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Supporting Information

High-Efficiency Visible-light Photocatalytic H_2O_2 Production Using CdSe-based Core/shell Quantum Dots†

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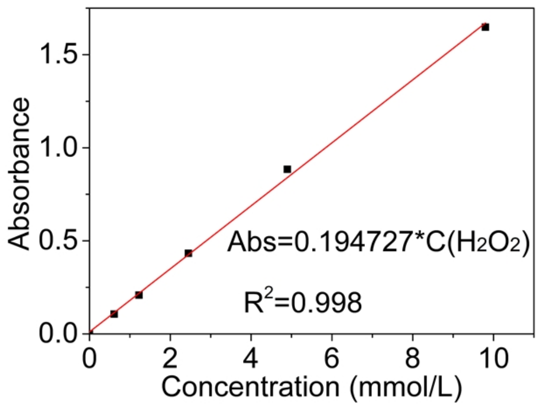

Fig S1. The work curve for determination of H_2O_2 concentration. The calibration curve was prepared by 1 mL of the H_2O_2 solution with quantified concentration and add with 2.0 mL of deionized water and 2.0 mL of titanium potassium oxalate solution (0.05 mol/L). The absorbance of H_2O_2 chromogenic solution was monitored by measuring the absorbance at 400 nm.

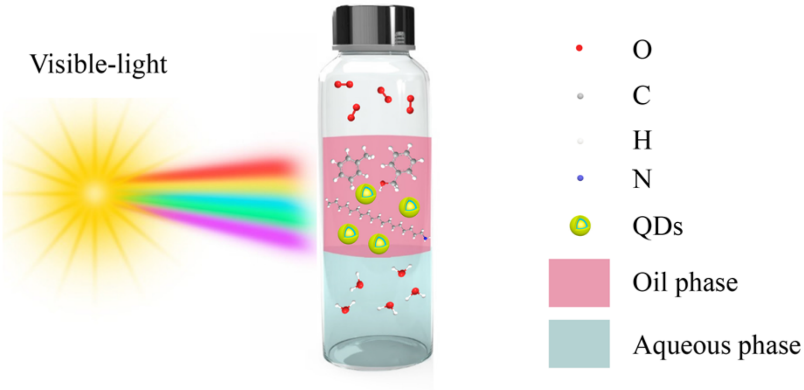

Fig S2. Photocatalytic H_2O_2 production utilizing the two-phase system.

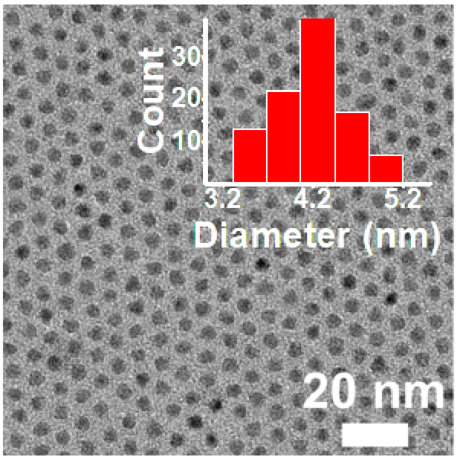

Fig S3. TEM images of $CdSe_{590}$ plain core QDs. Inset: the size distribution histograms of $CdSe_{590}$ plain core QDs.

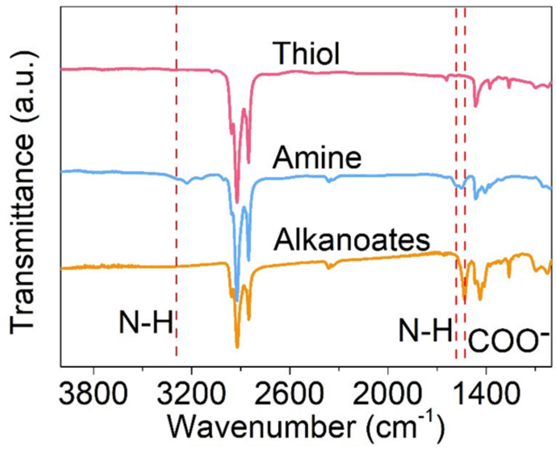

Fig S4. FT-IR spectra of thiol-, amine-, alkanoates-coated $CdSe_{550}$ QDs.

