

Supporting Information

The chemical stability of ZIF-8 in aldehydes under air condition

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Experimental

Materials

Zinc nitrate ($\text{Zn}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$), potassium hydroxide (KOH), methanol, ethanol, propionaldehyde, butyraldehyde, valeraldehyde, crotonaldehyde, cinnamaldehyde and citral were purchased from Sinopharm Chemical Reagent Co., Ltd.. 1-Methylimidazole (1-MIM) and 2-MIM were both purchased from Sigma Aldrich. All chemicals were employed without further purification unless mentioned. The deionized water was collected from the water ultra-purification system with a resistivity of 18.25 M Ω /cm (WP-UP-YZ-60, Water Purifier, and China) throughout the whole experiments.

Characterizations

Powder X-ray diffraction (XRD) measurements of the samples were carried out using an X'Pert Pro Multipurpose diffractometer (Smartlab-SE, Rigaku Corporation) with Cu K α radiation (0.15406 nm) at room temperature from 5 ° to 60 °.

The observation for morphology, nanoparticle size and element distribution of the samples were performed on the field-emission scanning electron microscope (FESEM, SU8020, HITACHI) operating at an accelerating voltage of 5 kV.

Nitrogen physisorption isotherms of the samples were detected on an Autosorb-iQ analyzer (Quantachrome Instruments U.S.). On account that ZIF-8 sample is observed to exhibit flexibility or breathing effect upon adsorption during the isotherm detection, thus there is uncertainty in the exact interpretation of specific surface area, total pore volume and pore size by the classical Brunauer-Emmett-Teller (BET) method and Barret-Joyner-Halenda (BJH) theory.¹⁻³ Thus, the specific surface areas of the samples were estimated *via* the single point at the relative pressure of 0.30. These data were still within the theoretical range (1947 m²/g),⁴ although they were different from some literatures owing to experimental methods, conditions and the probe molecules *et al.* in the detection of adsorption-desorption isotherms besides the preparation process of ZIF-8. The total pore volumes of the samples were calculated by the single point at the relative pressure of 0.95. The pore size distributions were evaluated by Saito-Foley (SF) method.

Fourier transform infrared spectra (FT-IR) of the samples were recorded on a Nicolet Nexus 870 in the wavenumber range from 4000 to 400 cm⁻¹.

