Electronic Supplementary Material (ESI) for Energy & Environmental Science.

Supporting Information

Extraordinarily Efficient Photocatalytic Hydrogen Evolution in Water Using Semiconductor Nanorods Integrated With Crystalline Nickel Phosphide Cocatalyst

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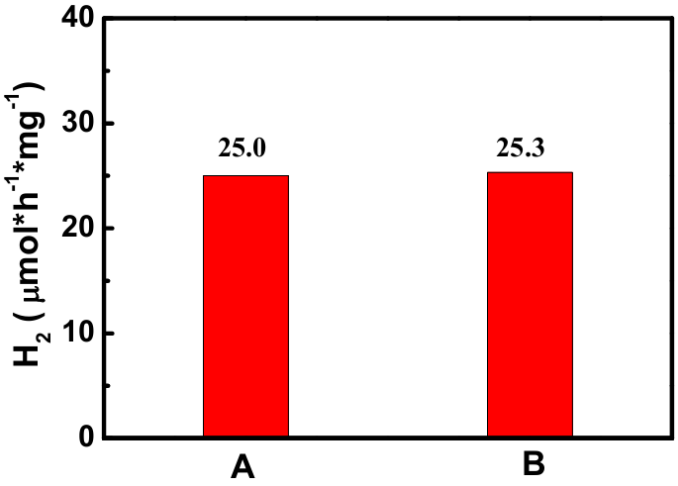

Figure S1. Comparison of photocatalytic activity of CdS NRs **(A)** with and without solvothermal treatment **(B)** under visible light (λ >420 nm). The conditions for solvothermal treatment were the same as that for synthesis of Ni_2P/CdS photocatalyst. The system contains 1.0 mg photocatalyst, 0.75 M Na_2S, and 1.05 M Na_2SO_3 in 20 mL aqueous solution.

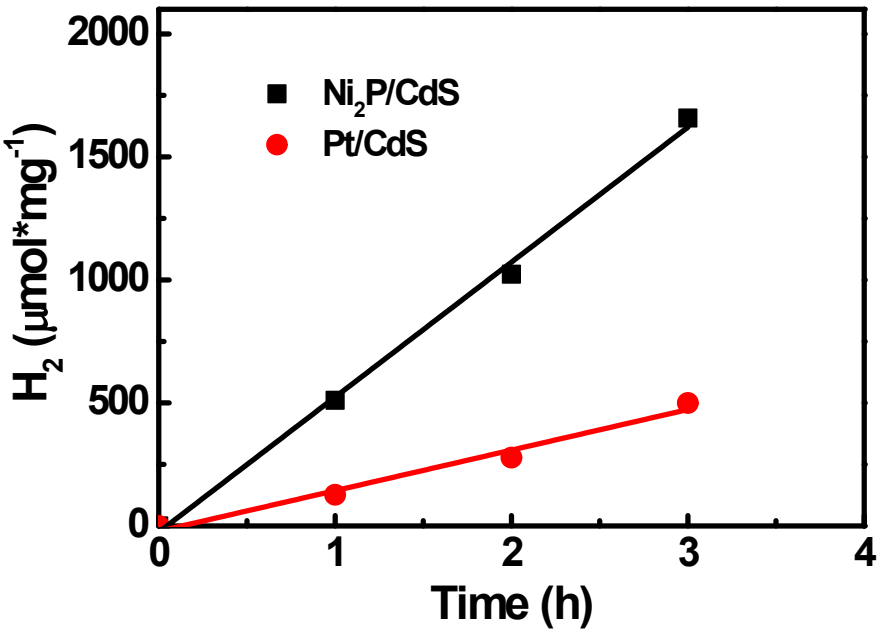

Figure S2. Comparison of photocatalytic activity of Ni_2P/CdS NRs and Pt/CdS NRs. Photocatalytic H_2 evolution over 0.5 wt % Ni_2P/CdS NRs (black line) and 0.5 wt % Pt/CdS NRs (red line) at room temperature under visible light ($\lambda > 420$ nm). The system contains 1.0 mg photocatalyst, 0.75 M Na_2S and 1.05 M Na_2SO_3 in 20 mL aqueous solution.

