Optimization of the NH_2-UiO-66@MoS_2 Heterostructure for Enhanced Photocatalytic Hydrogen Evolution Performance

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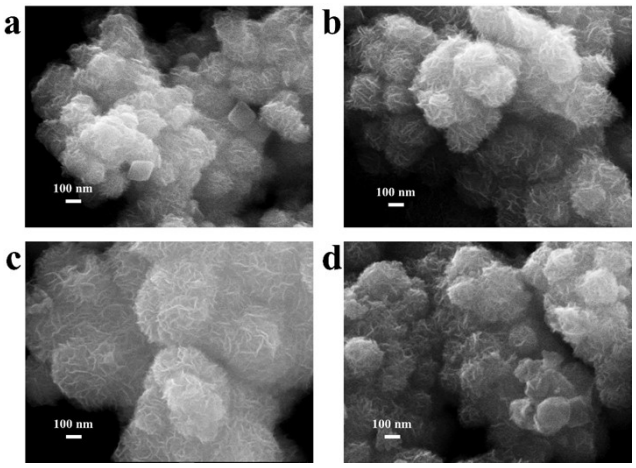

Figure S1. SEM images of (a) C-NUM-0.05; (b) C-NUM-0.1; (c) C-NUM-0.2 and (d) C-NUM-0.3.

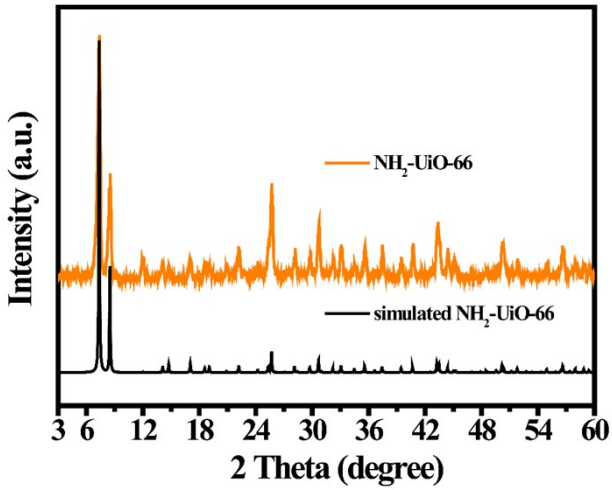

Figure S2. PXRD pattern of (a) NH_2-UiO-66 and (b) simulated NH_2-UiO-66.

