Electronic Supplementary Information (ESI) for

A Pillar-layered Binuclear 3D Cobalt(II) Coordination Polymer as Electrocatalyst for Overall Water Splitting and Chemosensor for Cr(VI) Anions Detection

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Table of Contents

Fig. S1 Selected H_4TPTC and BIBP organic ligands in the assembly of **1**.....2

Fig. S2 The asymmetry unit of **1** with 50% probability (Symmetry codes: i 1-*x*, 2-*y*, -*z*; ii 1-*x*, 1-*y*, 1-*z*; iii *x*, 1+*y*, -1+*z*; iv -*x*, 1-*y*, 1-*z*.).....2

Fig. S3 The coordination mode of $TPTC^{4-}$ ligand in **1**.....2

Fig. S4 The binuclear $\{Co_2(COO)_2\}$ SBU in **1**.....2

Fig. S5 The BIBP as pillars to connect the binuclear $\{Co_2(COO)_2\}$ SBUs in **1**.....3

Fig. S6 PXRD patterns of **1** under different conditions.....3

Fig. S7 TGA curve for **1**.....3

Fig. S8 The χ_m *versus* T of **1**.....3

Fig. S9 Relative cyclic voltammogram profile of NF.....4

Fig. S10 Lines fitting plots between $v^{1/2}$ and i of NF.....4

Fig. S11 PXRD patterns of **1** after electrochemical testing.....4

Fig. S12 The fluorescence spectra of free H_4TPTC, BIBP and **1** in solid state at room temperature.....5

Fig. S13 The luminescence intensities of CP **1** which were dispersed in the aqueous solution of different anions.....5

Fig. S14 The changes of emission spectra of **1** in aqueous solutions with incremental addition of CrO_4^{2-} anion.....5

Fig. S15 The changes of emission spectra of **1** in aqueous solutions with incremental addition of $Cr_2O_7^{2-}$ anion.....6

Fig. S16 The recycled tests for **1** to detect the (a) CrO_4^{2-} anion and (b) $Cr_2O_7^{2-}$ anion for 5 times.....6

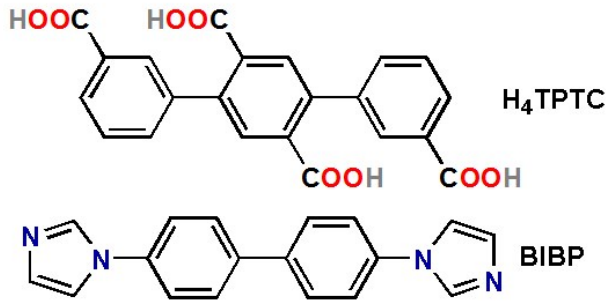
Table S1 Crystal data for **1** 7

Table S2 Selected bond lengths (Å) and angles (º) for **1**.....7

Table S3 Comparison of electrocatalytic performances of MOFs based materials for OER.....7

Table S4 Comparison of electrocatalytic performances of MOFs based materials for HER.....7

Table S5 Comparison of various MOFs based chemosensors for the detection of Cr(VI) anions.....7



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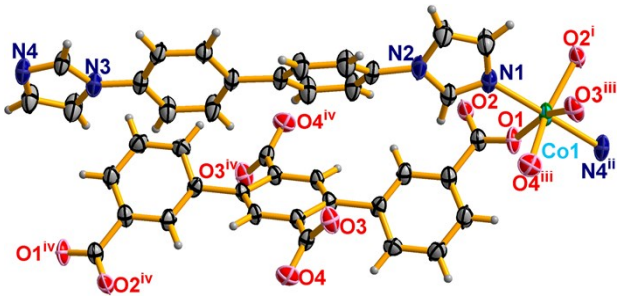

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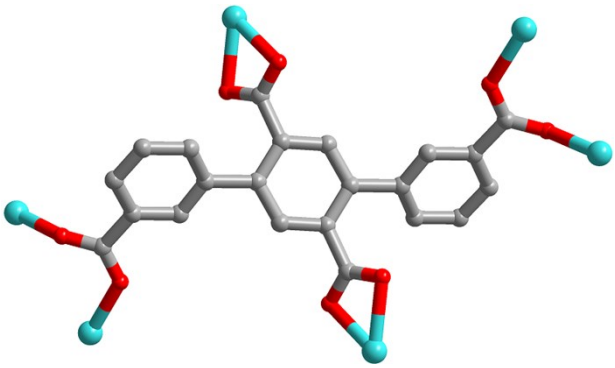

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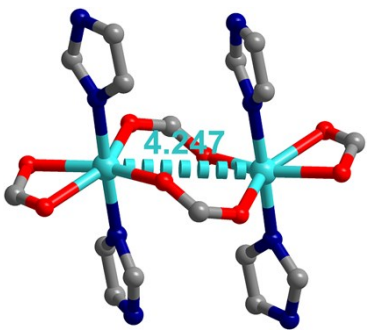


Fig. S4 The binuclear $\{Co_2(COO)_2\}$ SBU in **1**.