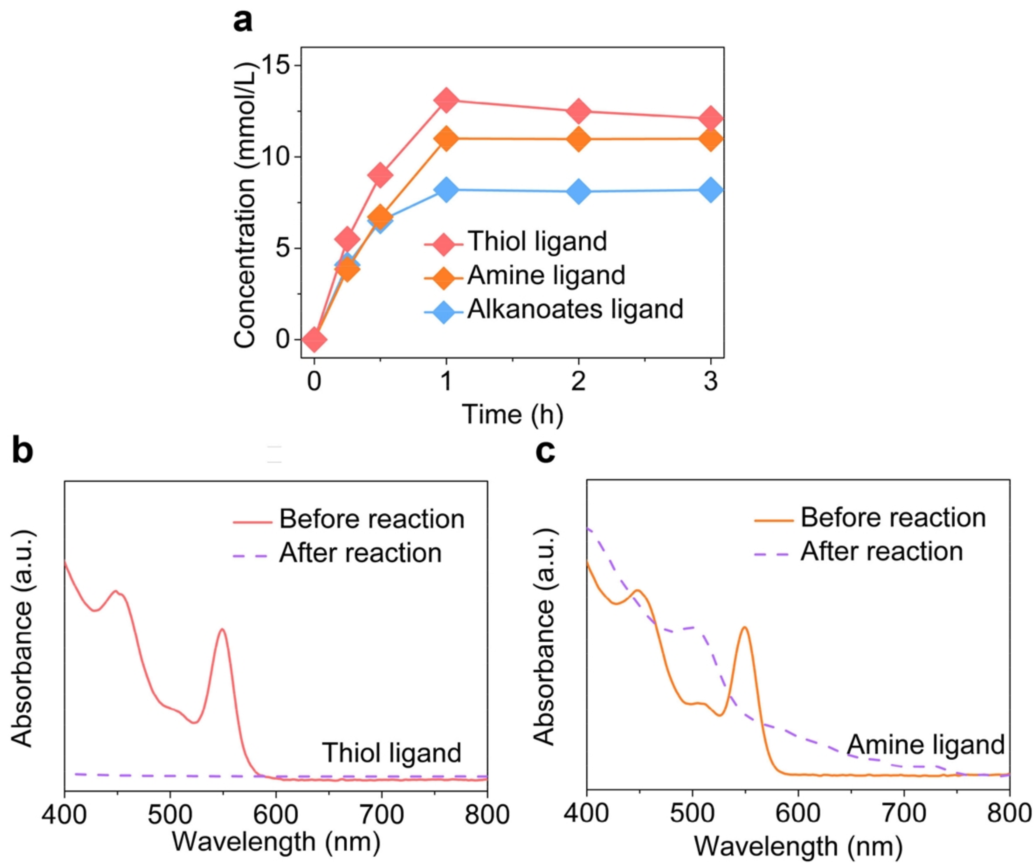

Fig S5. (a) Time courses of H_2O_2 production catalyzed by thiol-coated $CdSe_{550}$ QDs (pink), amine-coated $CdSe_{550}$ QDs (orange) and alkanoates-coated $CdSe_{550}$ QDs (blue). (b) the UV−vis absorption spectra of the thiol-coated $CdSe_{550}$ QDs before reaction (solid line) and after reaction (dash line) (c) the UV−vis absorption spectra of the amine-coated $CdSe_{550}$ QDs before reaction (solid line) and after reaction (dash line).

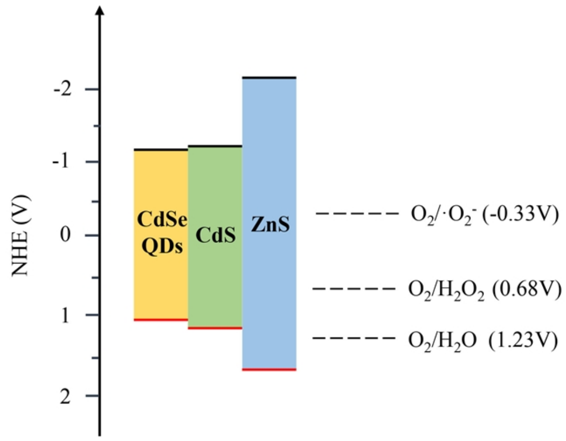

Fig S6. Energy levels of CdSe-based QDs and standard redox potential (*Versus* NHE) of oxygen reduction.