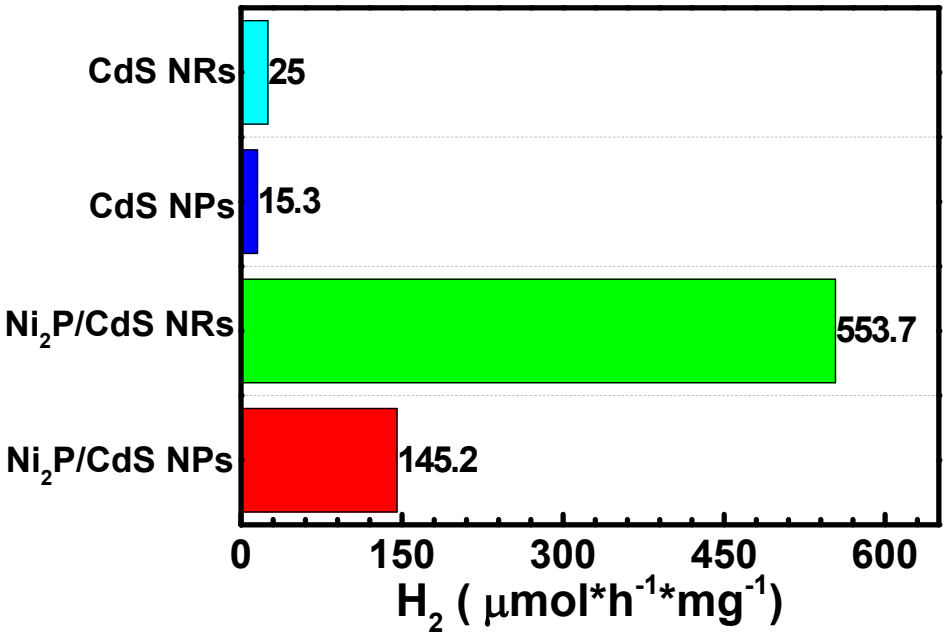

Figure S3. Comparison of photocatalytic activity of CdS NRs, CdS NPs, 0.5 wt % Ni_2P/CdS NRs, and 0.5 wt % Ni_2P/CdS NPs at room temperature under visible light ($\lambda > 420$ nm). The system contains 1.0 mg photocatalyst, 0.75 M Na_2S and 1.05 M Na_2SO_3 in 20 mL aqueous solution.

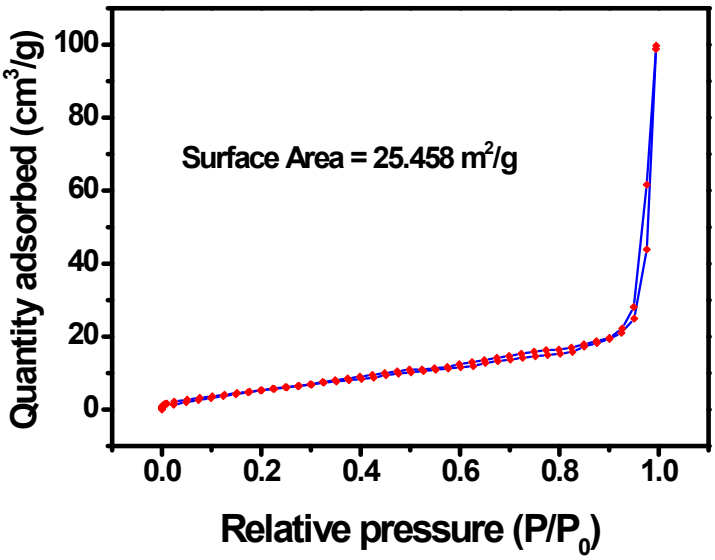

Figure S4. Nitrogen adsorption-desorption isotherms of the 0.5 wt % Ni_2P/CdS NRs.