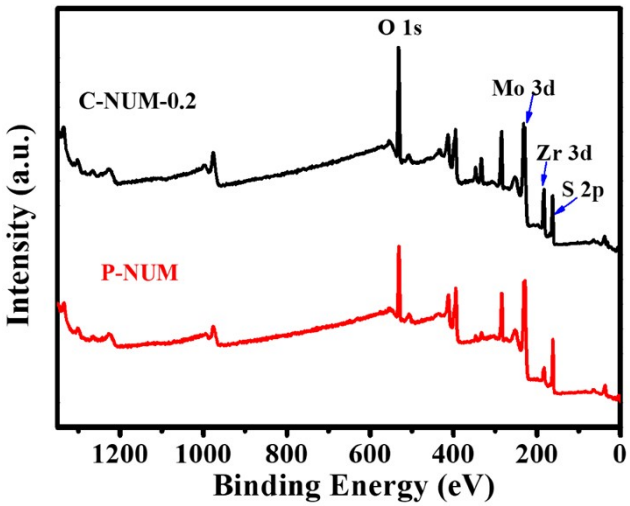

Fig. S3. Survey XPS spectra of C-NUM-0.2 and P-NUM

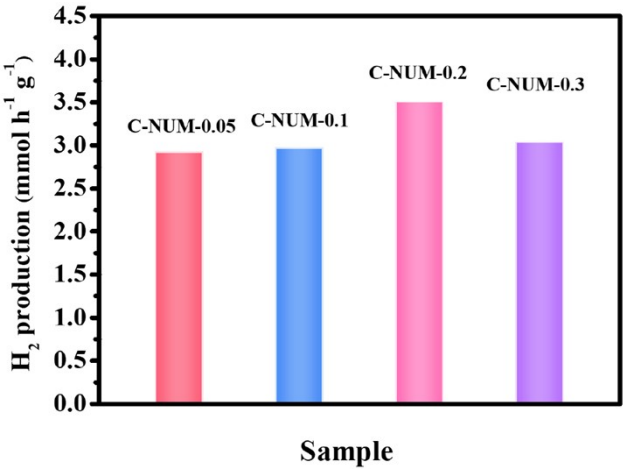

Figure S4. Hydrogen evolution performance of C-NUM-0.05; C-NUM-0.1; C-NUM-0.2 and C-NUM-0.3.

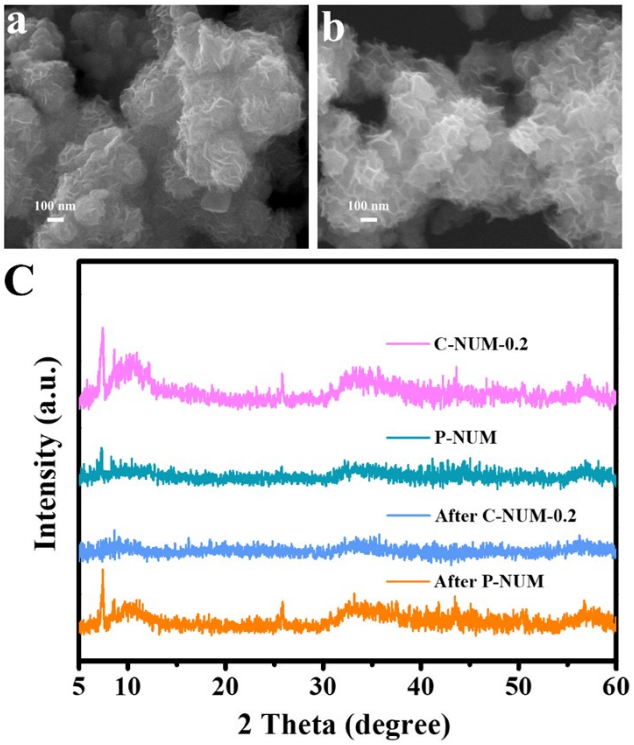

Figure S5. SEM image of (a) C-NUM-0.2 and (b) P-NUM after photocatalytic reaction; (c) PXRD pattern of C-NUM-0.2 and P-NUM before and after photocatalytic reaction.

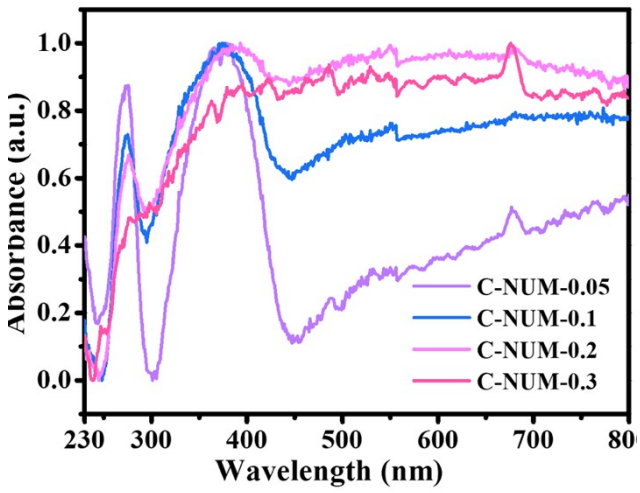

Figure S6. UV-vis spectra of C-NUM-0.05; C-NUM-0.1; C-NUM-0.2 and C-NUM-0.3.

