Electronic Supplementary Material (ESI) for Inorganic Chemistry Frontiers.

Tandem ZnCo-porphyrin Metal-Organic Frameworks for Enhanced Photoreduction of CO_2

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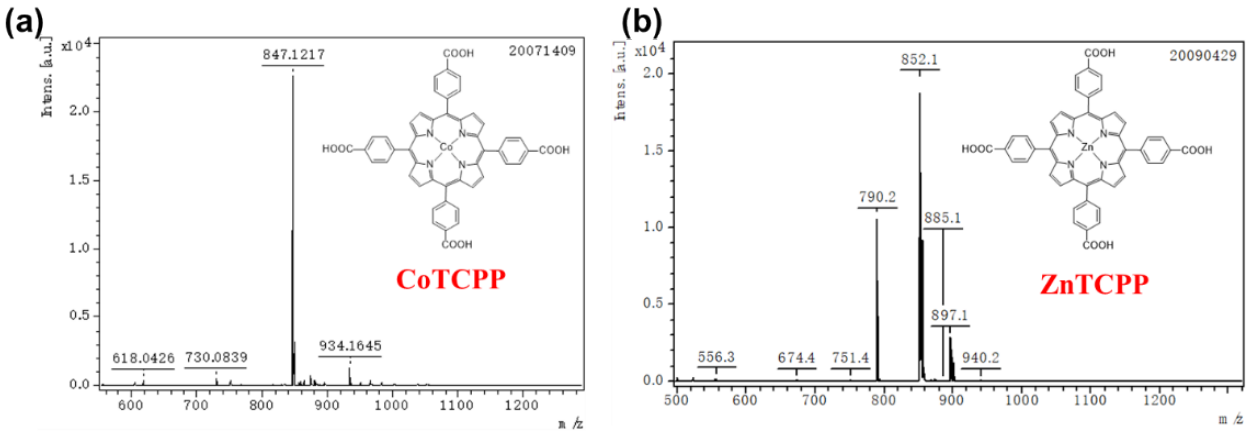

Figure S1. The MS of CoTCPP and ZnTCPP molecules.

Table S1 ICP results of ZnCo-BMOF.

ICP	Zn (%)	Co (%)
Zn-MOF	11.22	0
$Zn_{20}Co_1$-MOF	10.95	0.06
$Zn_{10}Co_1$-MOF	10.80	0.13
Zn_1Co_1-MOF	8.67	2.51
Co-MOF	8.13	3.58

The content of C, N, H, and O in $Zn_{10}Co_1$-BMOF were 53.66%, 7.67%, 4.303%, 21.08%, respectively.

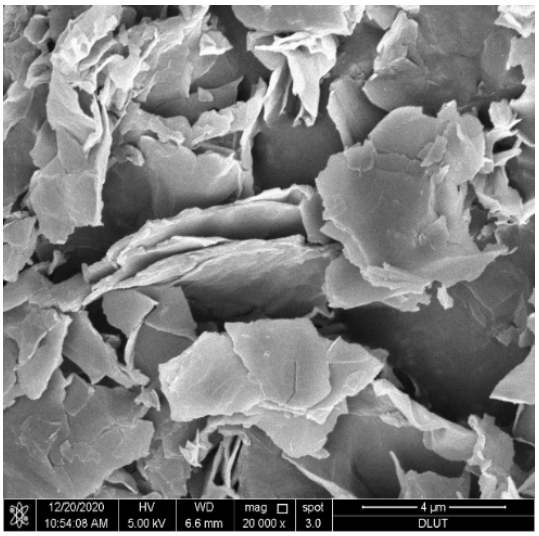

Figure S2. SEM image of $Zn_{10}Co_1$-BMOF.