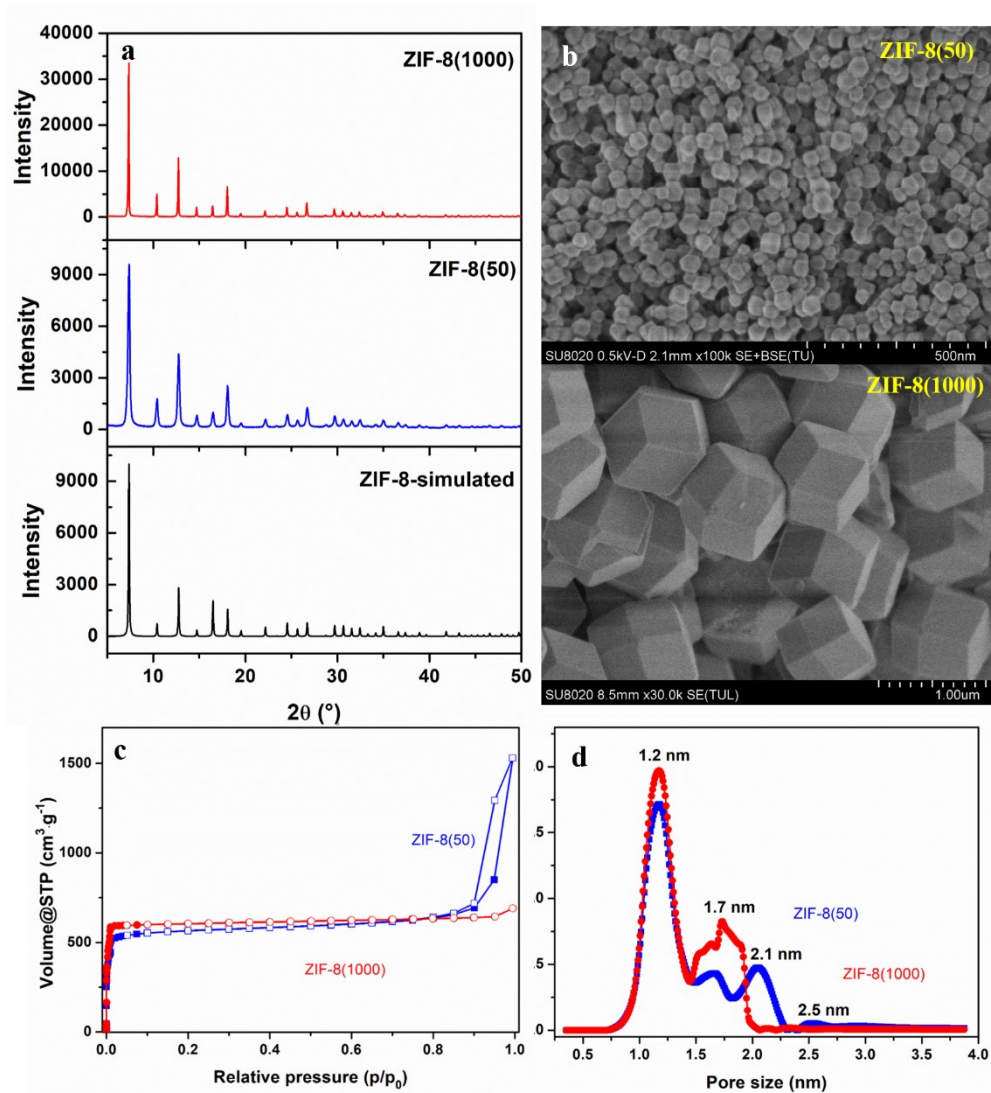


Fig. S1 The (a) XRD patterns (b) FESEM (c) N₂ physisorption isotherms and (d) pore size distributions of the as-synthesized ZIF-8(50) and ZIF-8(1000) samples

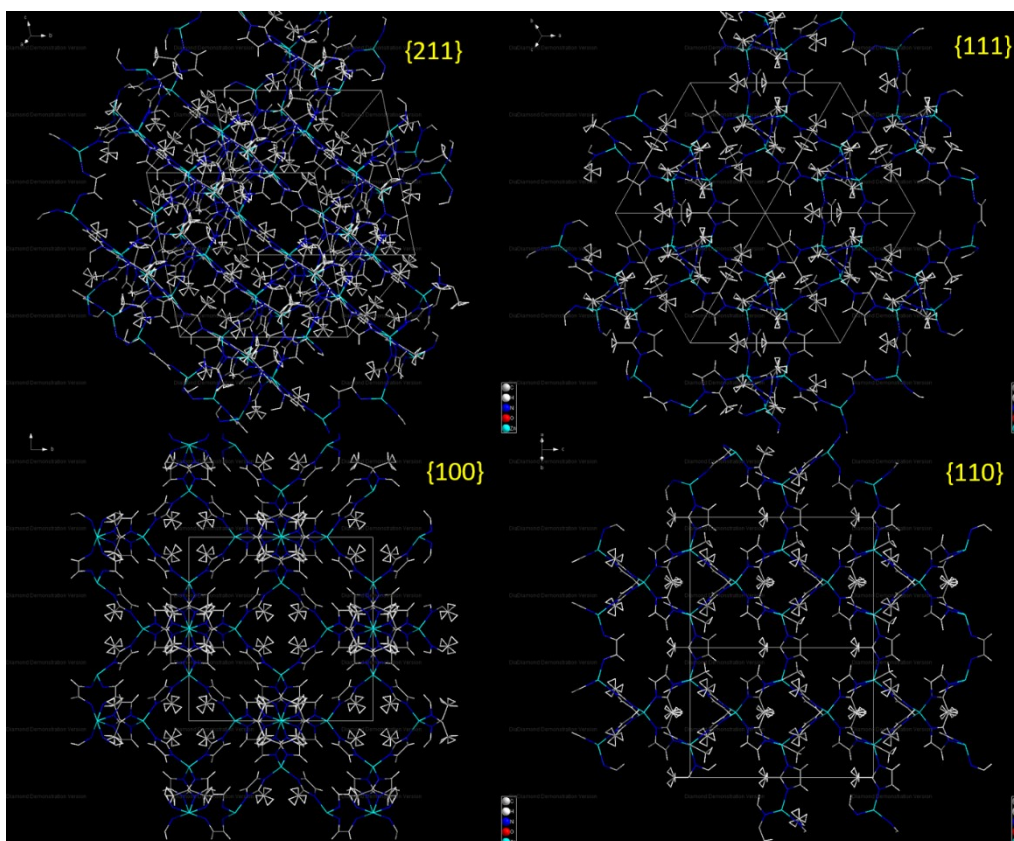


Fig. S2 The four exposed crystallographic planes {211} edge, {111} and {100} vertices, {110} facet of the rhombic dodecahedra ZIF-8