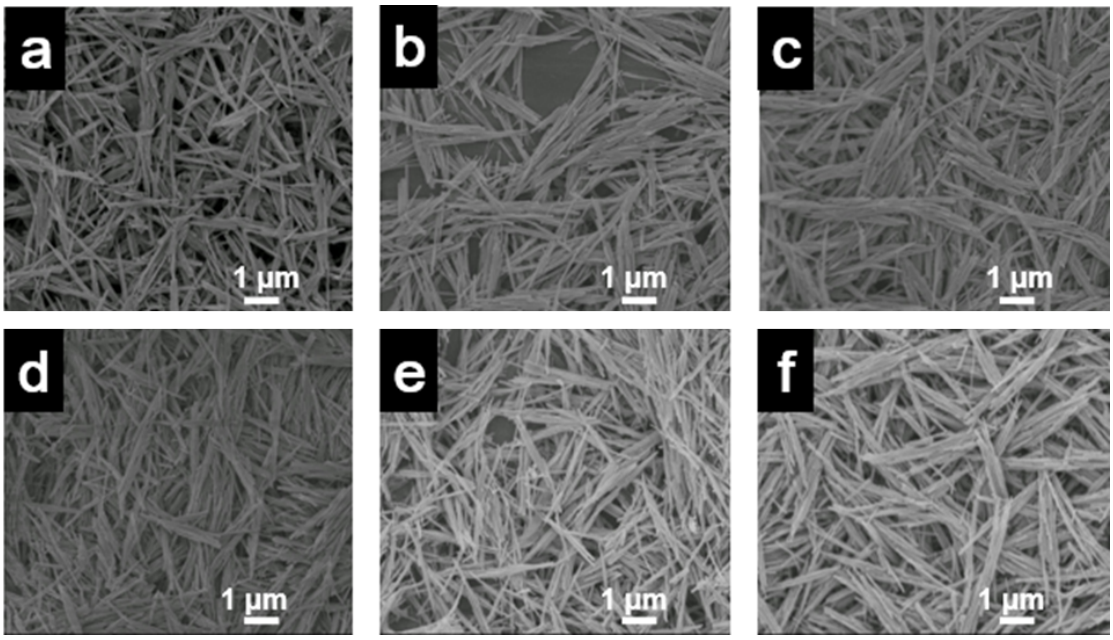

Figure S5. SEM images of pure CdS NRs and Ni_2P/CdS NRs. SEM images of **(a)** pure CdS NRs, **(b)** 0.25 wt % Ni_2P/CdS NRs, **(c)** 0.5 wt % Ni_2P/CdS NRs, **(d)** 1.0 wt % Ni_2P/CdS NRs, **(e)** 2.0 wt % Ni_2P/CdS NRs, **(f)** 10.0 wt % Ni_2P/CdS NRs.

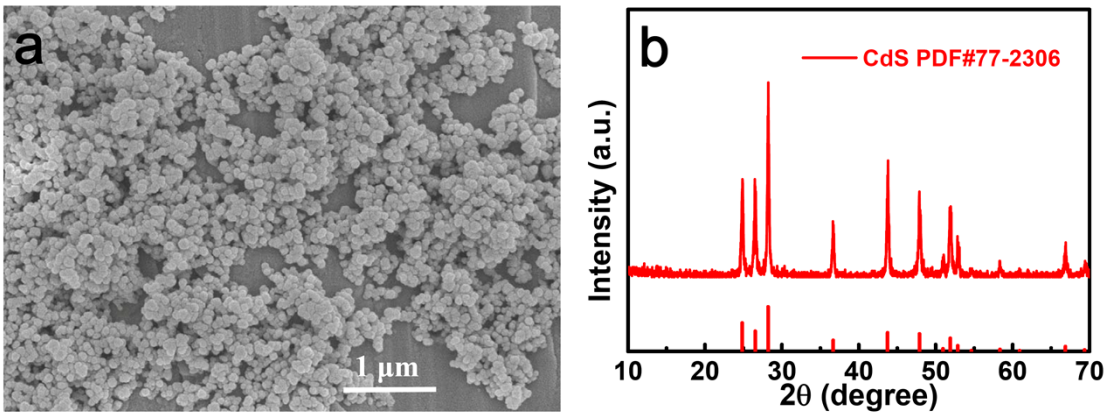

Figure S6. (a) SEM image and **(b)** XRD diffraction pattern of pure CdS nanoparticles.

