Electronic Supplementary Information

Vertically aligned ZnO-Au@CdS core-shell nanorod arrays as an all-solid-state vectorial Z-scheme system for photocatalytic application

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arrays, (4) ZnO@CdS nanorod arrays, and (5) ZnO-Au@CdS-2 nanorod arrays on FTO.

**Fig. S10** Electrochemical impedance spectroscopy (EIS) Nyquist plots of ZnO, ZnO-Au-2, ZnO@CdS and ZnO-Au@CdS-2 nanorod arrays electrodes in the electrolyte of \( \text{Na}_2\text{SO}_4 \) (0.2 M).

**Fig. S11** Recycling photocatalytic reduction of 4-NA over ZnO-Au@CdS-2 nanorod arrays composite under simulated solar light irradiation with the addition of ammonium formate as holes scavenger and \( \text{N}_2 \) purge in water; the irradiation time for each run is 14 min.

**Fig. S12** Chronoamperometry result of ZnO-Au@CdS-2 on the FTO glass without bias in the electrolyte of 0.2 M \( \text{Na}_2\text{SO}_4 \) with the addition of ammonium formate as holes scavenger under simulated sunlight irradiation.

**Fig. S13** XRD spectra of the fresh and used ZnO-Au@CdS-2 as well as the standard XRD patterns of ZnO (JCPDS No. 79-2205) for comparison.

**Fig. S14** SEM images of (A) fresh and (B) used ZnO-Au@CdS-2.

**Fig. S15** TEM images of (A) fresh and (B) used ZnO-Au@CdS-2.

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Fig. S1 FESEM image of ZnO seeds on FTO substrate.

Fig. S2 EDX spectrum for ZnO-Au@CdS-2 composite (the inset is the quantification results according to the EDX result).

Note: Fig. S2 shows the energy-dispersive X-ray (EDX) spectrum of ZnO-Au@CdS-2 nanorod arrays on FTO substrate. The results demonstrate that the ZnO-Au@CdS-2 composite contains O, Zn, Au, Cd and S elements. The signals of Si and Sn and the relatively high intensity of O signal can be ascribed to the presence of FTO substrate.
Note: As revealed by the cross-sectional elemental mapping results in Fig. S3, the elements of O, Zn, Au, Cd and S are evenly distributed in the arrays formed on the surface of FTO substrate and well consistent with the cross-section view FESEM image of ZnO-Au@CdS-2 nanorod arrays, as indicated by the dash lines.

Fig. S3 Cross-sectional FESEM image and the corresponding elemental mapping results of ZnO-Au@CdS-2 nanorod arrays on FTO substrate.

Fig. S4 XRD patterns of the ZnO-Au-2 and ZnO-Au@CdS composites with different contents of Au nanoparticles.
Fig. S5 (a) FESEM image and (b) XRD pattern of ZnO@CdS composite.

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Fig. S7 Controlled experiments for 4-NA reduction over ZnO-Au@CdS-2 nanorod arrays composite using K\textsubscript{2}S\textsubscript{2}O\textsubscript{8} as scavenger for photogenerated electrons under simulated solar light irradiation with the addition of ammonium formate as holes scavenger and N\textsubscript{2} purge in water.
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**Fig. S9** Photographs of (1) bare FTO substrate, (2) ZnO nanorod arrays, (3) ZnO-Au-2 nanorod arrays, (4) ZnO@CdS nanorod arrays, and (5) ZnO-Au@CdS-2 nanorod arrays on FTO.
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Fig. S12 Chronoamperometry result of ZnO-Au@CdS-2 on the FTO glass without bias in the electrolyte of 0.2 M Na$_2$SO$_4$ with the addition of ammonium formate as holes scavenger under simulated sunlight irradiation.

Note: It can be seen from the chronoamperometry result in Fig. S12 that with the simulated sunlight irradiation for nearly 2 h, the ZnO-Au@CdS-2 electrode is able to keep about 71.9% photocurrent density of the initial value, indicating its relatively good stability.$^{S1, S2}$

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