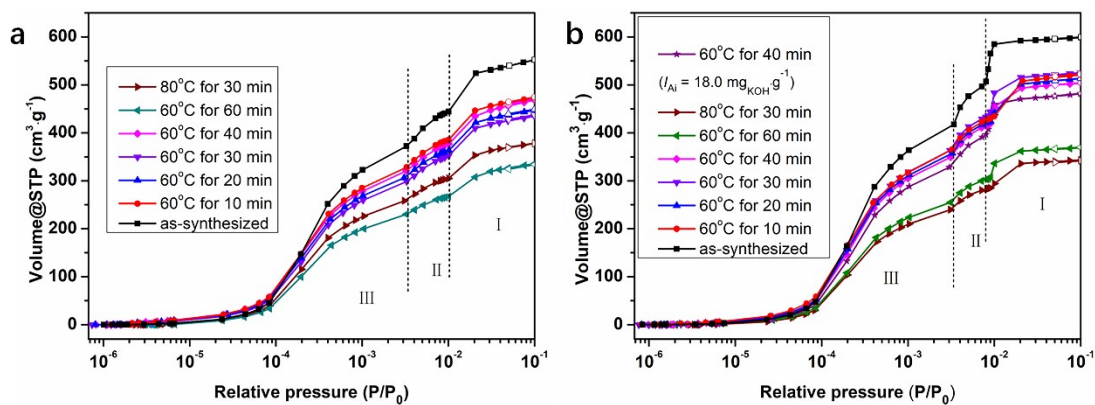


Fig. S3 The N_2 physisorption isotherms of (a) ZIF-8(50) and (b) ZIF-8(1000) samples in semilogarithmic scales after soaking in crotonaldehyde at different conditions.

