

## Supplementary Material

**New-fashioned  $\text{MnO}_x/\text{g-C}_3\text{N}_4@\text{ZIF-8}$  catalyst for the liquid-phase selective oxidation of toluene in the absence of solvent and additives conditions**

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## 1. Experimental

### 1.1. Reagents and instrument

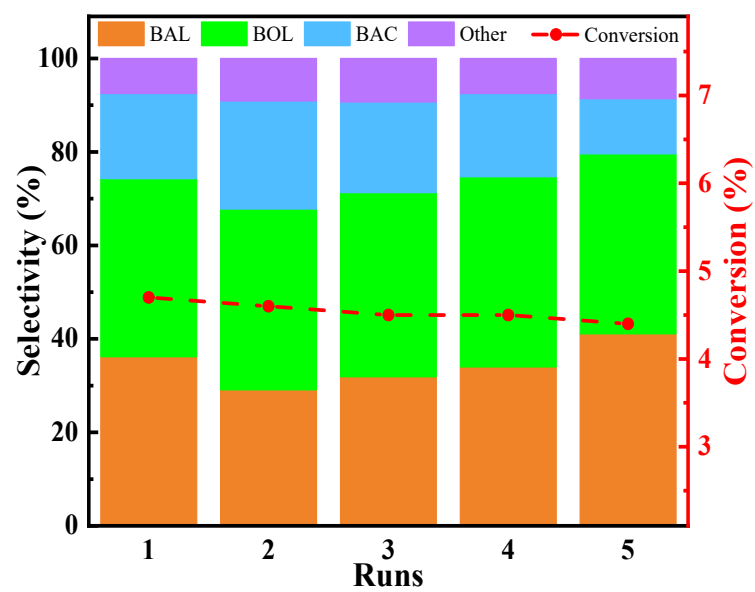
Melamine (AR, 99.0%) and zinc nitrate hexahydrate (AR, 99.0%) were obtained from Tianjin Komeo Chemical Reagent Co., Ltd, China. 2-methylimidazole (AR, 99.0%) was purchased from Rohn Reagent Co., Ltd, China. 50% manganese nitrate (AR, 99.0%) was afforded by Chengdu Jinshan Chemical Reagent Co., Ltd, China. The other reagents were purchased from the market. Micro high-pressure reactor (BE100) was provided by Shanghai LABE Instrument Co., Ltd, China. The products were analyzed by a gas chromatography (Agilent 7890B GC-FID).

### 2.2. Catalyst characterization

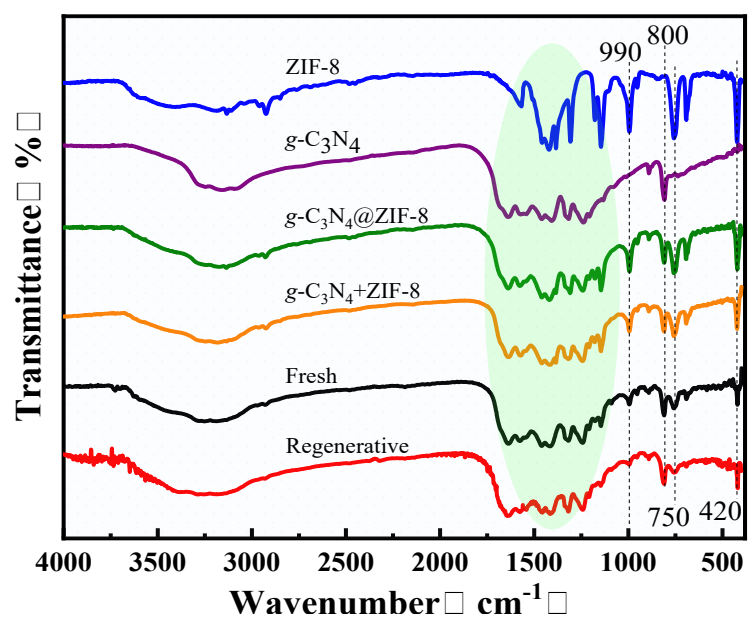
FT-IR spectrum was recorded using the Nicolet-380 in the 4000-400  $\text{cm}^{-1}$  range. SEM images were taken with a Sigma HD, Carl Zeiss (FE-SEM). XRD analyses were performed using the Rigaku Ultima IV X-ray powder diffractometer. XPS analyses were recorded using a 250Xi analyzer (Al  $K\alpha$  (1486.6 eV)). The textural properties of the samples were analyzed by  $\text{N}_2$  physisorption at 77 K in Quantachrome NOVA-2200e. The elemental content of all samples was analysed on a Thermo Scientific iCAP 7400 ICP-OES.

**Table S1** Comparison of catalytic performance of some different types of catalysts.

Catalyst	Solvent/ (Initiator)	Oxidizer	Tem. (°C)	Time (h)	Con. (%)	Sel. (%)			Ref.
						BAL	BOL	BAC	
VO(acac) <sub>2</sub>	Glacial acid	H <sub>2</sub> O <sub>2</sub>	90	4.0	19.8	50	6.1	22.2	[1]
Mn <sub>3</sub> O <sub>4</sub> /CNTs-3	TBHP	O <sub>2</sub>	90	12.0	24.63	43.5 1	46.98	-	[2]
CeMnO <sub>x</sub>	-	molecular oxygen	180	4.0	7.0	51.1		44.5	[3]
Pt/ZrO <sub>2</sub>	-	O <sub>2</sub>	90	3.0	37.2	19.6	6.5	70.4	[4]
Pd@C-GluA-550	-	molecular oxygen	160	7.0	-	51.0	-	-	[5]
[TPPFe <sup>III</sup> ] <sub>2</sub> O	-	molecular oxygen	165	3.75	7.36	59.06		-	[6]
Mn@ZIF-8	-	molecular oxygen	180	2.5	6.5	31.6	38.7	24.8	[7]
MnO <sub>x</sub> /g-C <sub>3</sub> N <sub>4</sub> @ZIF-8	-	molecular oxygen	180	2.0	4.7	36.2	38.1	18.2	This work



**Fig. S1** Recycling results of  $\text{MnO}_x/\text{g-C}_3\text{N}_4@\text{ZIF-8}$  catalysts.



**Fig. S2** FT-IR spectra of different samples.

## References

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