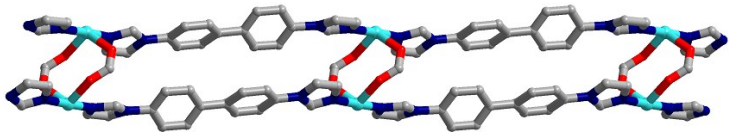


Fig. S5 The BIBP as pillars to connect the binuclear $\{Co_2(COO)_2\}$ SBUs in **1**.

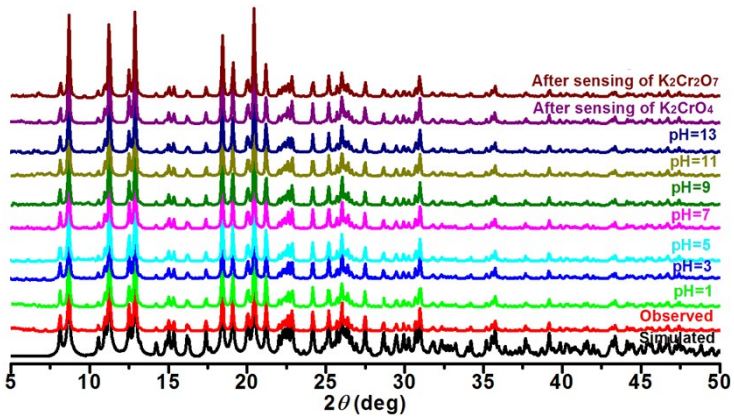


Fig. S6 PXRD patterns of **1** under different conditions.

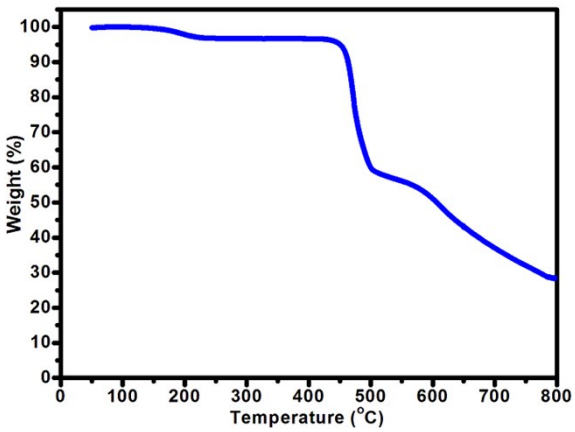


Fig. S7 TGA curve for **1**.

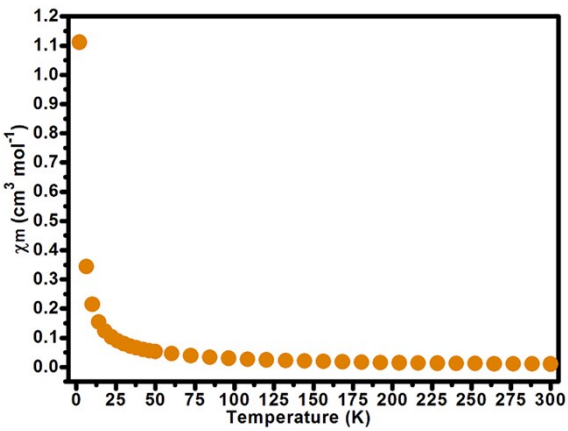


Fig. S8 The χ_m *versus* T of **1**.

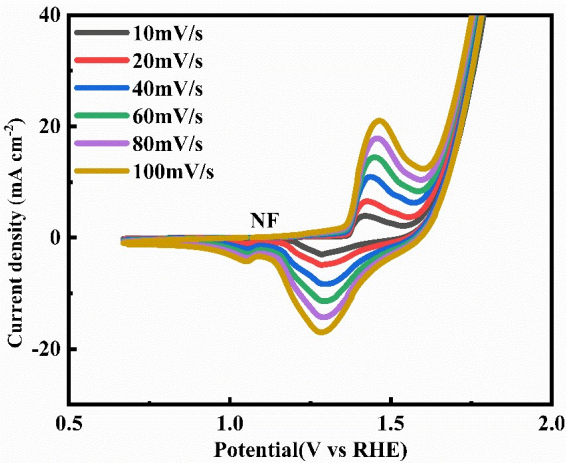


Fig. S9 Relative cyclic voltammogram profile of NF.

