Electronic Supplementary Material (ESI) for RSC Advances.

Carbazole-based Bis–Imidazole Ligand-Involved Synthesis of Inorganic−Organic Hybrid Polyoxometalates as Electrochemical Sensors for Detecting Bromate and Efficient Catalysts for Selective Oxidation of Thioether

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Table S1 Selected bond lengths (Å) and angles (°) of complexes **1-3**.

Complex **1**			
Ni(1)-O(7)	2.119(4)	Ni(1)-O(5)	2.191(4)
Ni(1)-N(10)	2.058(5)	Ni(1)-N(9)	2.056(5)
Ni(1)-N(8)	2.123(5)	Ni(1)-N(4)	2.079(5)
O(7)-Ni(1)-O(5)	71.61(14)	N(10)-Ni(1)-O(7)	94.09(16)
N(10)-Ni(1)-O(5)	165.68(17)	N(9)-Ni(1)-O(7)	87.83(17)
N(9)-Ni(1)-O(5)	89.21(18)	N(9)-Ni(1)-N(10)	89.5(2)
Complex **2**			
O(2W)-Cu(1)	2.087(4)	O(8)-Cu(1)	2.303(3)
N(4)-Cu(1)	1.951(4)	N(4)-Cu(1)-O(2W)	91.57(17)
O(2W)-Cu(1)-O(8)	89.84(13)	N(4)-Cu(1)-O(8)	90.57(15)
Complex **3**			
N(5)-Ni(1)	2.051(3)	N(1)-Ni(1)	2.063(4)
Ni(1)-O(1W)	2.091(4)	Ni(1)-O(2W)	2.111(3)
Ni(1)-O(5)	2.087(3)	Ni(1)-O(6)	2.083(3)
N(5)-Ni(1)-O(2W)	172.82(14)	N(5)-Ni(1)-O(5)	91.01(14)
O(5)-Ni(1)-O(1W)	173.74(15)	O(5)-Ni(1)-O(2W)	85.46(14)
N(5)-Ni(1)-N(1)	96.21(14)	N(5)-Ni(1)-O(1W)	94.96(16)

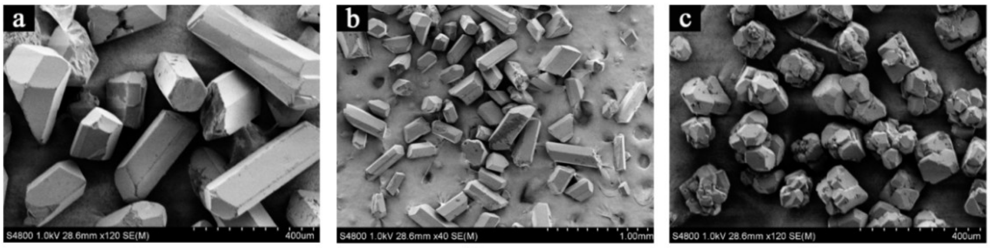

Fig. S1 The SEM images for complexes **1**(a), **2**(b) and **3**(c).

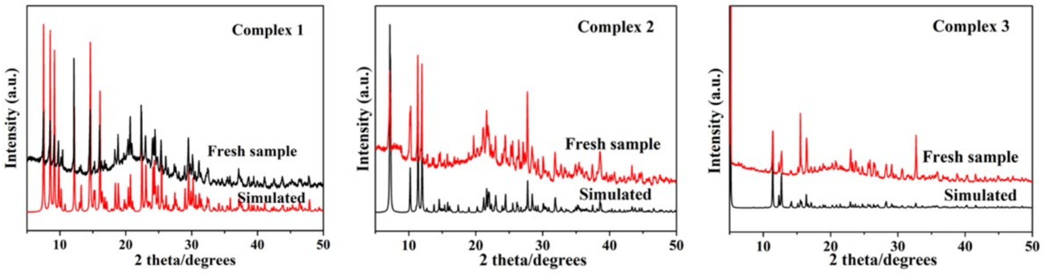

Fig. S2 The PXRD patterns for complexes **1-3**.

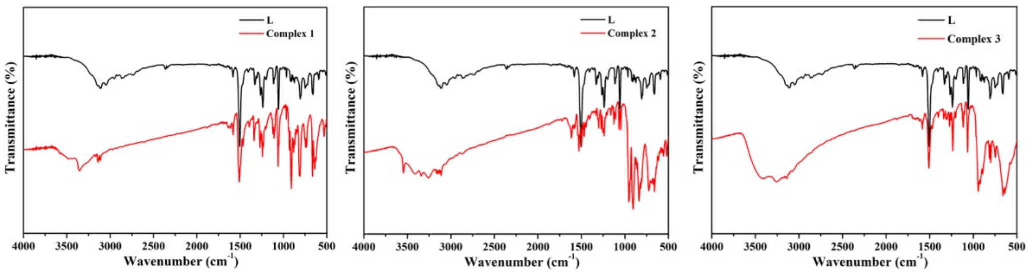

Fig. S3 IR spectra of complexes **1-3**.