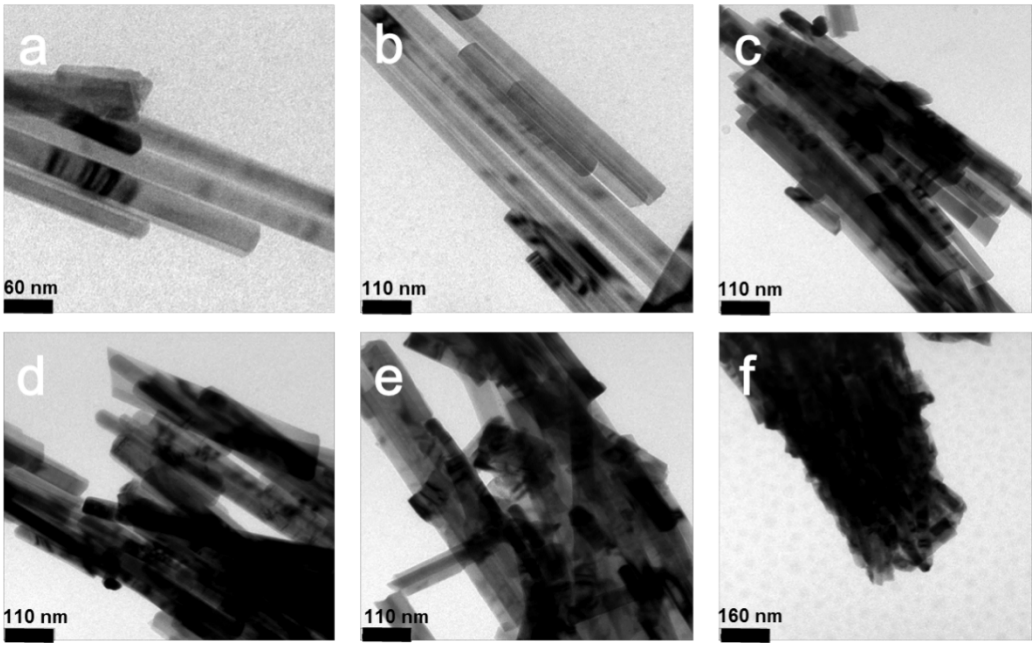

Figure S7. TEM images of pure CdS NRs and Ni_2P/CdS NRs. TEM images of (a) pure CdS NRs, (b) 0.25 wt % Ni_2P/CdS NRs, (c) 0.5 wt % Ni_2P/CdS NRs, (d) 1.0 wt % Ni_2P/CdS NRs, (e) 2.0 wt % Ni_2P/CdS NRs, (f) 10.0 wt % Ni_2P/CdS NRs.