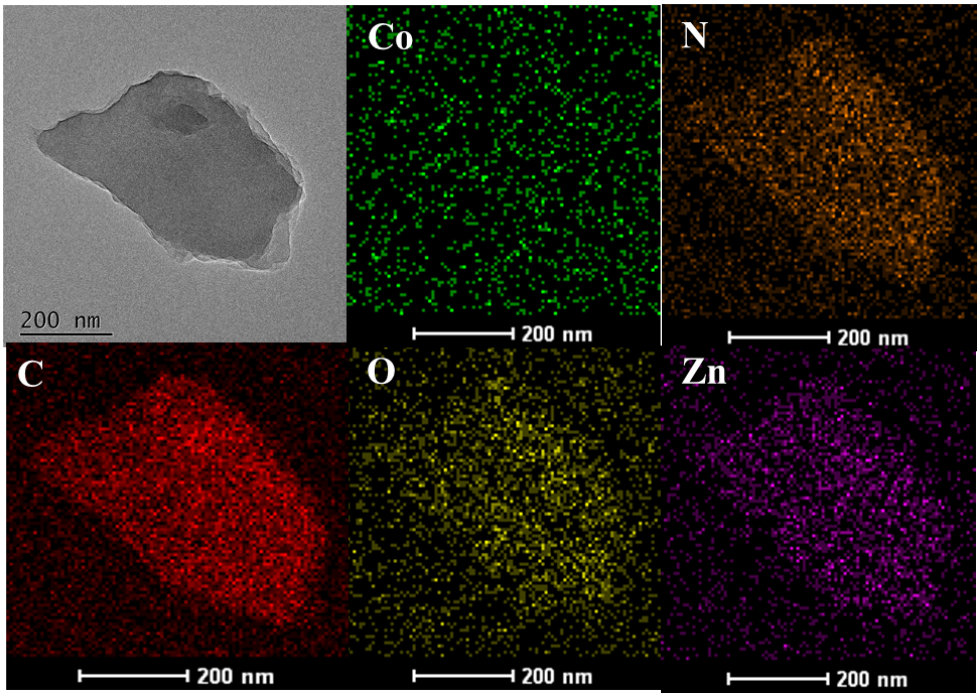

Figure S3. TEM image of $Zn_{10}Co_1$-BMOF and corresponding to EDS mapping images.

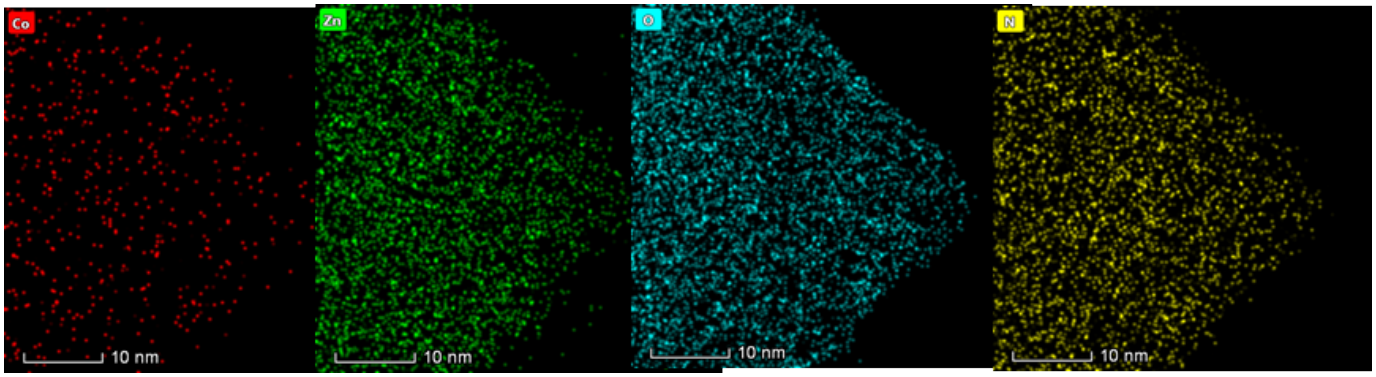

Figure S4. EDS elemental mapping images of HAADF-STEM image.

