Supporting Information

Enhancing the Photocatalytic Hydrogen Production Performance of CdS by Introducing Co-catalyst $CoTPPBr_4$ (7,8,17,18-Tetrabromo-5,10,15,20-tetraphenylporphyrin)

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Table S1 Comparison between the materials prepared in this study and those reported in literature.

Photocatalyst	Co-catalysts	Sacrificial reagent	Light source	Activity (mmol h^{-1} g^{-1})	Ref.
CdS	Cd-TCPP	TEOA	300 W Xe lamp(λ > 420 nm)	3.15	1
CdS	Fe-MOF-525$_{2.3}$	TEOA	300 W Xe lamp(λ > 420 nm)	3.638	2
CdS	Ni_2P	0.35 M Na_2S/0.25 M Na_2SO_3	300 W Xe lamp(λ > 420 nm)	16.02	3
CdS	ZnO/ZnS	0.35 M Na_2S/0.25 M Na_2SO_3	300 W Xe lamp(λ > 420 nm)	2.64	4
CdS	CoP	0.35 M Na_2S/0.25 M Na_2SO_3	300 W Xe lamp(λ > 420 nm)	15.74	5
CdS	MoS_2/Ti_3C_2	Lactic acid	300 W Xe lamp	14.1	6
CdS NRs	25-CDs	0.5 M Na_2S/0.5 M Na_2SO_3	300 W Xe lamp	1.076	7
CdS	$Sr_2MgSi_2O_7$:(Eu,Dy)	0.35 M Na_2S/0.25 M Na_2SO_3	300 W Xe lamp	18.07	8
CdS	ZnNi-C	0.35 M Na_2S/0.25 M Na_2SO_3	LED lamp(λ > 420 nm)	15.7	9
CdS	Pyr-GDY-CeO2-15%	Lactic acid	PCX-50B	21.16	10
CdS	$NiWO_4$	Lactic acid	300 W Xe lamp(λ > 420 nm)	26.43	11
CdS	$CoTPPBr_4$	Lactic acid	300 W Xe lamp	41.3	This work

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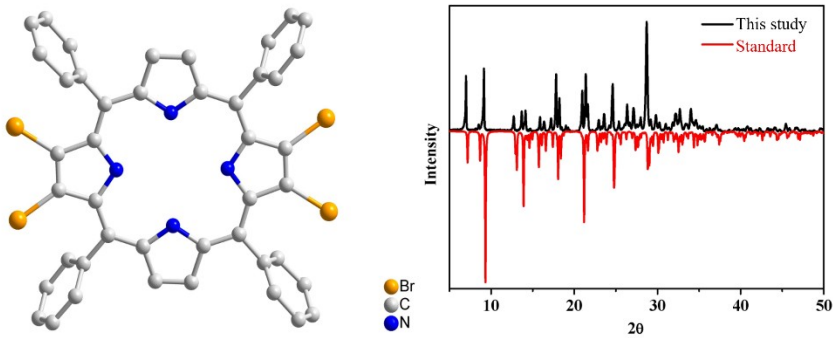


Figure S1. The structure, standard XRD spectrum, and XRD data obtained for H_2TPPBr_4 in this study.

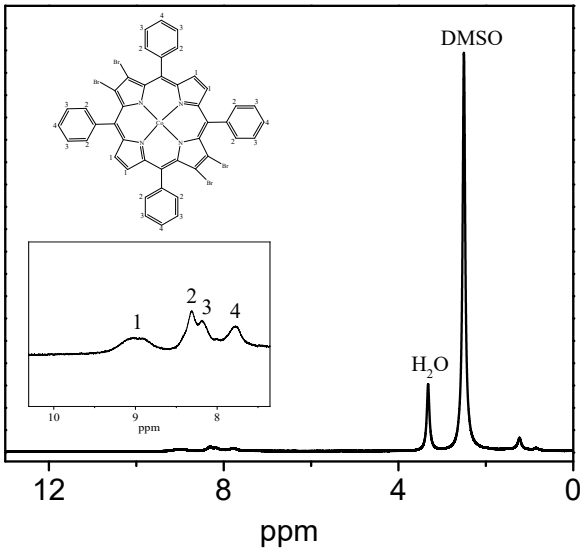
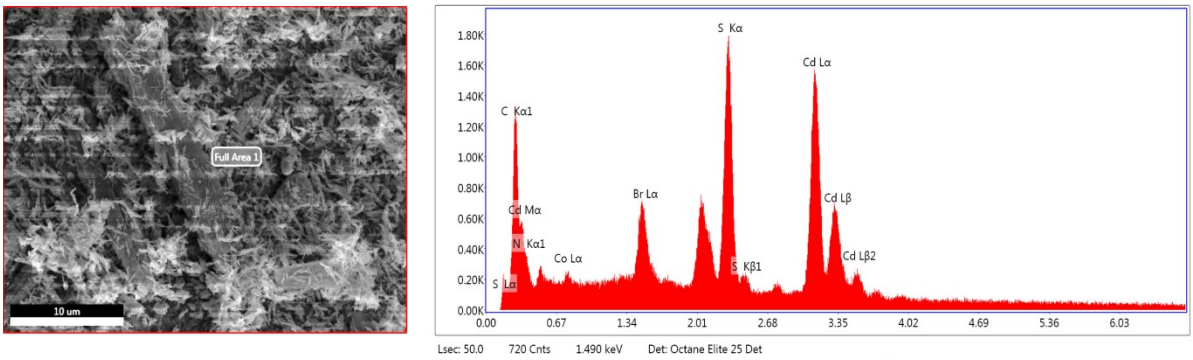


Figure S2. The NMR hydrogen spectrum data of $CoTPPBr_4$.



