fig. S2 HRTEM images of the representative CdS@NiMoS samples: CNMS1 (A) and CNMS5 (B).

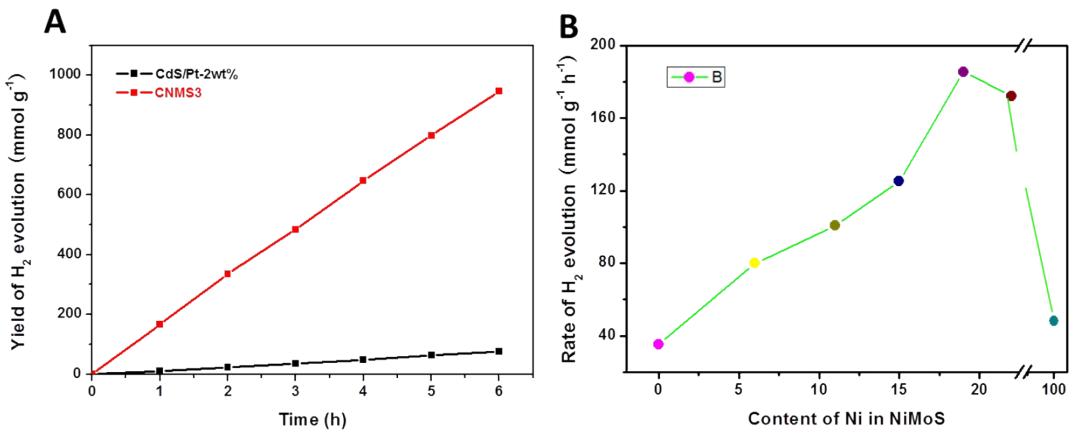

Fig. S3 Comparison of the photocatalytic H2 evolution activity of different samples (A), and the photocatalytic H2 evolution of the corresponding CdS@NiMoS samples (B).

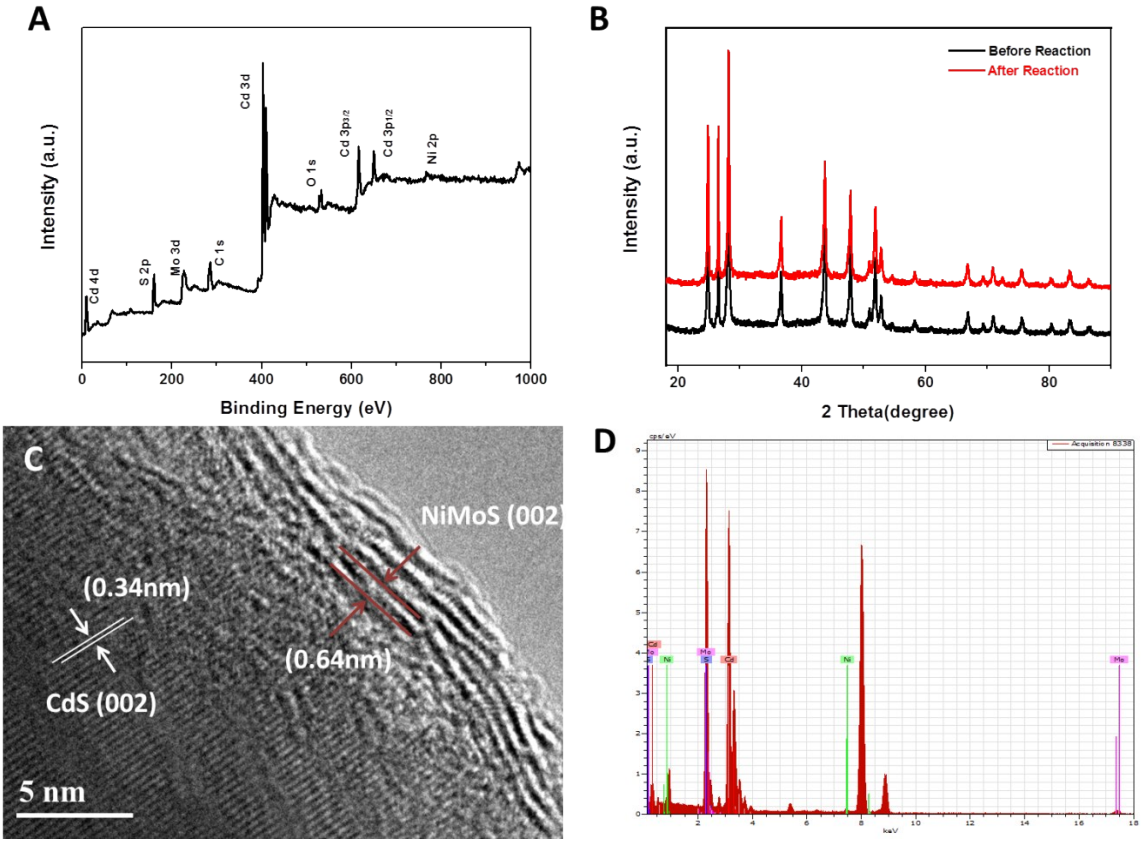

Fig. S4 XPS survey spectra of the CdS@NiMoS core-shell nanorods (A), Comparing XRD spectra before and after photocatalytic reaction (B), HRTEM image of 3wt% CdS@NiMoS nanocomposite (C), EDS spectrum of 3wt% CdS@NiMoS nanocomposite (D).