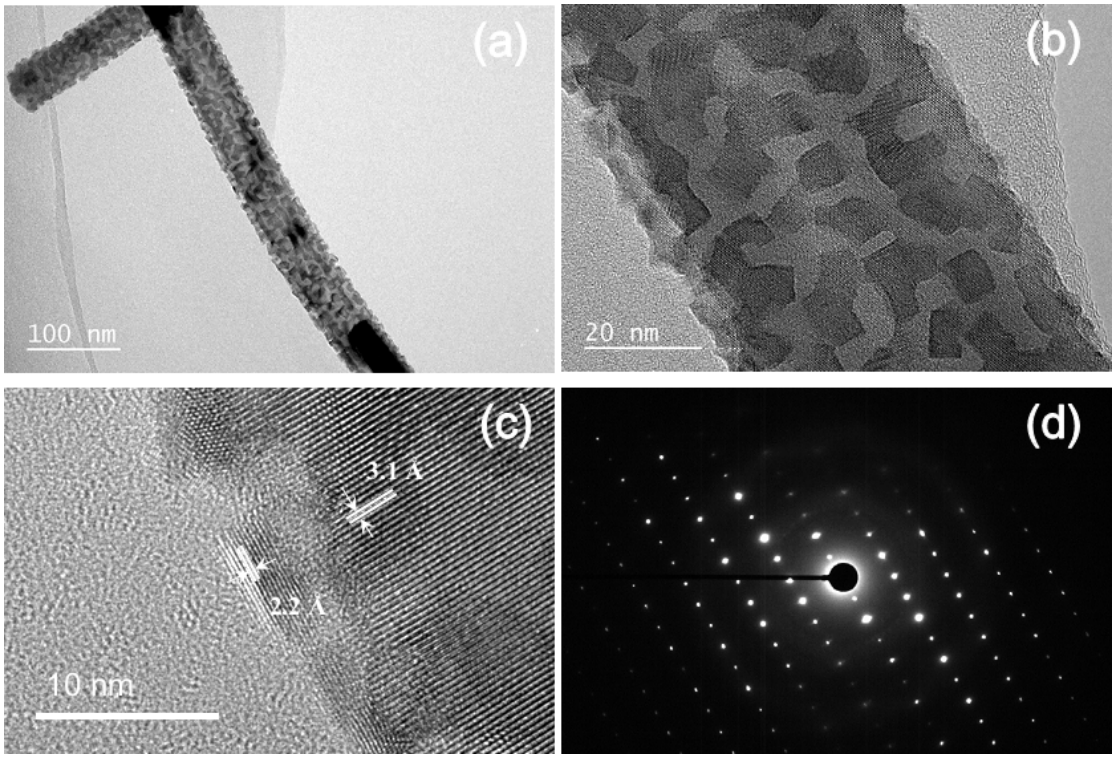

Figure S8. HRTEM images of Ni_2P/CdS NRs and SAED patterns. (a) HRTEM image, and (b) and (c) high-magnification HRTEM images of 0.5 wt % Ni_2P/CdS NRs; (d) selected-area electron diffraction (SAED) patterns.

