

## Supporting Information

### Methanol-water mixture evaporation induced self-assembly of ZIF-8 particles

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## Materials

Hexadecyltrimethylammonium bromide ( $C_{19}H_{42}ClN$ , J&K Scientific, 99%), 1H,1H,2H,2H-perfluorodecyltrimethoxysilane ( $C_{13}H_{13}F_{17}O_3Si$ , J&K Scientific, 97%), 2-ethylimidazole ( $C_4H_6N_2$ , Acros Organics, 99%), zinc acetate dihydrate ( $Zn(CH_3COO)_2 \cdot 2H_2O$ , Aladdin, 99.995%), methanol ( $CH_3OH$ , Aladdin, 99.5%), ethanol ( $CH_3CH_2OH$ , Aladdin, 99.5%), acetone (Tianjin Fengchuan Chemical, 99.5%), methanal ( $CH_2O$ , Aladdin, 99.5%), ethylacetate ( $C_4H_8O_2$ , Aladdin, 99.5%) were purchased from the mentioned sources and used without further purification. Deionized (DI) water was obtained from a Milli-Q water purification system.

## Characterization

X-ray diffraction (XRD) patterns were obtained using a Smart Lab 9KW (Rigaku) diffractometer with Cu  $K\alpha$  radiation. Scanning electron microscopy (SEM) images were taken by a FEI Quanta FEG 250 with an accelerating voltage of 10 kV. Transmission electron microscope (TEM) images were taken by FEI TECNAI G2 Spirit TWIN. Microscopic images were taken by a LV100ND (Nikon).

## Synthesis of ZIF-8 particles

ZIF-8 particles were produced by following Avci et al. reported in a previous work.<sup>1</sup>  $Zn(CH_3COO)_2 \cdot 2H_2O$  (300 mg) dissolved in 5 mL of water was added to 5 mL of an aqueous solution containing 2-MiM (1.1166 g) and CTAB (0.50 mM) with gentle stirring for a few seconds. The mixture was left at room temperature for 2 h. The resulting ZIF-8 particles were washed upon centrifugation at 9000 rpm in 50 mL Falcon tubes. The collected wet pellets were finally redispersed in a mixture of methanol and water at a concentration of 60 mg/mL.

## MOF particles were assembled at room temperature

Cover glasses were washed with water and ethanol, and dried with a pressurized  $N_2$  gun. Then, the 20  $\mu$ L of suspension of ZIF-8 particles was added dropwise onto the clean substrate and the sample was left to dry at room temperatures. The temperature was kept at  $298 \pm 3$  K and the humidity was set at  $45 \pm 5\%$  during the experiments.