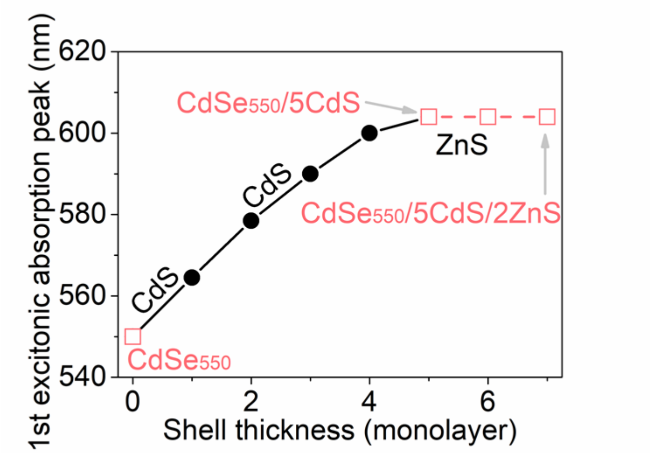

Fig. S7. Evolution of the 1st absorption peak of QDs with the shell thickness.

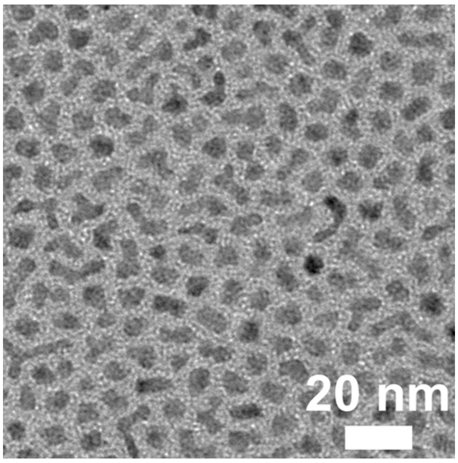

Fig S8. TEM images of $CdSe_{550}$ /5CdS/3ZnS QDs.

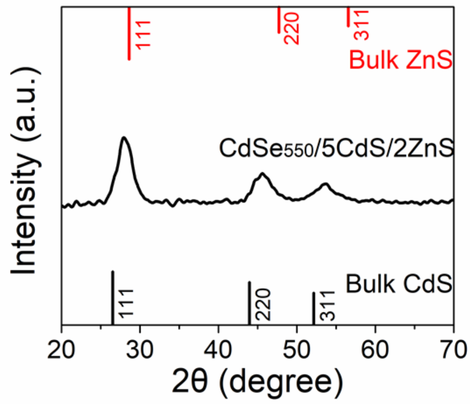

Fig S9. XRD pattern of $CdSe_{550}$/5CdS/2ZnS after reaction.

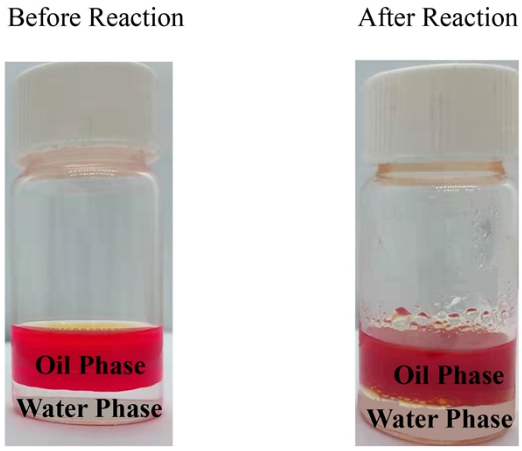

Fig S10. The digital photographs of two-phase systems composed of an aqueous phase and an oil phase containing $CdSe_{550}/5CdS/2ZnS$ before reaction (left) and after reaction (right).