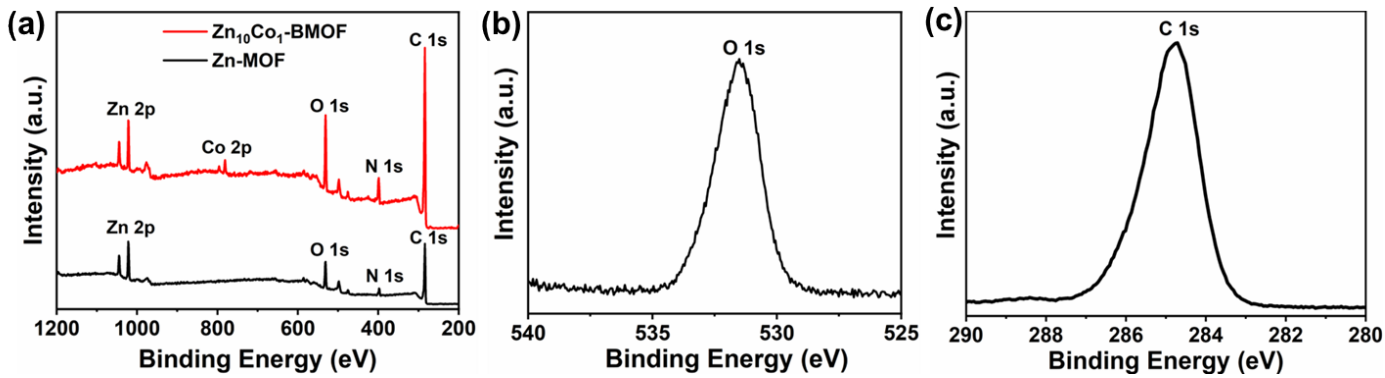

Figure S5. (a) XPS survey of $Zn_{10}Co_1$-BMOF and Zn-MOF (b) XPS of O 1s; (c) XPS of C1s.