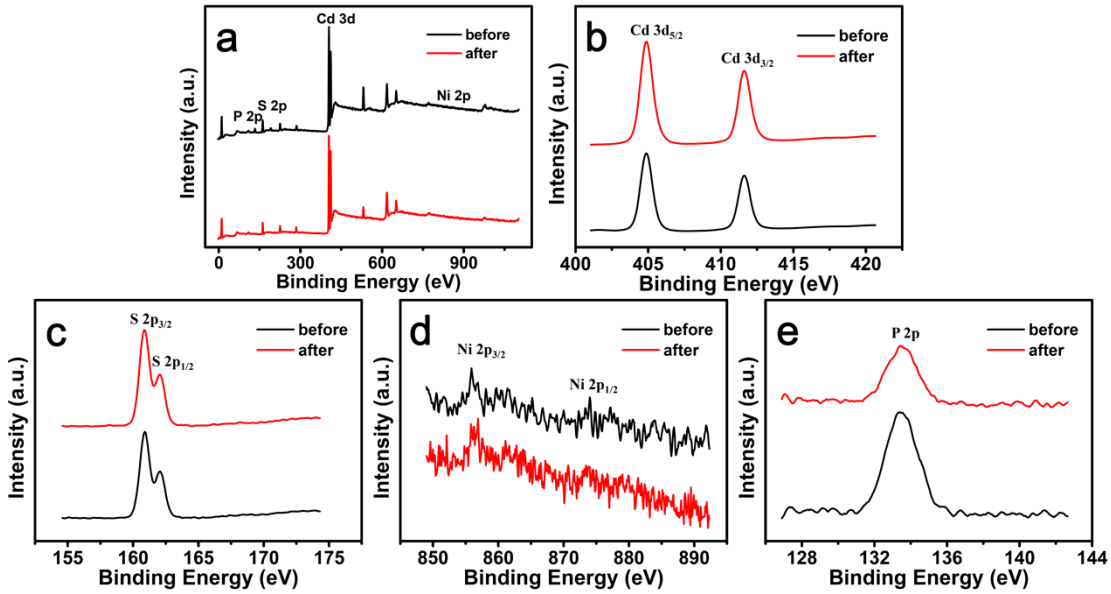

Figure S9. XPS data of 0.5 wt% Ni_2P/CdS NRs before and after photocatalysis. **(a)** XPS survey spectra and High-resolution XPS spectra of **(b)** Cd 3d, **(c)** S 2p, **(d)** Ni 2p, and **(e)** P 2p of the 0.5 wt % Ni_2P/CdS NRs sample before and after photocatalytic H_2 production for 6 hours under visible light irradiation (λ >420 nm). The system contains 1.0 mg photocatalyst, 0.75 M Na_2S, and 1.05 M Na_2SO_3 in 20 mL aqueous solution.

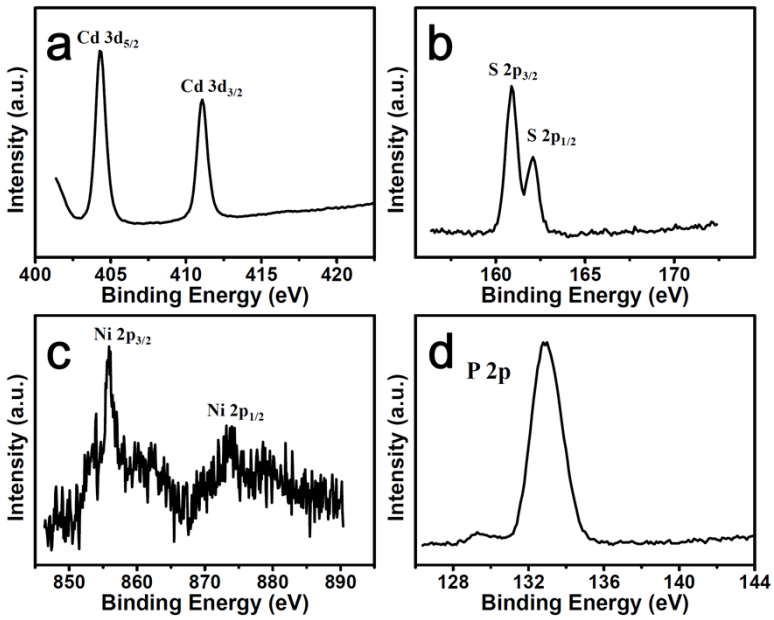

Figure S10. XPS data of 10 wt% Ni_2P/CdS. High-resolution XPS spectra of **(a)** Cd 3d, **(b)** S 2p, **(c)** Ni 2p, and **(d)** P 2p.

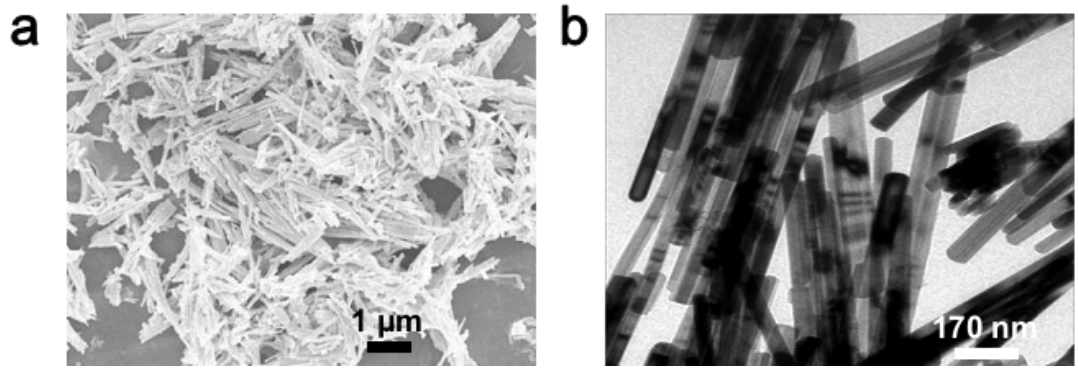

Figure S11. SEM and TEM images of Ni_2P/CdS NRs after photocatalysis. **(a)** SEM and **(b)** TEM images of 0.5 wt% Ni_2P/CdS NRs sample after photocatalytic H_2 production for 6 hours under visible light irradiation (λ >420 nm). The system contains 1.0 mg photocatalyst, 0.75 M Na_2S, and 1.05 M Na_2SO_3 in 20 mL aqueous solution.