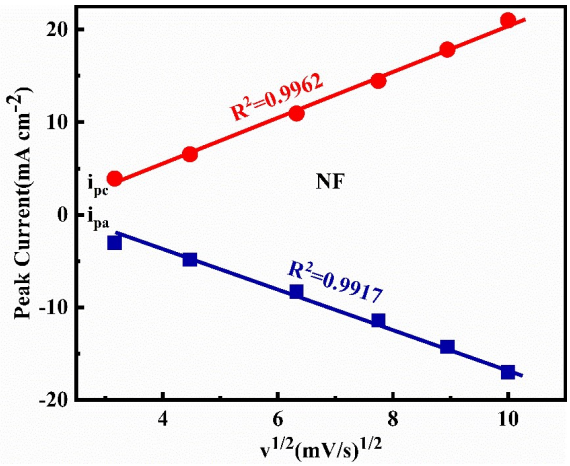


Fig. S10 Lines fitting plots between $v^{1/2}$ and i of NF.

5

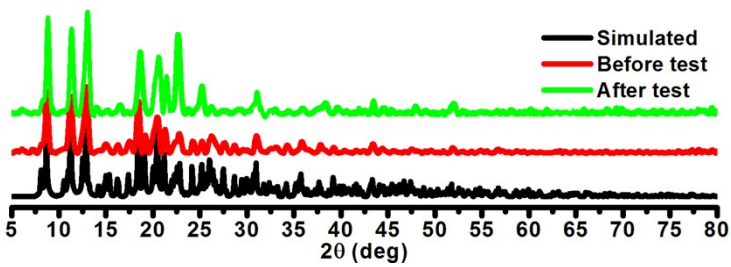


Fig. S11 PXRD patterns of **1** after electrochemical testing.

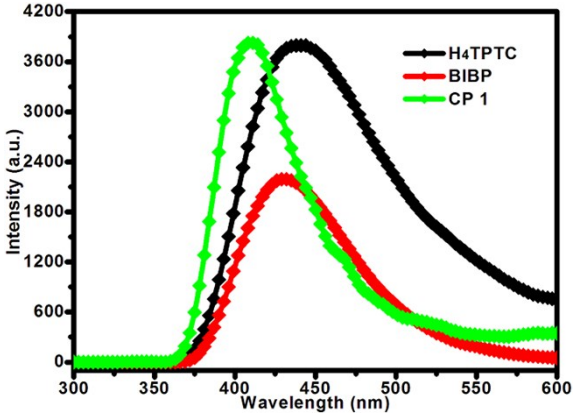


Fig. S12 The fluorescence spectra of free H_4TPTC, BIBP and **1** in solid state at room temperature.

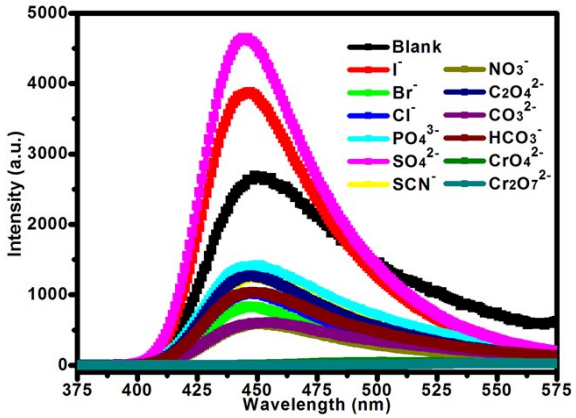


Fig. S13 The luminescence intensities of **1** which were dispersed in the aqueous solution of different anions.

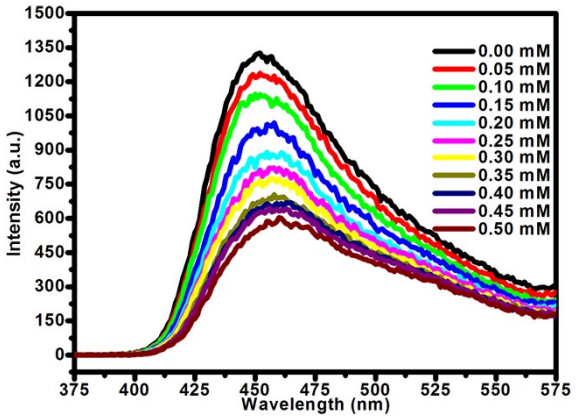


Fig. S14 The changes of emission spectra of **1** in aqueous solutions with incremental addition of CrO_4^{2-} anion.