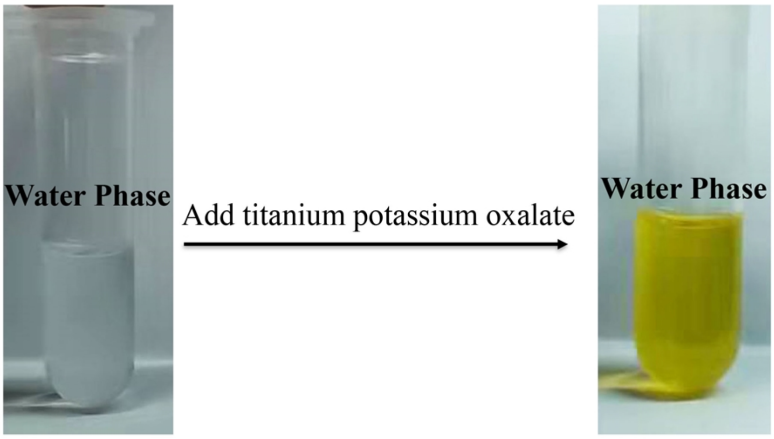

Fig S11. The digital photographs of the water phase in the two-phase system solution after photocatalytic reaction before (left) and after (right) adding titanium potassium oxalate.

Table S1. Summary of the photocatalytic H_2O_2 production with various photocatalysts.

Catalyst	Solvent	Concentration of photocatalyst /mg mL^{-1}	Time/ h	H_2O_2 yields /mmol L^{-1}	References
CdSe/5CdS/2ZnS	**Oil/Water**	**~3.2**	**2**	**126**	**This work**
a-C_3N_4	Ethanol/water	1	4	~30	*J. Energy Chem. 2022*[1]
CdSe/KPN-HCP	Water	1	1	0.9	*Chem. Eng. J.2021*[2]
Pd-$BiVO_4$	CH_3OH/water	9.9	2	0.6	*Appl. Catal.2020*[3]
MIL-125-NH_2	benzyl alcohol /water	~0.7	3	～2.4	*Angew. Chem. Int. Ed. 2019*[4]
SN-GQD/TiO_2	2-propanol/water	0.5	1	0.45	*Appl. Catal.2018*[5]
CdS–graphene	Water	1	12	~0.16	*J. Catal.2016*[6]
g-C_3N_4/PDI_x	Water	1.7	48	1.7	*Angew. Chem. Int. Ed. 2014*[7]
TiO_2	benzyl alcohol /water	10	10	40	*ACS Catal. 2013*[8]

Table S2. Simulation parameters used for ESR measurement (DMPO radical trapping agent).

	Simulation Parameters		
Radicals	A_N/G	A_H/G	Additional A_H/G
$\cdot O_2^-$	13.3	8.5	14.2
Ph·CHOH	14.2	21.5	/

