

**Electronic Supporting Information (ESI)**  
**for**

**A dinuclear cobalt cluster as electrocatalyst for oxygen reduction reaction**

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## S1. Experimental Section

*Syntheses of catalyst.* Dinuclear  $\{\text{Co}^{\text{II}}_2\}$  cluster catalyst was synthesized according our reported experiment [reference 13 in main text] and as bellow:

A mixture of ligand Hpmat (27.7 mg, 0.1 mmol) in  $\text{CHCl}_3/\text{MeOH}$  (10/2 mL) was stirred and dissolved under 60 °C silicone oil bath. Then a solution of  $\text{Co}(\text{ClO}_4)_2 \cdot 6\text{H}_2\text{O}$  (55.01 mg, 0.15 mmol) in 5 mL MeOH was added dropwise in the above solution. The mixture stirred in 60 °C bath for 8 hours and then cooled to room temperature and filtered. Purple needle (macrography) shaped crystals of  $\{\text{Co}_2\}$  catalyst were collected. Yield: 13% based on Co. Elemental analysis (%) for  $\{\text{Co}_2\}$  catalyst,  $\text{C}_{16}\text{H}_{18}\text{ClCoN}_7\text{O}_6$  (M = 498.74): *Calcd.*: C, 38.53; H, 3.64; N, 19.66; *Found*: C, 38.81; H, 3.32; N, 19.46. IR (KBr disk,  $\text{cm}^{-1}$ ) see **Fig. S2** in **ESI**.

## S2. Figures in Supporting Information

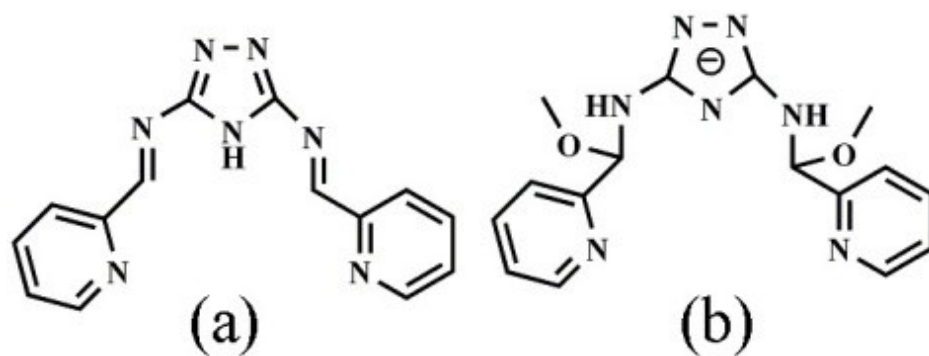


Fig. S1 The initial Hpmat ligand (a) and final pmmat<sup>-</sup> ligand (b) of {Co<sup>II</sup>} catalyst.