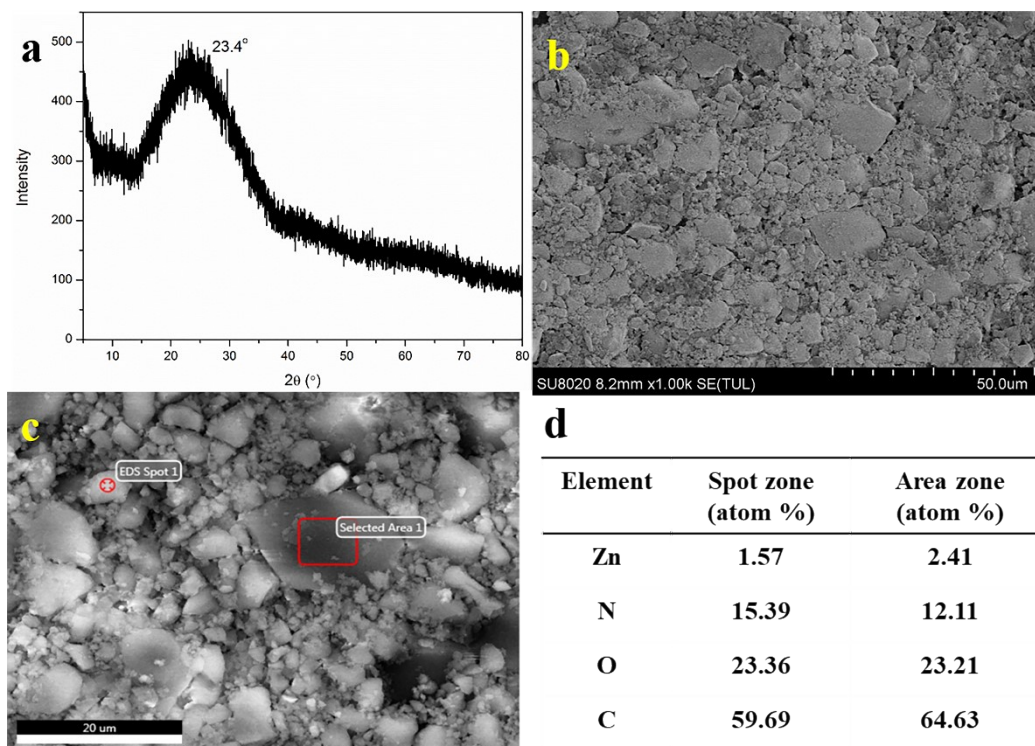


Fig. S4 The (a) XRD patterns and (b) FESEM (c and d) EDS analysis of the deposition sample after ZIF-8(1000) soaking in aldehyde at 60 °C for 30 min with the I_{Ai} of $1.32 \text{ mg}_{\text{KOH}} \cdot \text{g}^{-1}$

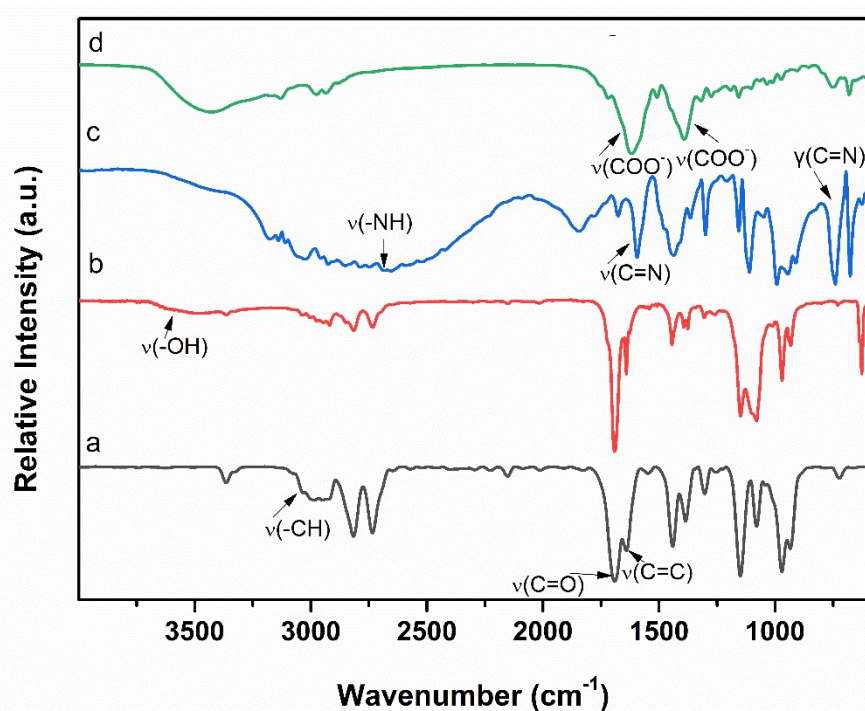


Fig. S5 The FT-IR spectra of crotonaldehyde after (a) just distilled (b) stood for 30 days and (c) 2-MIM (d) the deposition sample after ZIF-8(1000) soaking in aldehyde at 60 °C for 30 min with the I_{Ai} of $1.32 \text{ mg}_{\text{KOH}} \cdot \text{g}^{-1}$.

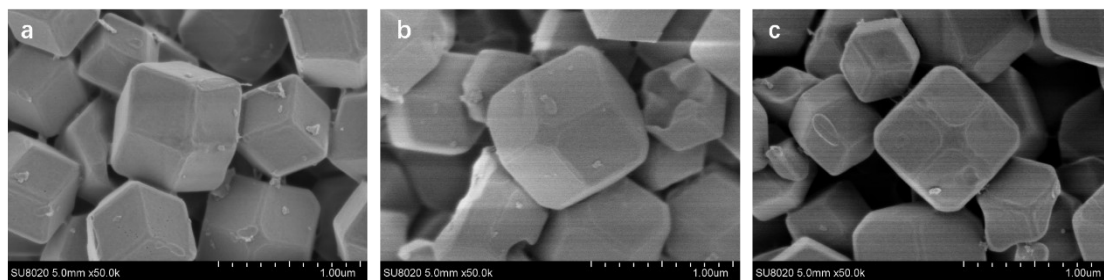


Fig. S6 The FESEM images of ZIF-8(1000) after dissolved in different aldehydes: (a) propionaldehyde, (b) butyraldehyde and (c) valeraldehyde at 20 °C for 30 min