## Fabrication of hydrophobic silicon wafers

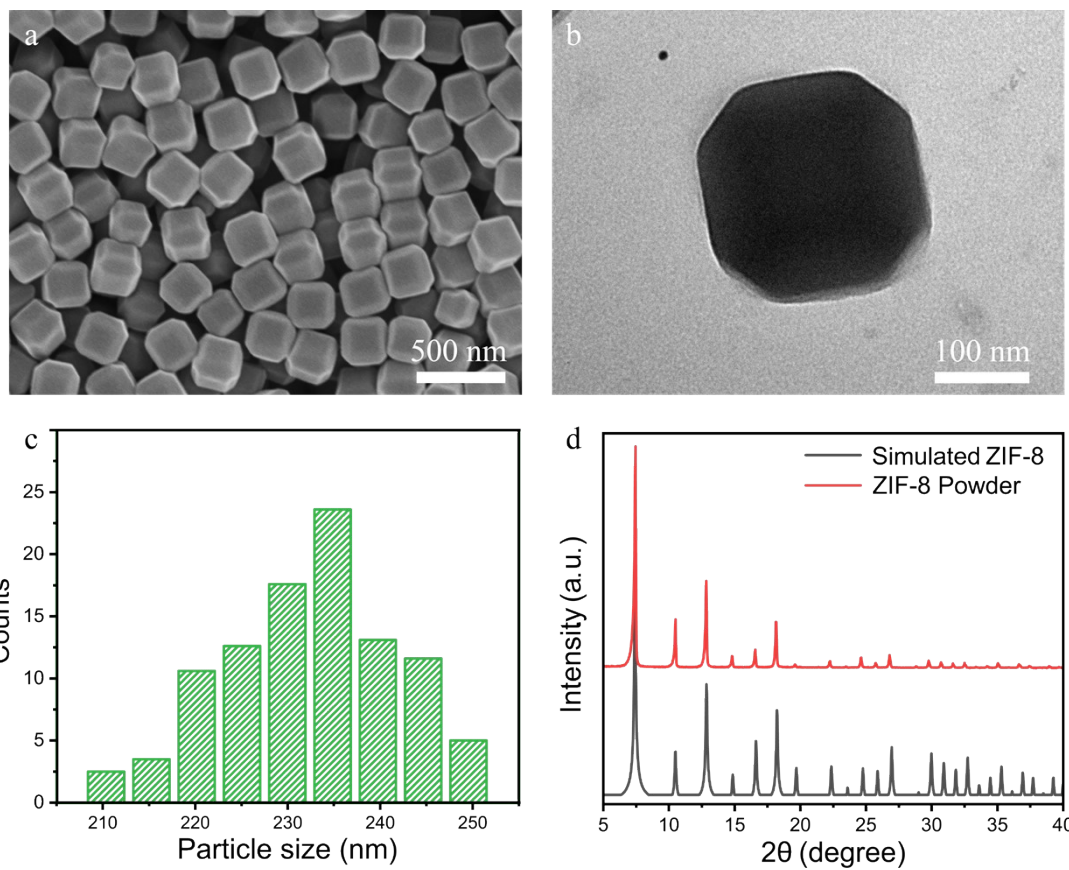
The silicon wafers were placed in a desiccator with 1H,1H,2H,2H-perfluorodecyltrimethoxysilane (FAS) (5  $\mu$ L) under vacuum for 30 mins. After the vacuum valve was closed, the desiccator was placed in a vacuum oven and heated at 120 °C for 2 h.

## Fabrication of hydrophobic polydimethyl-siloxane (PDMS)

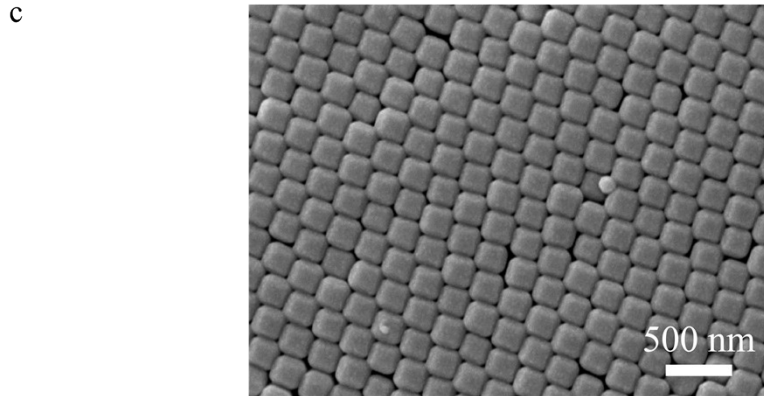
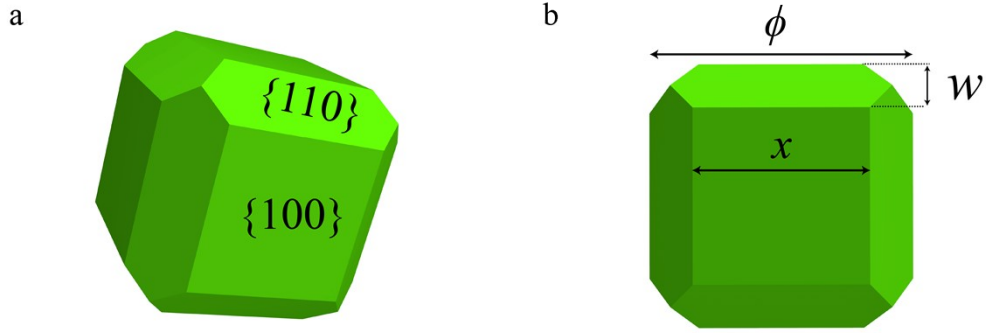
The polydimethylsiloxane (PDMS) polymer and the crosslinker were mixed 10:1. The cleaned glass sheet is placed on the vacuum chuck of the homogeniser and the mixture is applied dropwise to the glass sheet and spin coated at 2000 rpm for 60 s. The spin-coated glass substrate is then placed in an oven and cured at 80 °C for 24 h.