Element	Weight %	Atomic %	Error %
C	14.63	49.47	10.16
N	0.43	1.23	49.01
Co	0.64	0.44	30.63
Br	5.55	2.82	6.59
S	19.41	24.59	4.02
Cd	59.35	21.45	4.72

Figure S3. Energy dispersive X-ray spectroscopy (EDX) analysis of the composite.

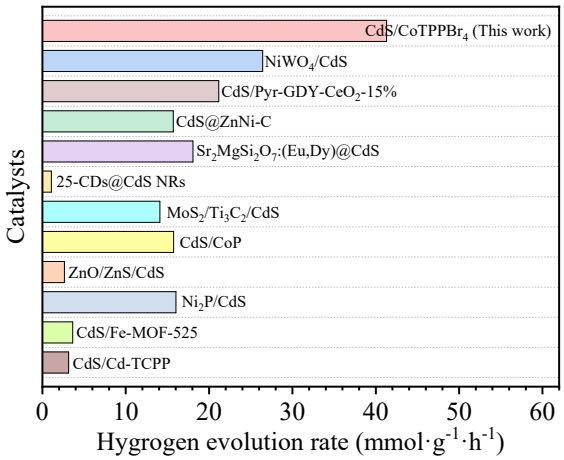


Figure S4. Comparison between the materials prepared in this study and those reported in literature.

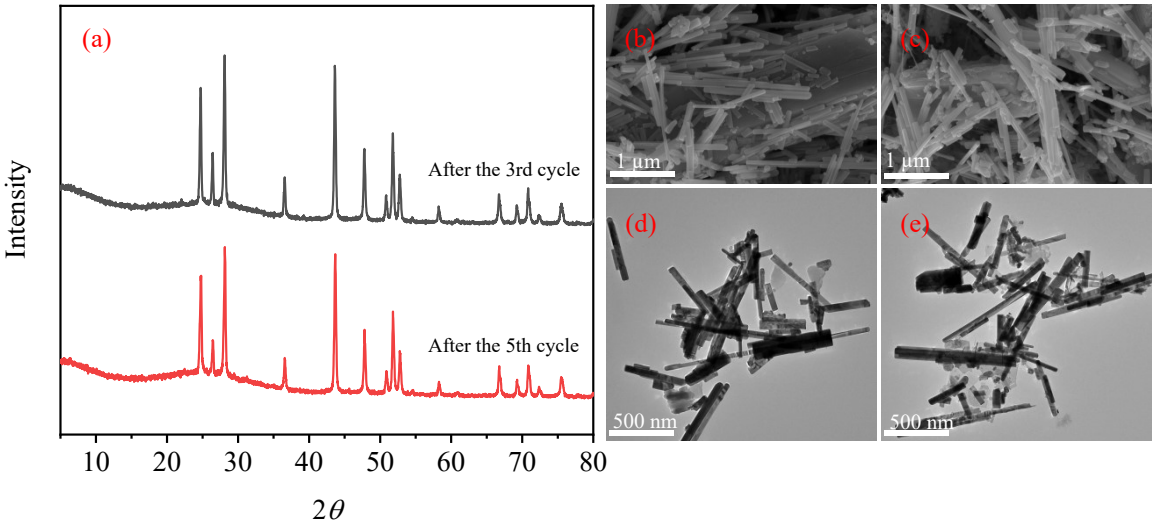


Figure S5. The XRD, SEM, and TEM characterization of the materials after 3 and 5 cycles of reaction. (a) XRD; (b) SEM after 3 cycles; (c) SEM after 5 cycles; (d) TEM after 3 cycles; (e) TEM after 5 cycles.

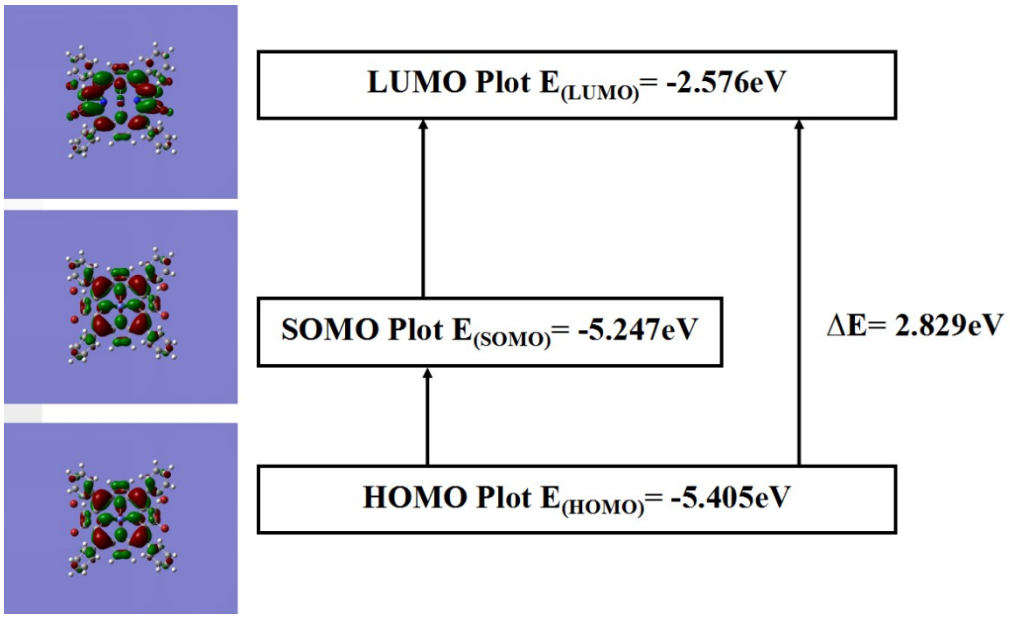


Figure S6 The DFT calculation of the $CoTPPBr_4$