Table S1. The specific surface areas and pore volumes of the ZIF-8 samples after degradation at different times

Samples	t (min)	S _{BET} (m ² ·g ⁻¹)	S _{micro} (m ² ·g ⁻¹)	S _{external} (m ² ·g ⁻¹)	V _p (cm ³ ·g ⁻¹)	V _{micro} (%)	V _{meso} (%)
ZIF-8(50)	as-synthesized	1747.7	1565.7	182.0	1.32	31	69
	10	1500.7	1377.1	123.6	0.90	32	68
	20	1424.1	1298.4	125.7	0.88	35	65
	30	1379.7	1251.0	128.7	0.86	31	69
	40	1499.5	1332.2	167.3	0.97	28	72
	60	1076.7	969.0	107.7	0.71	29	71
	30 ^a	1193.0	1118.8	74.2	0.74	29	71
ZIF-8(1000)	as-synthesized	1857.4	1795.7	61.7	1.00	86	14
	10	1621.1	1550.1	71.0	0.86	76	24
	20	1601.6	1517.3	84.3	0.86	81	19
	30	1626.8	1571.2	55.6	0.86	87	13
	40	1566.6	1503.5	63.1	0.84	85	15
	60	1147.6	1102.0	45.6	0.61	79	21
	30 ^a	1068.1	1021.0	47.1	0.57	79	21
	40 ^b	1507.6	1419.1	88.5	0.82	61	39

^a ZIF-8 at 80 °C for 30 min under the I_{Ai} of 1.32 mg_{KOH}·g⁻¹; ^b ZIF-8 at 60 °C for 40 min under I_{Ai} of 18.0 mg_{KOH}·g⁻¹.

Table S2. The dissolution information of ZIF-8(50) in crotonaldehyde with different I_A

Day	I_{Ai} (mg _{KOH} ·g ⁻¹)	I_{Af} (mg _{KOH} ·g ⁻¹)	X (%)
0	1.32	11.22	30.0
5	1.32	11.22	30.0
10	1.65	11.88	30.4
15	2.31	13.20	32.0
20	3.23	14.85	38.4
25	3.96	17.16	45.6
30	6.59	19.80	56.0

T = 60 °C, t = 40 min, the storage test was performed by using 50 ml newly distilled crotonaldehyde in 50 ml brown glass bottle with plug at room temperature.

Table S3. The dissolution information of ZIF-8(50) in crotonaldehyde at different conditions

t (min)	T (°C)	I_{Ai} (mg _{KOH} ·g ⁻¹)	I_{Af} (mg _{KOH} ·g ⁻¹)	X (%)
10		1.32	4.29	4.0
20	60	1.32	6.93	10.0
40		1.32	12.54	25.6
60		1.32	17.82	45.2
	0	1.98	3.30	0
	20	1.32	5.28	4.8
30	40	1.32	6.60	15.6
	60	1.32	9.24	19.6
	80	1.32	11.55	26.8

Table S4. The dissolution information of ZIF-8(1000) in crotonaldehyde at different conditions

t (min)	T (°C)	I_{Ai} (mg _{KOH} ·g ⁻¹)	I_{Af} (mg _{KOH} ·g ⁻¹)	X (%)
10		1.32	3.96	0.0
20	60	1.32	6.60	7.2
40		1.32	12.54	23.2
60		1.32	17.16	37.6
	0	1.98	3.63	0.0
	20	1.32	7.26	0.8
30	40	1.32	8.58	8.0
	60	1.32	9.24	16.4
	80	1.98	11.55	24.8

Table S5 The dissolution ratio of ZIF-8 in other aldehydes for 30 min

Sample	solvent	T (°C)	I_{Ai} (mg _{KOH} ·g ⁻¹)	I_{Af} (mg _{KOH} ·g ⁻¹)	SR (%)
ZIF-8(1000)	propionaldehyde	20	1.98	24.42	22.4
	butyraldehyde	20	3.30	24.42	17.6
	valeraldehyde	20	10.56	25.74	25.7
	crotonaldehyde	20	1.32	7.26	0.8
	cinnamaldehyde	80	n.d.	n.d.	emulsion
	citral	80	n.d.	n.d.	emulsion

Reference

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