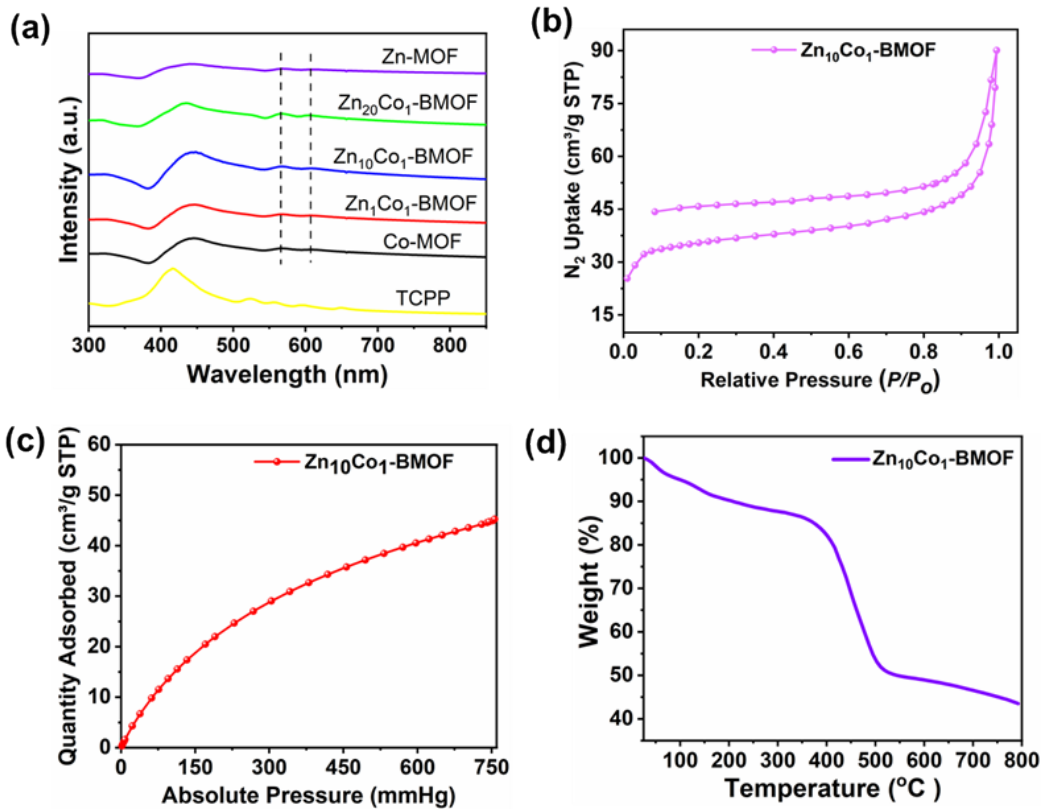

Figure S6. (a) UV-vis spectra of Zn-MOF, $Zn_{20}Co_1$-BMOF, $Zn_{10}Co_1$-BMOF, Zn_1Co_1-BMOF and Co-MOF; (b) N_2 adsorption isotherms of $Zn_{10}Co_1$-BMOF; (c) CO_2 adsorption of $Zn_{10}Co_1$-BMOF; (d) Thermogravimetric (TG) analysis of $Zn_{10}Co_1$-BMOF.

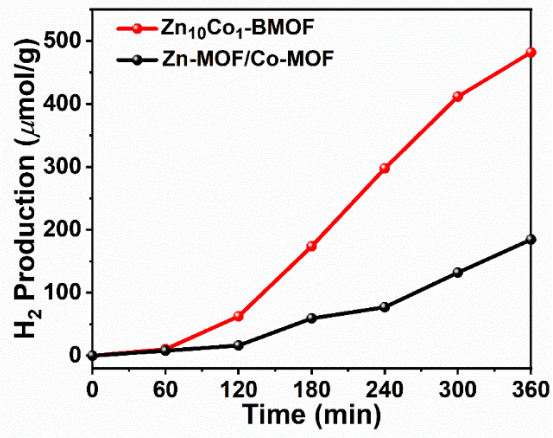

Figure S7. H_2 production comparisons between $Zn_{10}Co_1$-BMOF nanosheets and Zn-MOF/Co-MOF system for photocatalytic CO_2 reduction 6 h.

[a] The selectivity of CO by $Zn_{10}Co_1$-BMOF was 61.7%.

Table S2 The comparison of photocatalytic performance for CO_2 reduction of in one MOF platform.

Catalyst	Product	Evolution rate (μ mol g^{-1} h^{-1})	Reference
$(Co/Ru)_{2.4}$-UiO-67(bpydc)	CO	282.5	Appl. Catal. B, 2019, 245, 496–501
	H_2	570.1	
MOF-525-Co	CH_4	36.67	Angew. Chem. Int. Ed. , 2016, 55, 14310
	CO	200.6	
PCN-222	$HCOO^-$	60	J. Am. Chem. Soc., 2015, 137, 13440
Ru-MOF-253-Re	CO	111.5	Inorg. Chem., 2018, 57, 8276
	$HCOO^-$	475	
	H_2	5.5	
$Zn_{10}Co_1$-BMOF	CO	129.6	This work
	H_2	80.3	

Table S3 Control experiments for photocatalytic CO_2 reduction

Condition	CO (μmol)	H_2 (μmol)
Normal reaction	7.78	4.81
Without catalyst	0.07	/
Ar instead of CO_2	/	/
Without PS	0.15	0.19
Without BIH	/	/
Without TEOA	0.75	1.86
In the dark	/	/
Without bpy	/	/