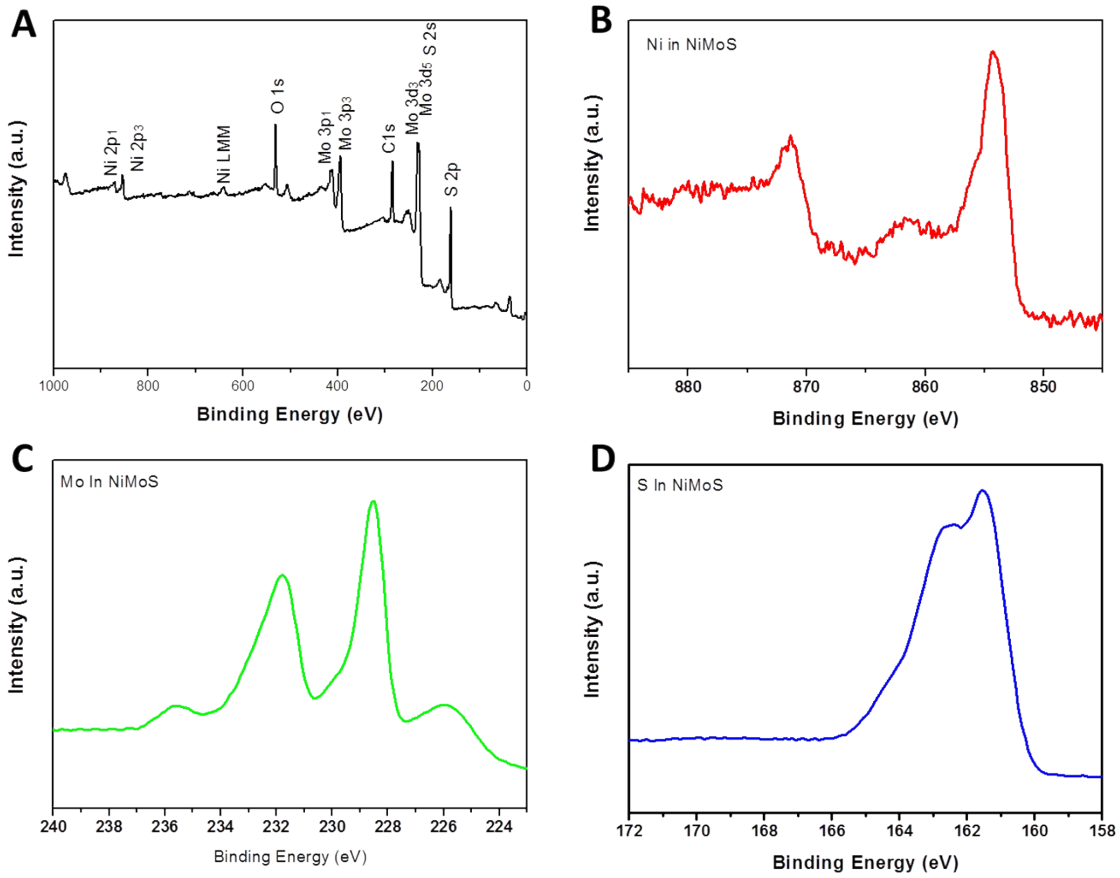

Fig. S5 (A)The XPS survey spectrum of the NiMoS catalysts and corresponding high-resolution spectrum of (B) Ni 2p, (C) Mo 3d, and (D) S 2p.

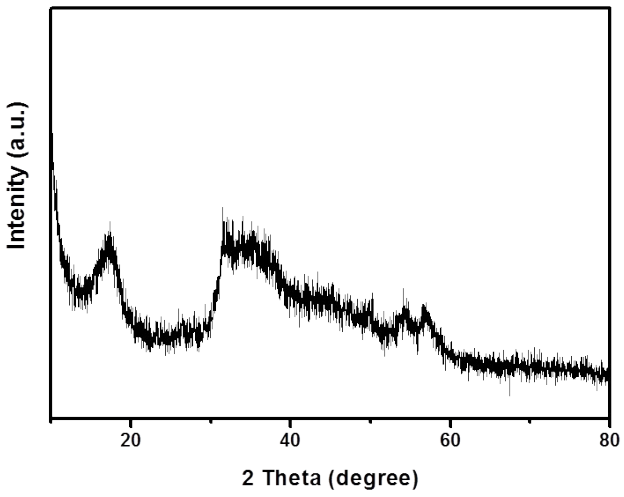

Fig. S6 X-ray diffraction pattern for NiMoS.

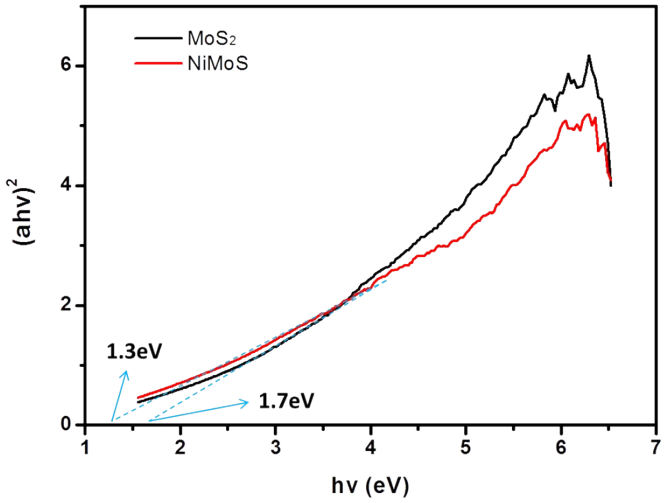

Figure S7 The band gap of NiMoS and MoS_2 determined from the $(ahv)^2$ versus photon-energy.

Table S1 The rate of H_2 evolution over different samples and corresponding AQE.

	Rate of H_2 evolution (mmol g^{-1} h^{-1})	AQE (%)
CdS@NiMoS	185.4	21.82
CdS@MoS_2	35.4	4.21
CdS@NiS	48.2	5.73