## Vapor Sensing Measurements

Photonic crystals made of ZIF-8 particles were placed in a detachable quartz sample cell (60 × 35 × 7 mm) with an adhered glass window. The saturated vapors of analytes (methanol, ethanol, acetone, methanal and ethyl acetate) were produced by bubbling air through a separate bottle containing the corresponding solvents. The peristaltic pump (LEAD-2, Longer) was used for transferring the saturated vapors of analytes to the detachable quartz sample cell. The reflection spectra of photonic crystals were acquired using a commercial optical fiber spectrometer (Flame, Ocean Optics) and monitored in real time at room temperature. The distance between the probe of the spectrometer and the photonic crystal surface was ~5 mm and was kept constant in all measurements.



**Fig. S1.** (a, b) The SEM and TEM images of ZIF-8 particles, and (c) the size distribution histograms of ZIF-8 particles. (d) XRD patterns of simulated ZIF-8 and ZIF-8 powder.



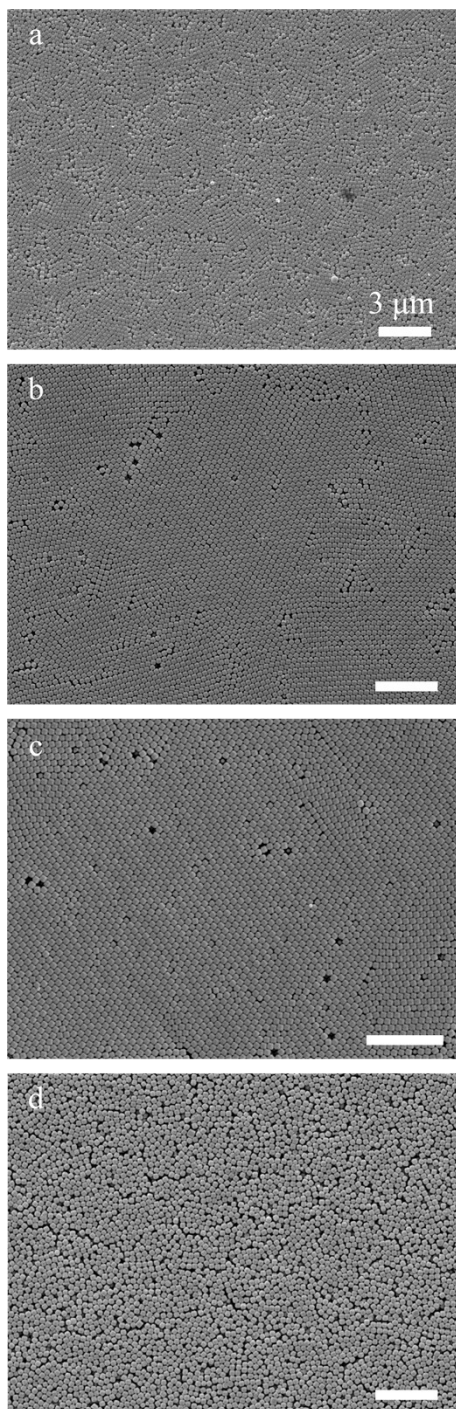
d

$$w = \frac{(\phi - x)}{2} \#(1)$$

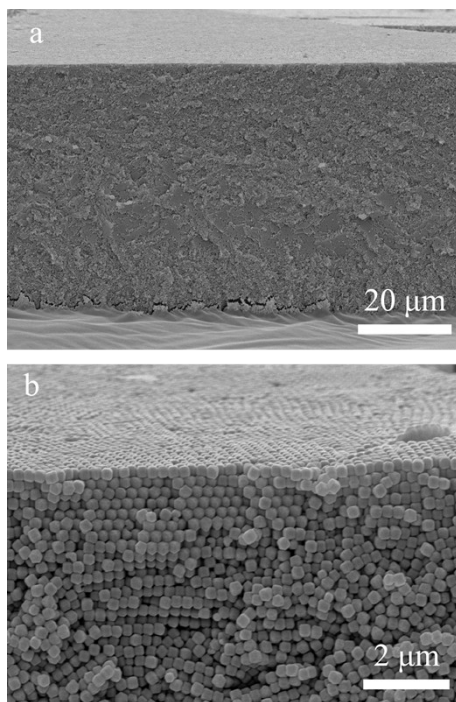
$$t = \frac{x}{x + w} \#(2)$$

$$d = \frac{2w(w^2 - \phi w) + \phi(\phi^2 - w^2)}{[2(w^2 - \phi w)^2 + (\phi - w^2)^2]^{\frac{1}{2}}} \#(3)$$