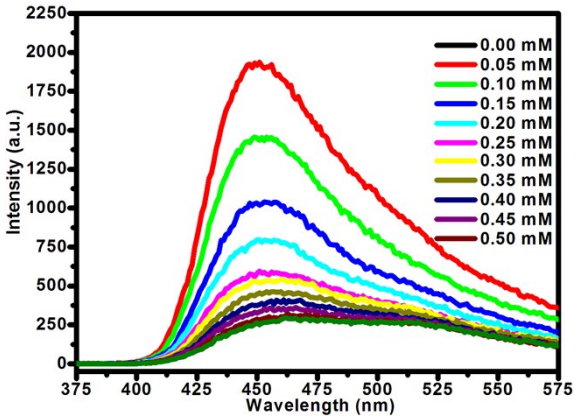
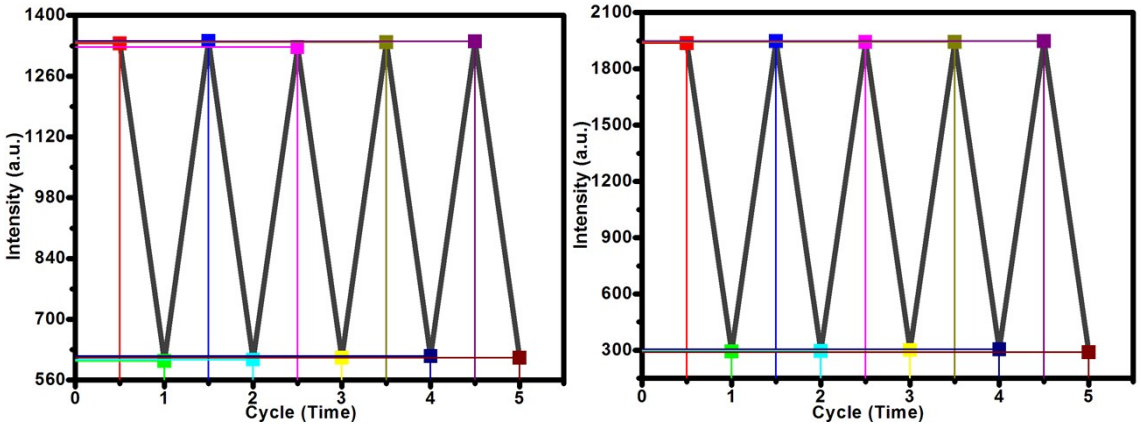


Fig. S15 The changes of emission spectra of **1** in aqueous solutions with incremental addition of $Cr_2O_7^{2-}$ anion.



(a) (b)

Fig. S16 The recycled tests for **1** to detect the (a) CrO_4^{2-} anion and (b) $Cr_2O_7^{2-}$ anion for 5 times.

Table S1 Crystal data for **1**.

Formula	$C_{29}H_{21}CoN_4O_5$
Formula weight	564.43
Crystal system	Monoclinic
Space group	$P2_1/c$
a (Å)	10.3161(3)
b (Å)	14.7176(4)
c (Å)	16.3208(4)
α (°)	90
β (°)	98.968(3)
γ (°)	90
V(Å^3)	2447.67(12)
Z	4
D_{calcd} (Mg/m^3)	1.532
μ(mm^{-1})	0.751
Temperature (K)	295(2)
F(000)	1160
R_{int}	0.0521
R_1 [$I > 2\sigma(I)$]	0.0465
wR_2 [$I > 2\sigma(I)$]	0.1172
Gof	1.044

Table S2 Selected bond lengths (Å) and angles (°) for **1**.

