Electronic Supplementary Information

1D CdS nanowires-2D $BiVO_4$ nanosheets heterostructures toward photocatalytic selective fine-chemical synthesis

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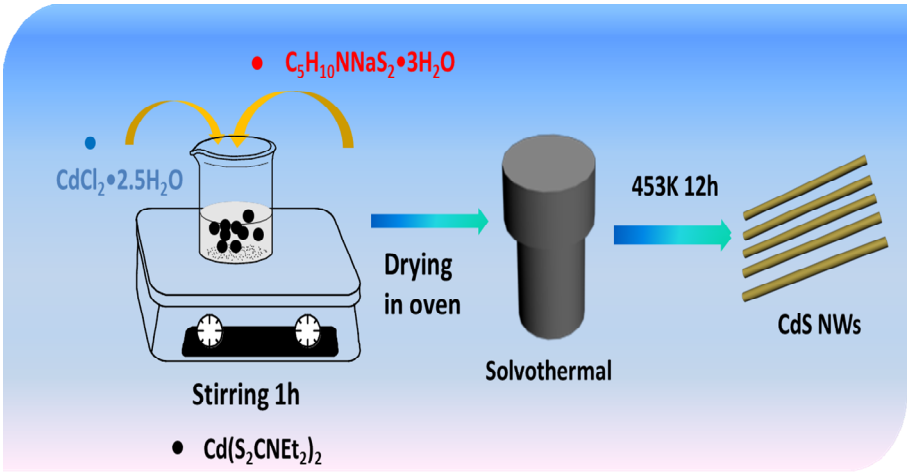
Experimental section

(1) ***Preparation of CdS nanowires***

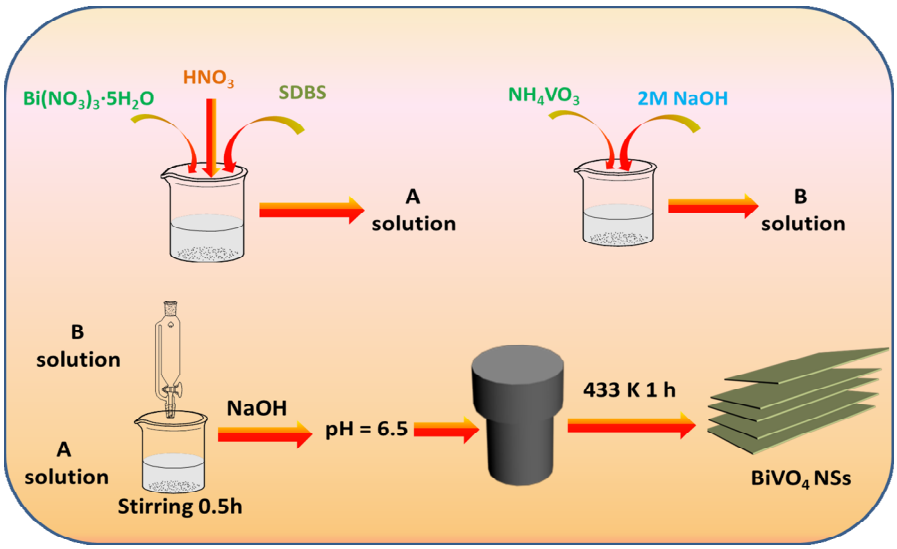
Uniform CdS NWs were grown through a modified method,[S1-S2] as generalized in **Scheme S1**. In a typical process, 2.248 g of cadmium diethyldithiocarbamate ($Cd(S_2CNEt_2)_2$), prepared by precipitation from a stoichiometric mixture of sodium diethyldithiocarbamate trihydrate and cadmium chloride in deionized water, was added to a Teflon-lined stainless steel autoclave with a capacity of 100 mL. Then, the autoclave was filled with 80 mL of ethylenediamine to about 80% of the total volume. The autoclave was maintained at 453 K for 24 h and subsqeuently allowed to cool to room temperature. A yellowish precipitate was collected and washed with absolute ethanol and deionized water to remove residue of organic solvents. The final products were dried in oven at 333 K for 12 h.[S1-S2]