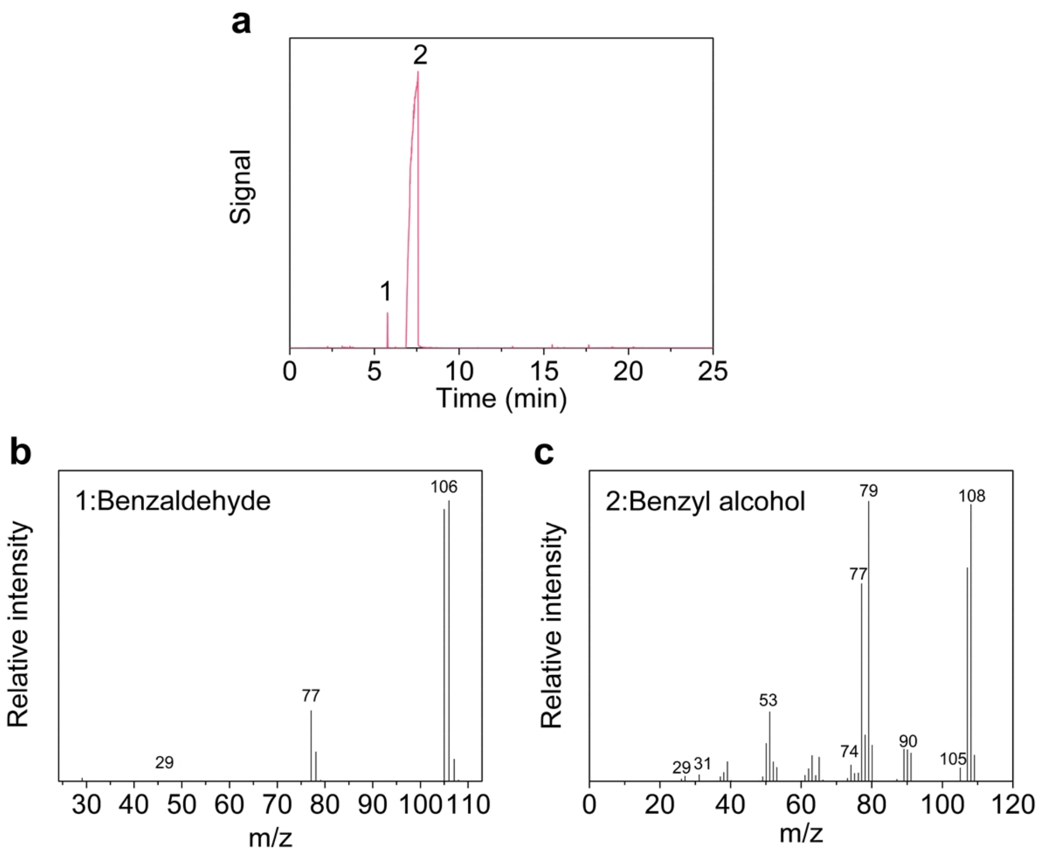

Fig S12. The oil phase product of the two-phase system catalyzed by $CdSe_{550}/5CdS/2ZnS$ QDs. (a) GC spectral. (b)-(c) The MS spectral of the two peaks marked with 1, 2 in a. Benzyl alcohol was oxidized to benzaldehyde as product.

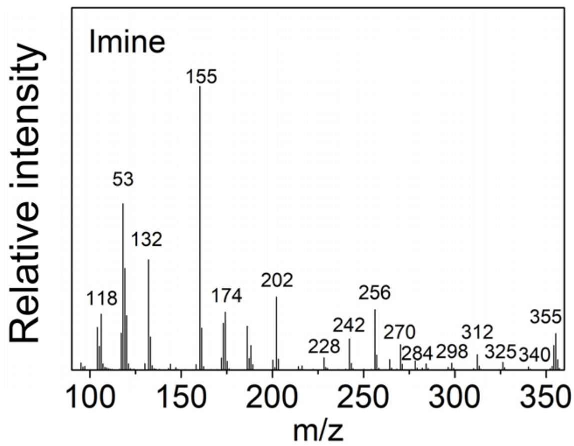

Fig S13. The MS spectral of the imine produced by the experiment.

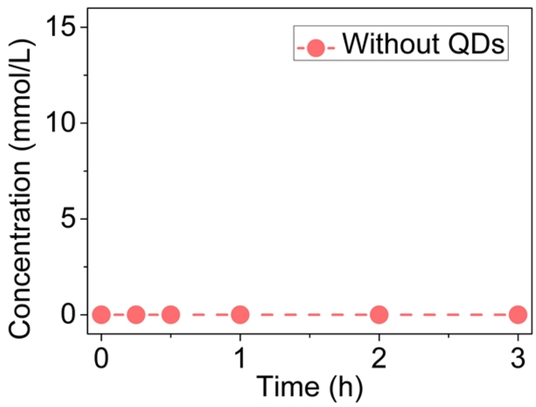

Fig S14. Time courses of H_2O_2 production of two-phase system without adding QDs.

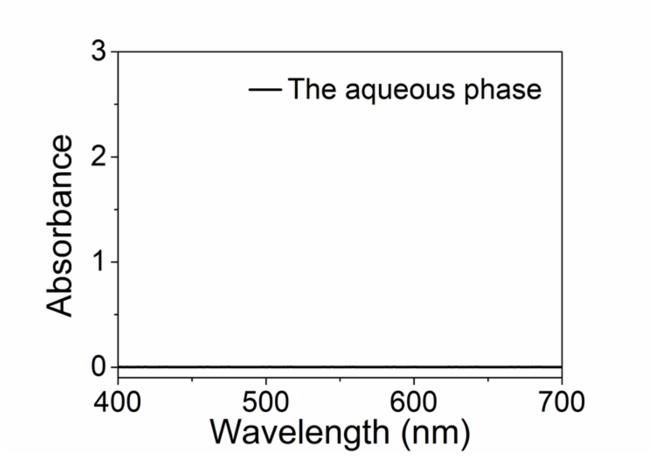

Fig S15. The UV−vis absorption spectra of the aqueous phase after reaction.

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