Co(1)-O(1)	2.036(2)	O(2)$^{\#1}$-Co(1)-O(4)$^{\#3}$	149.54(8)	N(1)-Co(1)-N(4)$^{\#2}$	178.24(9)	O(1)-Co(1)-O(4)$^{\#3}$	99.40(8)
Co(1)-O(2)$^{\#1}$	2.0704(2)	N(4)$^{\#2}$-Co(1)-O(4)$^{\#3}$	95.39(9)	O(1)-Co(1)-O(3)$^{\#3}$	158.38(8)	O(1)-Co(1)-N(4)$^{\#2}$	86.09(9)
Co(1)-N(1)	2.118(2)	O(2)$^{\#1}$-Co(1)-N(1)	93.31(9)	O(2)$^{\#1}$-Co(1)-O(3)$^{\#3}$	90.43(8)	N(1)-Co(1)-O(4)$^{\#3}$	85.32(9)
Co(1)-N(4)$^{\#2}$	2.132(2)	O(3)$^{\#3}$-Co(1)-O(4)$^{\#3}$	59.14(7)	N(1)-Co(1)-O(3)$^{\#3}$	88.76(9)	O(1)-Co(1)-O(2)$^{\#1}$	111.06(9)
Co(1)-O(3)$^{\#3}$	2.208(2)	O(2)$^{\#1}$-Co(1)-N(4)$^{\#2}$	86.90(9)	N(4)$^{\#2}$-Co(1)-O(3)$^{\#3}$	92.99(8)	O(1)-Co(1)-N(1)	92.20(9)
Co(1)-O(4)$^{\#3}$	2.224(2)						
Symmetry codes: #1 -x+1, -y+1, -z+2; #2 x+1, y, z+1; #3 x, -y+1/2, z+1/2.							

Table S3 Comparison of electrocatalytic performances of MOFs based materials for OER.

Catalyst	Substrate	Electrolyte	η_{10}	Reference
Co-BPDC/Co-BDC_3	GCE	1 M KOH	335 mV	47
UTSA-16	GCE	1 M KOH	408 mV	48
Co-ZIF-9(III)	GCE	1 M KOH	380 mV	49
Unsaturated ZIF-67	GCE	1 M KOH	410 mV	50
CTGU-14	GCE	1 M KOH	454 mV	51
1@NF	NF	1 M KOH	377 mV	**this work**

Table S4 Comparison of electrocatalytic performances of MOFs based materials for HER.

Catalyst	Substrate	Electrolyte	η_{10}	Reference
Ni–ZIF	GCE	1 M KOH	218 mV	52
Fe_2Co-MOF	GCE	1 M KOH	221 mV	53
NiFe-MOF	NF	1 M KOH	255 mV	54
Co/Cu-MOF	GCE	1 M KOH	391 mV	55
Ni-CP	GCE	1 M KOH	422 mV	56
1@NF	NF	1 M KOH	242 mV	**this work**

Table S5 Comparison of various MOFs based chemosensors for the detection of Cr(VI) anions.

	Analyte	MOFs based Fluorescent Materials	Quenching constant (K_{SV}, M^{-1})	Detection Limits	Media	Ref
1	CrO_4^{2-}	$[Cd_2(HDDB)(bib)_{1.5}(H_2O)]$	4.7×10^3	N/A	H_2O	61
2		$[Cd_2(HDDB)(m\text{-bimb})]$	2.5×10^3	N/A	H_2O	
3		$[Cd_2(DDB)(p\text{-bimb})]$	6.0×10^3	N/A	H_2O	
4		$[Tb(Hbptc)(H_2O)_4]$	1.27×10^4	2.36×10^{-6} M	H_2O	62
5		$[Ni_{1.5}(H_2L)(bib)_{1.5}(H_2O)_2]$	3.0×10^3	N/A	H_2O	63
6		$[Pb_2(HL)(bib)_{1.5}(H_2O)]$	7.4×10^3	N/A	H_2O	
7		$\{[Co(TPTC)_{0.5}(BIBP)]\cdot H_2O\}_n$	2.5×10^3	3.42×10^{-6} M	H_2O	**this work**
1	$Cr_2O_7^{2-}$	$[Cd_2(HDDB)(bib)_{1.5}(H_2O)]$	2.7×10^4	N/A	H_2O	61
2		$[Cd_2(HDDB)(m\text{-bimb})]$	1.8×10^4	N/A	H_2O	
3		$[Cd_2(DDB)(p\text{-bimb})]$	2.8×10^4	N/A	H_2O	
4		$[Cd(TIPA)_2(ClO_4)_2]$	7.15×10^4	8 ppb	H_2O	62
5		$[Tb(Hbptc)(H_2O)_4]$	1.04×10^5	2.88×10^{-7} M	H_2O	63
6		$[Cd_3\{Ir(ppy\text{-}COO)_3\}_2]$	3.475×10^4	145.1 ppb	H_2O	64
7		$[Ni_{1.5}(H_2L)(bib)_{1.5}(H_2O)_2]$	2.9×10^4	N/A	H_2O	65
8		$[Pb_2(HL)(bib)_{1.5}(H_2O)]$	2.8×10^4	N/A	H_2O	
9		$\{[Co(TPTC)_{0.5}(BIBP)]\cdot H_2O\}_n$	1.15×10^4	2.96×10^{-7} M	H_2O	**this work**