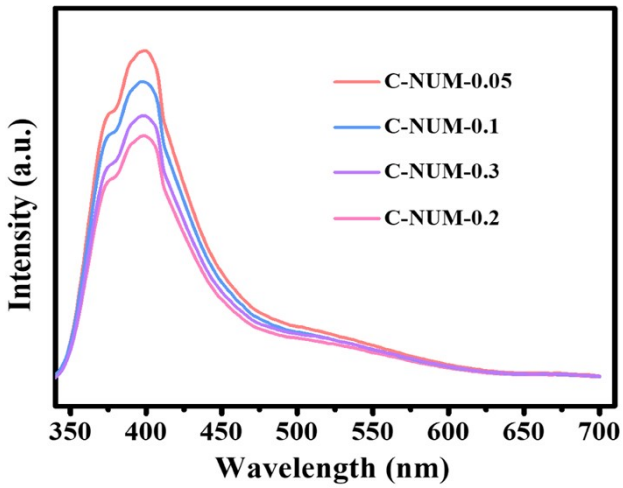

Figure S7. PL spectra of C-NUM-0.05; C-NUM-0.1; C-NUM-0.2 and C-NUM-0.3.

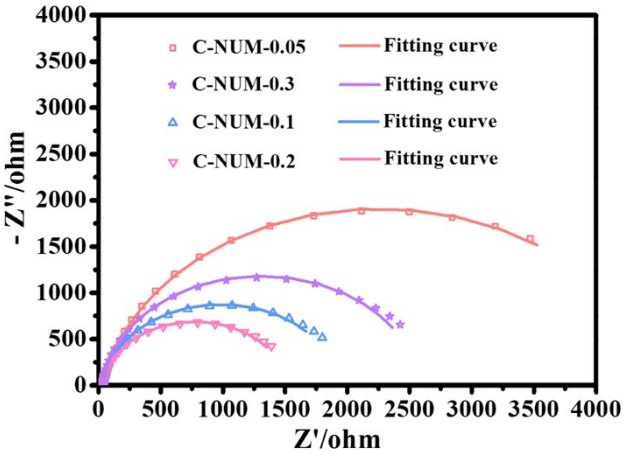

Figure S8. EIS plots of C-NUM-0.05; C-NUM-0.1; C-NUM-0.2 and C-NUM-0.3.

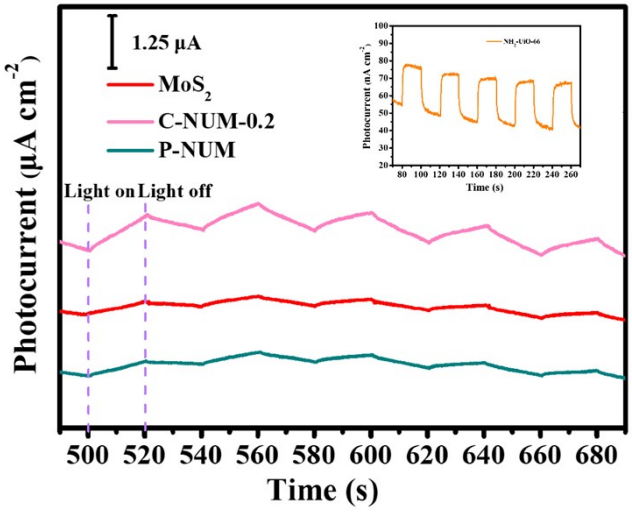

Figure S9. I-t curves of MoS_2; C-NUM-0.2; P-NUM and NH_2-UiO-66(inset).