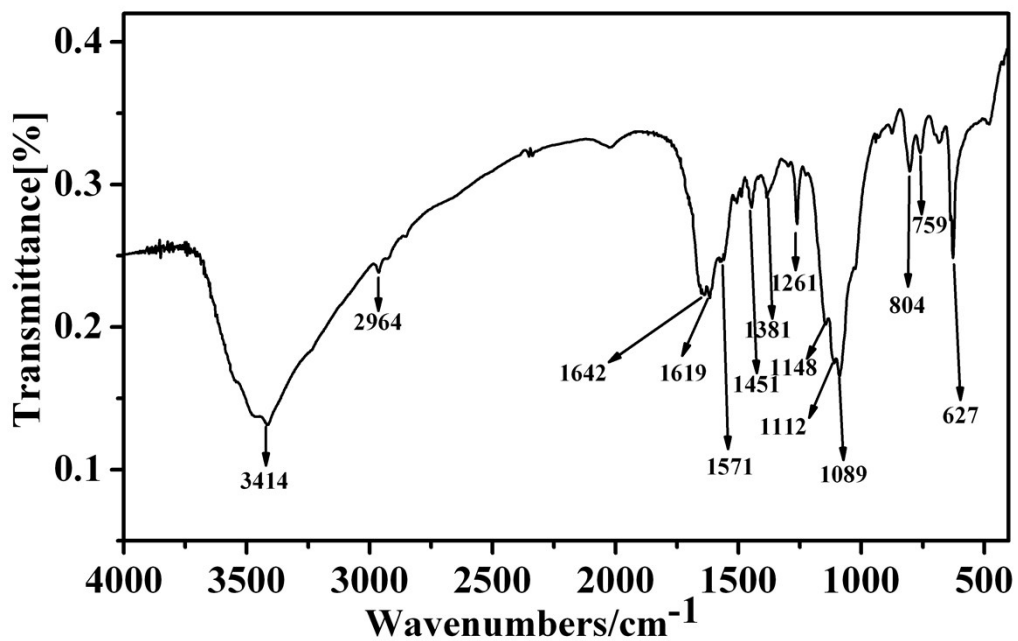
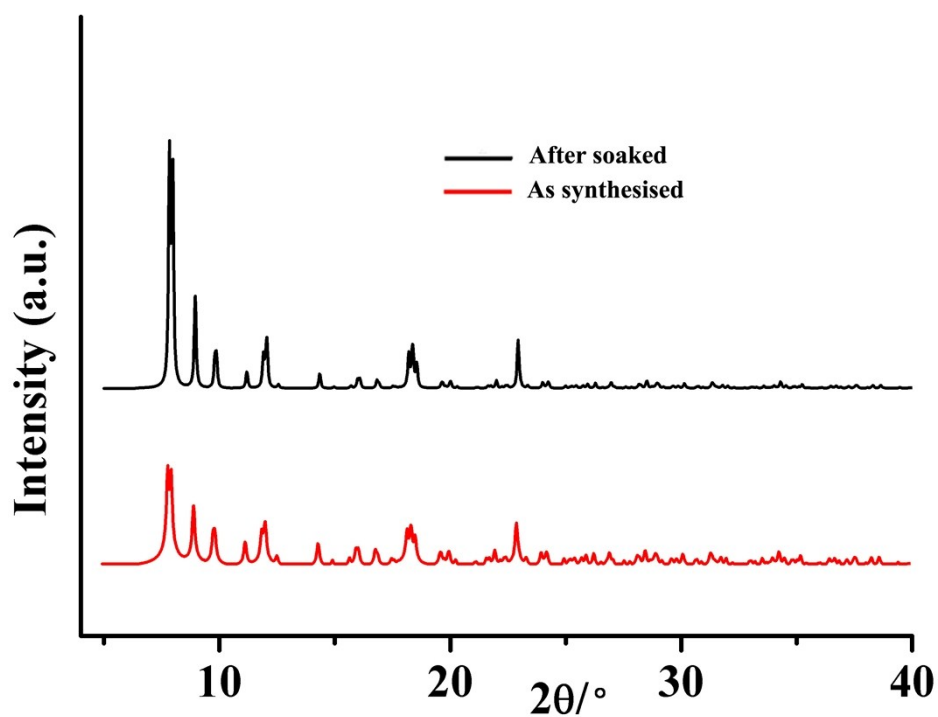
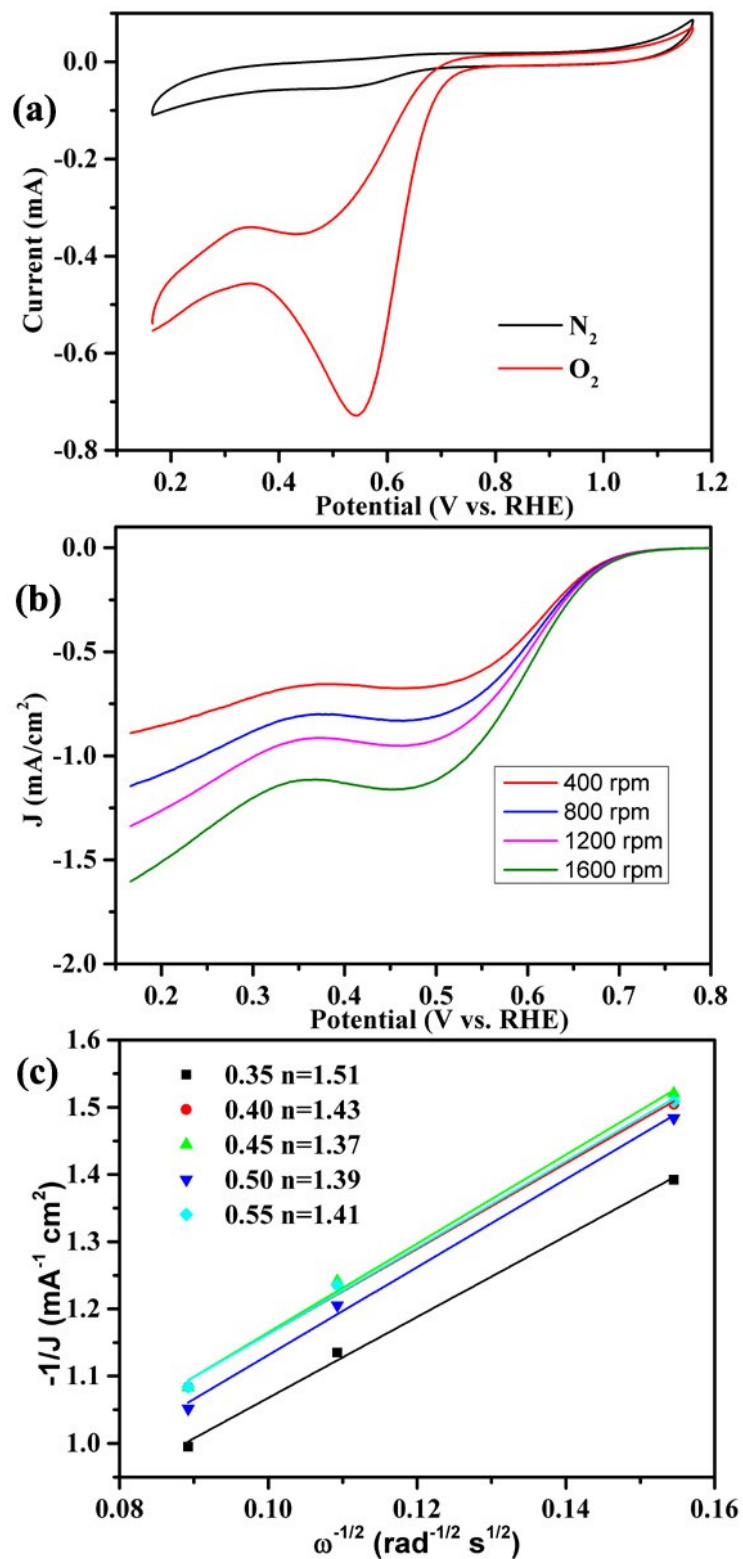