(2) ***Fabrication of $BiVO_4$ nanosheets***

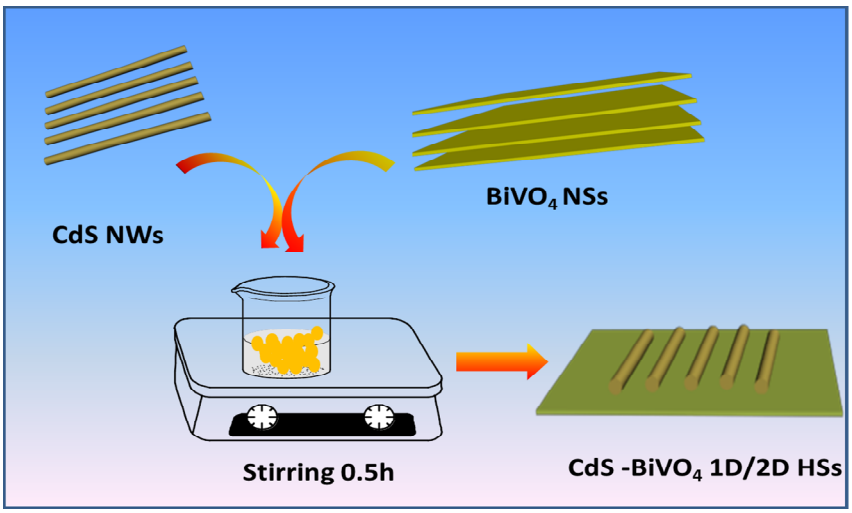
The protocol of preparing $BiVO_4$ nanosheets is modified from the previously reported method,[S3] as displayed in **Scheme S2**. Briefly, 0.485 g of $Bi(NO_3)_3{\cdot}5H_2O$ and 0.250 g of $C_{18}H_{29}NaO_3S$ (SDBS) were initially dissolved in 10 mL of 4 M HNO_3 solution and the resultant solution was marked as A solution. Simultaneously, 0.117 g of NH_4VO_3 was added to 10 mL of 2 M NaOH solution, and the resultant solution was marked as B solution. Then, B solution was added into the A solution drop by drop under vigorous stirring. After 0.5 h, the pH value of the mixed solution was adjusted to 6.5 by 2 M NaOH solution. After another 0.5 h, the resultant solution was sealed in a 50 mL Teflon-lined stainless steel autoclave. The autoclave was heated to 433 K and maintained for 1 h, and then allowed to cool to room temperature. The vivid yellow precipitate was collected after centrifugation, washed with distilled water and absolute alcohol, and then dried at 373 K for 4 h.



Scheme S1. Schematic flowchart for preparation of CdS NWs.



Scheme S2. Schematic flowchart for synthesis of $BiVO_4$ NSs.



Scheme S3. The overall sketch for preparation of CdS-$BiVO_4$ 1D/2D HSs.

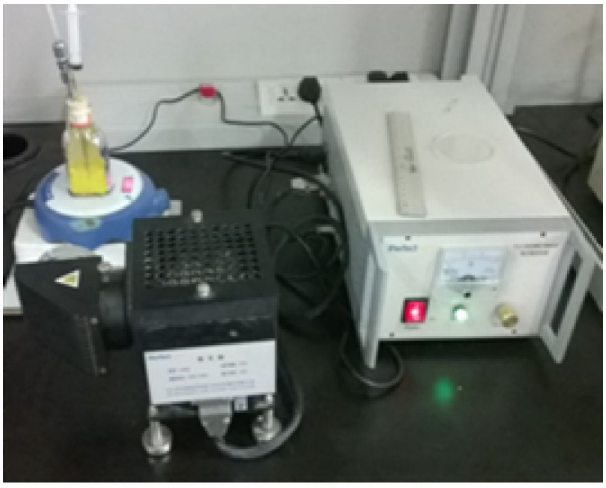


Fig. S1 Photograph of the experimental setup for photocatalytic activity testing.

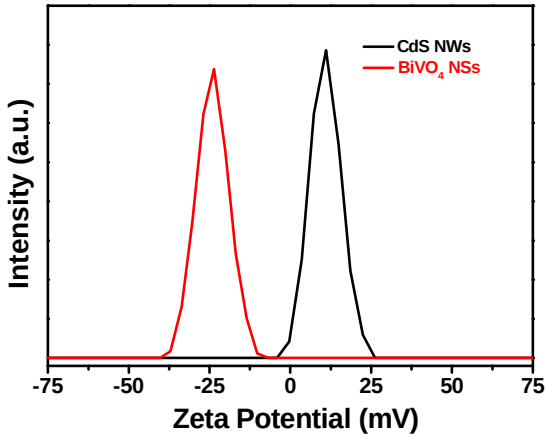


Fig. S2 The zeta potentials (ξ) of CdS NWs and $BiVO_4$ NSs aqueous dispersion.

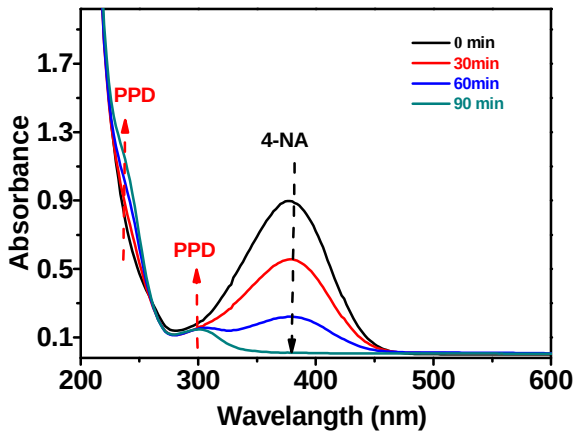


Fig. S3 Time-dependent UV-vis spectral variation during the photocatalytic reduction of 4-nitroaniline (4-NA) to *p*-phenylenediamine (PPD) over CdS-1% $BiVO_4$ 1D/2D HSs under visible light irradiation (λ > 420 nm) with the addition of ammonium oxalate as a quencher for photo-generated holes and N_2 purge at room temperature in the aqueous phase.