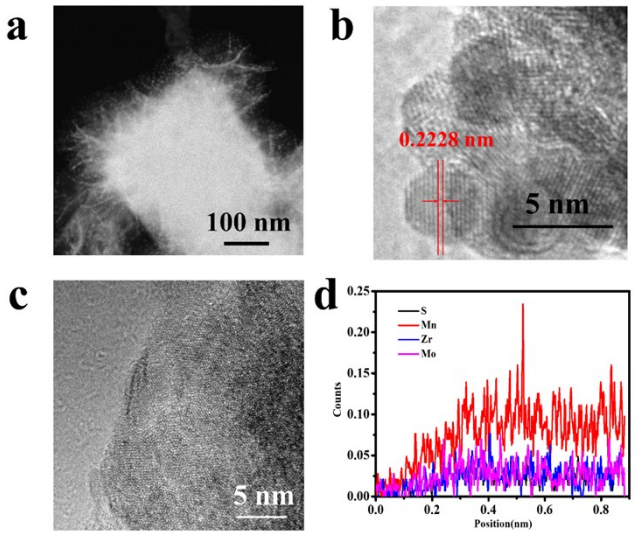

Figure S10. (a) TEM image of C-NUM-0.2/Pt, (b) HRTEM image of Pt nanoparticle, (c) TEM image of C-NUM-0.2/MnO_x, (d) EDS line scan result of C-NUM-0.2/MnO_x

Table S1. ICP-OES results for the contents of Zr and Mo.

Samples	Zr (wt %)	Mo (wt %)
C-NUM-0.05	10.96	28.15
C-NUM-0.1	6.70	34.36
C-NUM-0.2	3.71	38.53
P-NUM	3.91	38.01
C-NUM-0.3	2.72	36.39

Table S2. BJH results of NH_2-UiO-66, MoS_2, C-NUM-0.2 and P-NUM.

Samples	Adsorption (cm^3/g)	Desorption (cm^3/g)
NH_2-UiO-66	0.080	0.080
MoS_2	0.144	0.145
C-NUM-0.2	0.077	0.077
P-NUM	0.079	0.081

Table S3. Similar reported photocatalyst

Sample	Test conditions	Light source	H_2 production rate	Ref.
C-NUM-0.2	$H_2O/Na_2S/Na_2SO_3$	Full spectrum	3.509 mmol g^{-1} h^{-1}	This work
1TMoS$_2$/HCN-4	TEOA	AM1.5G	2724.2 mmol g^{-1} h^{-1}	[1]
CN/MoS$_2$-1	TEOA	λ≥400 nm	441.3 μmol g^{-1} h^{-1}	[2]
ac-MoS$_x$/TiO$_2$	Ethanol/H_2O	365 nm LED	3.43 mmol h^{-1} g^{-1}	[3]
1T-MoS$_2$/MIL-125-NH_2	MeCN/TEA/H_2O	λ ≥ 420 nm	1454 μmol g^{-1} h^{-1}	[4]
MoS$_2$-MoC@rGO/TiO$_2$	CH_3OH/H_2O	UV light	575 μmol h^{-1} g^{-1}	[5]
MoS$_2$/ZnO	$H_2O/Na_2S/Na_2SO_3$	Visible light	235 μmol g^{-1} h^{-1}	[6]
CdS/MoS$_2$	$H_2O/Na_2S/Na_2SO_3$	UV light	5587 μmol g^{-1} h^{-1}	[7]
g-C_3N_4–MoS$_2$–ZnNi-ZIF	TEOA	λ ≥ 420 nm	77.8 μmol g^{-1} h^{-1}	[8]

Table S4. Parameters of equivalent circuit for the impedance data of NH_2-UiO-66, MoS_2, C-NUM-0.2 and P-NUM.

Samples	R_1 (Ω)	R_2 (Ω)
NH_2-UiO-66	42.94	$1.27*10^7$
MoS_2	42.53	2456
C-NUM-0.2	35.27	1479
P-NUM	42.85	2343

Table S5. Parameters of equivalent circuit for the impedance data of C-NUM-0.05; C-NUM-0.1; C-NUM-0.2 and C-NUM-0.3

Samples	R_1 (Ω)	R_2 (Ω)
C-NUM-0.05	42.68	4434
C-NUM-0.1	35.29	1897
C-NUM-0.2	35.27	1479
C-NUM-0.3	38.63	2538

Reference

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