Fig. S2 IR spectra of {Co<sup>II</sup>} catalyst.



**Fig. S3** (a) The PXRD of as synthesised  $\{Co^{II}_2\}$  catalyst. (b) The PXRD of catalyst after soaked in mixture ink.



**Fig. S4** (a) CV curves of free ligand Hpmat. (b) LSV curves of free ligand Hpmat. (c) K-L plots of free ligand Hpmat at different potentials.

**S3. Table S1** Crystal Data and Structure Refinement Parameters for {Co<sup>II</sup><sub>2</sub>} catalyst.

<b>Compound</b>	<b>{Co<sup>II</sup><sub>2</sub>} catalyst</b>
Formula	C <sub>16</sub> H <sub>18</sub> ClCoN <sub>7</sub> O <sub>6</sub>
Fw	498.74
$\lambda/\text{\AA}$	0.71073
$T/\text{K}$	298(2)
Crystal system	Orthorhombic
Space group	<i>Pcca</i>
$a$ [Å]	22.1561(18)
$b$ [Å]	11.2746(7)
$c$ [Å]	19.7428(17)
$\alpha$ [°]	90
$\beta$ [°]	90
$\gamma$ [°]	90
$V$ (Å <sup>3</sup> )	4931.8(7)
$Z$	4
$D_c/\text{Mg}\cdot\text{m}^{-3}$	1.343
$F(000)$	2040
Reflections collected/unique	24089/4364
$R_{\text{int}}$	0.2293
Data/Restraints/Parameters	4364/86/290
$R_1/wR_2$ [ $I > 2\sigma(I)$ ] <sup>a</sup>	0.2000/0.4782
$R_1/wR_2$ [(all data)] <sup>a</sup>	0.2977/0.5397
GOF on $F^2$	1.175

<sup>a</sup>  $R_1 = \Sigma(|F_0| - |F_C|)/\Sigma|F_0|$   $wR_2 = [\Sigma w(|F_0|^2 - |F_C|^2)^2/(\Sigma w|F_0|^2)^2]^{1/2}$ .