**Fig. S2.** The schematic illustrations of the TRD ZIF-8 particle show (a) the {110} and {100} facets, and (b) the particle size  $\phi$ , edge length  $x$  of the {100} square facets, and chamfer  $w$ . (c) SEM image of a self-assembled superstructure composed of ZIF-8 particles. (d) The formulas for calculating the length parameters of TRD ZIF-8 particles include chamfer ( $w$ ), a constant truncation ( $t$ ), and interplanar distances ( $d$ ).<sup>1</sup>



**Fig. S3.** (a-d) SEM images of self-assembled superstructures made of ZIF-8 particles with methanol concentrations of 0%, 50%, 80%, and 100%.



**Fig. S4.** Cross-section of the self-assembled superstructure made of ZIF-8 particles with methanol concentration of 80%.

a

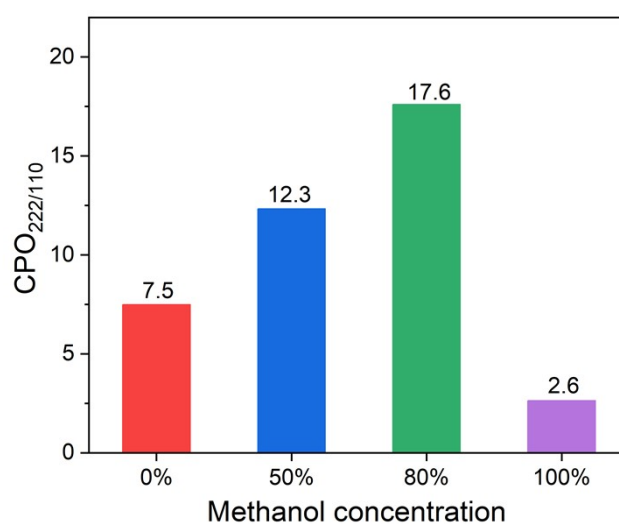
$$CPO_{(Y)}^{(X)} = \frac{\left(\frac{I_A^{(X)}}{I_A^{(Y)}}\right) - \left(\frac{I_P^{(X)}}{I_P^{(Y)}}\right)}{\left(\frac{I_P^{(X)}}{I_P^{(Y)}}\right)}$$

*I* : intensity of a reflection X or Y

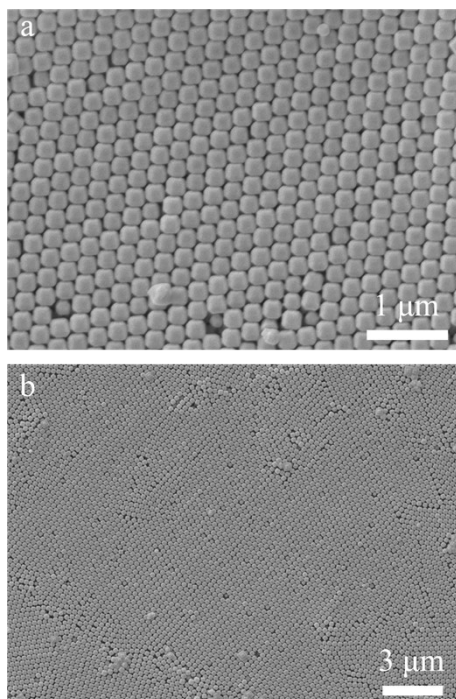
*A* : assembled

*P* : powder

b



**Fig. S5.** (a) Crystallographic preferred orientation (CPO) index equation, which determine the degree of preferred crystal orientation.<sup>2</sup> (b) CPO<sub>222/110</sub> values of ZIF-8 superstructures with different methanol concentrations.



**Fig. S6.** SEM images of the self-assembled superstructures after analyte saturated vapors adsorption experiments.



## References

- 1 C. Avci, I. Imaz, A. Carne-Sanchez, J. A. Pariente, N. Tasios, J. Perez-Carvajal, M. I. Alonso, A. Blanco, M. Dijkstra, C. Lopez and D. Maspoch, *Nat. Chem.*, 2017, **10**, 78-84.
- 2 J. Y. Kim, K. Barcus and S. M. Cohen, *J. Am. Chem. Soc.*, 2021, **143**, 3703-3706.