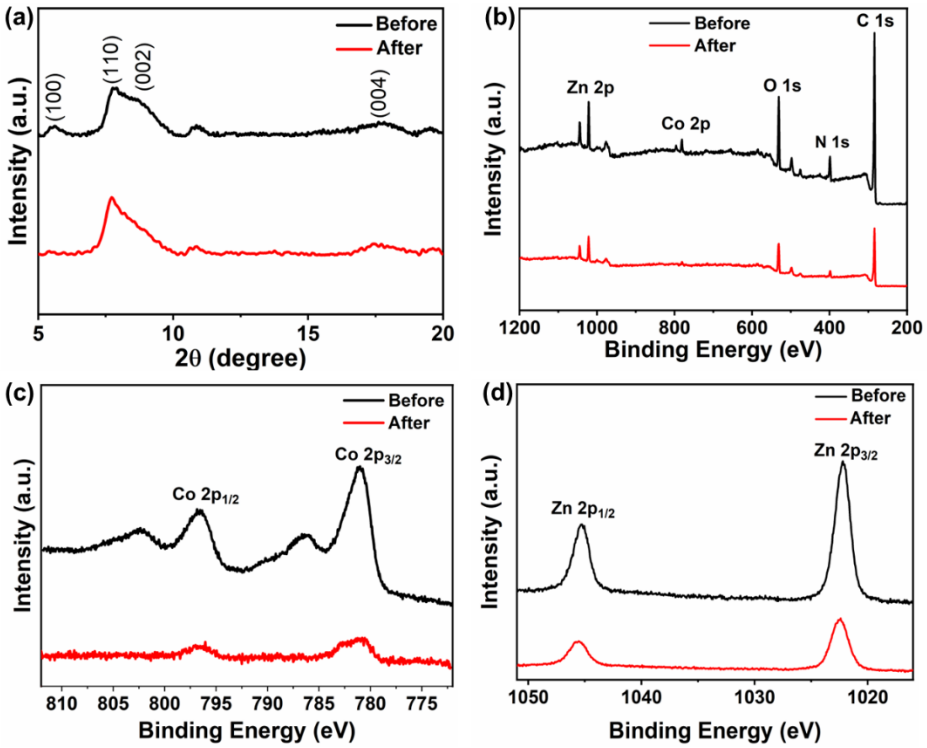

Figure S8. $Zn_{10}Co_1$-BMOF before and after 6 h photocatalytic CO_2 reduction (a) XRD; (b) XPS survey; (c) Co 2p XPS; (d) Zn 2p XPS image.

Table S4 ICP results of $Zn_{10}Co_1$-BMOF before and after photocatalysis.

ICP	Zn (%)	Co (%)
Before	10.80	0.13
After	9.92	0.11

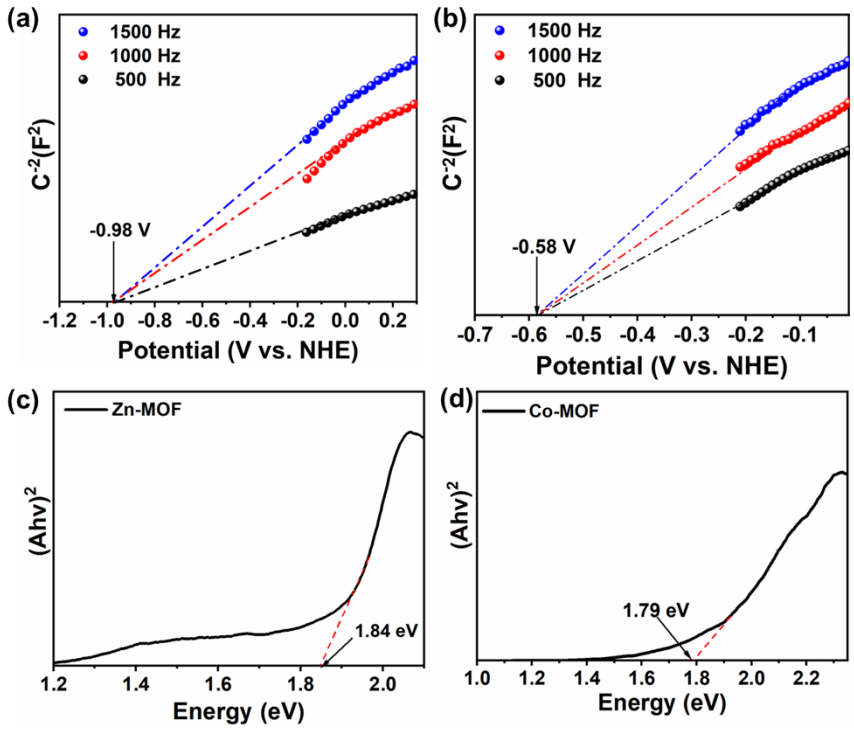

Figure S9. (a) and (b) Mott-Schottky measurements of Zn-MOF and Co-MOF; (c) and (d) UV−vis spectra of Zn-MOF and Co-MOF.