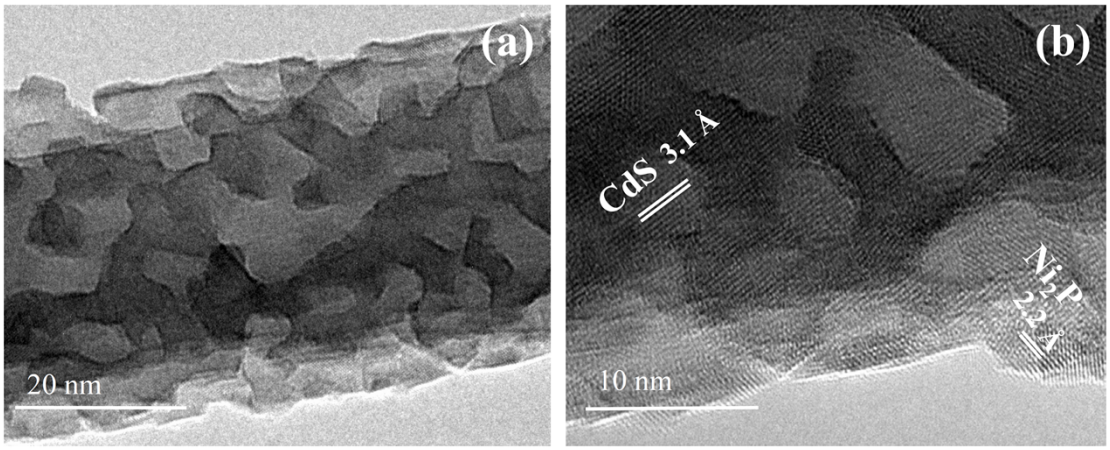

Figure S12. HRTEM images of 0.5 wt% Ni_2P/CdS NRs after photocatalytic H_2 production for 6 hours under visible light irradiation (λ >420 nm). The system contains 1.0 mg photocatalyst, 0.75 M Na_2S, and 1.05 M Na_2SO_3 in 20 mL aqueous solution.

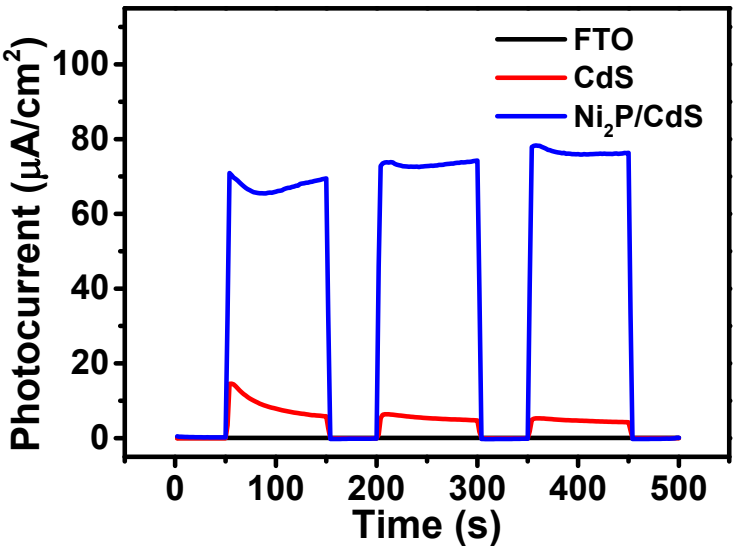

Figure S13. The transient photocurrent responses of blank FTO, CdS NRs, and 0.5 wt% Ni_2P/CdS NRs.