Note: The peak located at 380 nm is attributed to 4-NA and the peaks at 300 nm and 240 nm are ascribed to PPD.

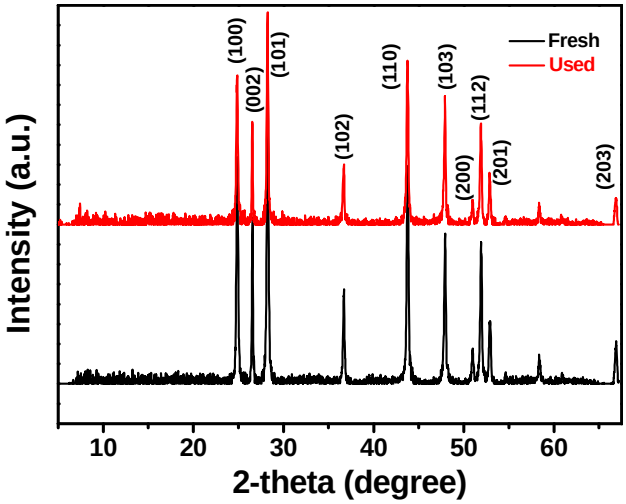


Fig. S4 XRD patterns of CdS-1% $BiVO_4$ 1D/2D HSs before and after photo-reduction of 4-NA.

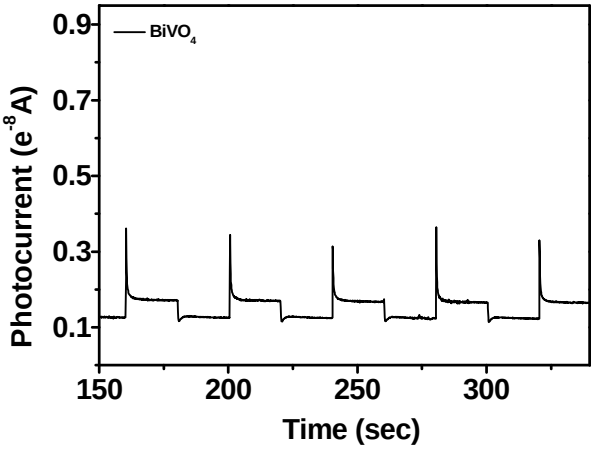


Fig. S5 Transient photocurrent-time (I-t) curves of blank $BiVO_4$ NSs under visible light irradiation ($\lambda > 420$ nm).

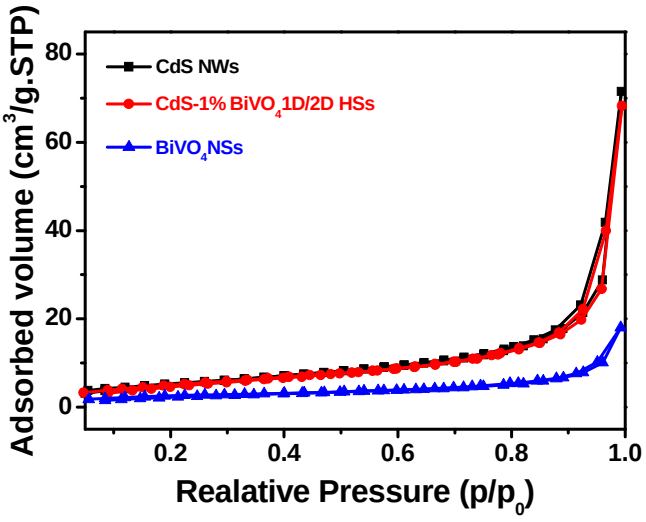


Fig. S6 Nitrogen adsorption-desorption isotherm of the blank CdS NWs, $BiVO_4$ NSs and CdS-1% $BiVO_4$ 1D/2D HSs.

Table S1 Summary of surface area, pore volume and pore size of the as-prepared CdS NWs, $BiVO_4$ NSs and CdS-1% $BiVO_4$ 1D/2D HSs.

Samples	S_{BET} (m^2/g)[a]	Total pore volume (cm^3/g)[b]	Average pore size (nm)[c]
CdS NWs	20.59	0.11	21
$BiVO_4$ NSs	9.13	0.03	17
CdS-1% $BiVO_4$ 1D/2D HSs	18.28	0.11	23

[a] BET surface area is calculated from the linear part of the BET plot.
[b] Single point total pore volume of the pores at $P/P_0 = 0.99$.
[c] Adsorption average pore width (4V/A by BET).

References

S1. S. Liu, Z. Chen, N. Zhang, Z.-R. Tang and Y.-J. Xu, *J. Phys. Chem. C*, 2013, **117**, 8251-8261.

S2. L. Wang, H. Wei, Y. Fan, X. Gu and J. Zhan, *J. Phys. Chem. C*, 2009, **113**, 14119-14125.

S3. L. Zhang, D. Chen and X. Jiao, *J. Phys .Chem. B*, 2006, **110**, 2668-2673.