Table S2 The comparison of LODs of **1**–**3**–CPEs and reported sensors.

Sensor	Concentration (M)	Coefficient of association	sensitivity ($\mu A \cdot mM^{-1}$)	LOD (μM)	ref
1–CPE	2×10^{-5}–1×10^{-3}	0.998	8.58	0.315	this work
2–CPE	2×10^{-5}–1×10^{-3}	0.999	27.61	0.098	this work
3–CPE	2×10^{-5}–1×10^{-3}	0.999	0.54	0.551	this work
$\{[Cu_8(H_2O)_6](dpyh)_4(\alpha\text{–}\gamma\text{-}Mo_8O_{26})\} \cdot (\beta\text{-}Mo_8O_{26}) \cdot 8.5H_2O$	1×10^{-5}–1×10^{-4}	0.998	0.05	83.2	1
$[CoL^1(\beta\text{-}Mo_8O_{26})_{0.5}]$	1×10^{-5}– 4.2×10^{-3}	0.992	0.69	1503	2
$[Co(H_2O)_2L^2(\beta\text{-}Mo_8O_{26})_{0.5}]$	1×10^{-5}–9×10^{-4}	0.995	8.0	25.4	2
$[Zn(HL_3)_2(\beta\text{-}Mo_8O_{26})]$	1×10^{-5}–5×10^{-3}	0.999	2.0	24	2

$[Ag_4L^a{}_5(SiW_{12}O_{40})]\cdot 28H_2O$	1.2×10^{-5}–5.8×10^{-4}	0.991	12.7	5.61	3
$[Ag_3L^a{}_4(PW_{12}O_{40})]$	3.4×10^{-3}–8×10^{-3}	0.997	101.7	16.9	3
$(Ni_4[(P_8W_{48}O_{184})(WO_2)]^{28-}$	1×10^{-4}–1×10^{-3}	0.998	69.4	0.2	4
NENU-3/CC	5.0×10^{-5}–5.6×10^{-3}	0.997	45.1	0.55	5
NENU-5/CC	1.5×10^{-5}–3.8×10^{-5}	0.996	18.8	1.18	5
NENU-3/film	5.0×10^{-5}–7.2×10^{-4}	0.998	0.02	12	6
Ag/PMo_{12}/PBz-modified electrode	1×10^{-3}–7.5×10^{-3}	0.999	2.2	86.3	7
$[(C_3H_7)_2$-bim$]_2[CdCl_4]$	5×10^{-9}–2×10^{-8}	0.998	0.10	0.01	8

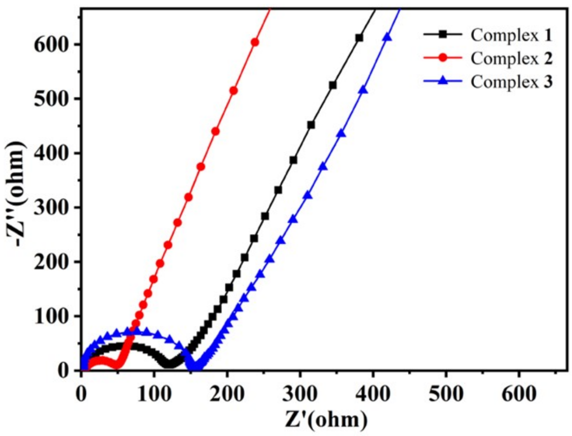

Fig. S4 The EIS spectra of **1–3**–based electrodes

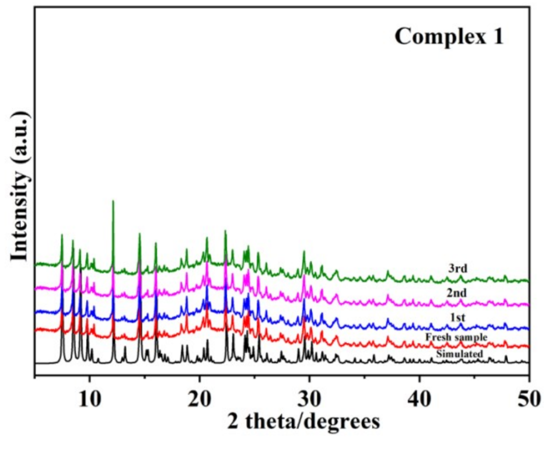

Fig. S5 The PXRD patterns of simulated and recycled after acting as catalyst of **1**.

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