

Supplementary Information

A small molecule with a big scissoring effect: sodium dodecyl sulfate working on two-dimensional metal-organic frameworks

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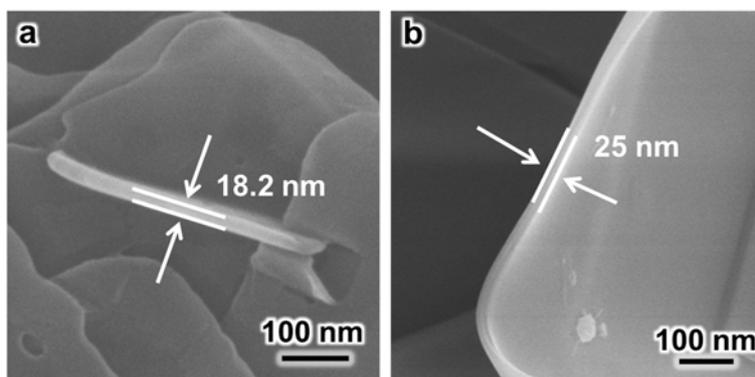


Fig. S1 Enlarged FESEM images of Fig. 1 with tagged thickness of (a) ZIF-8, (b) CuBDC NSs.

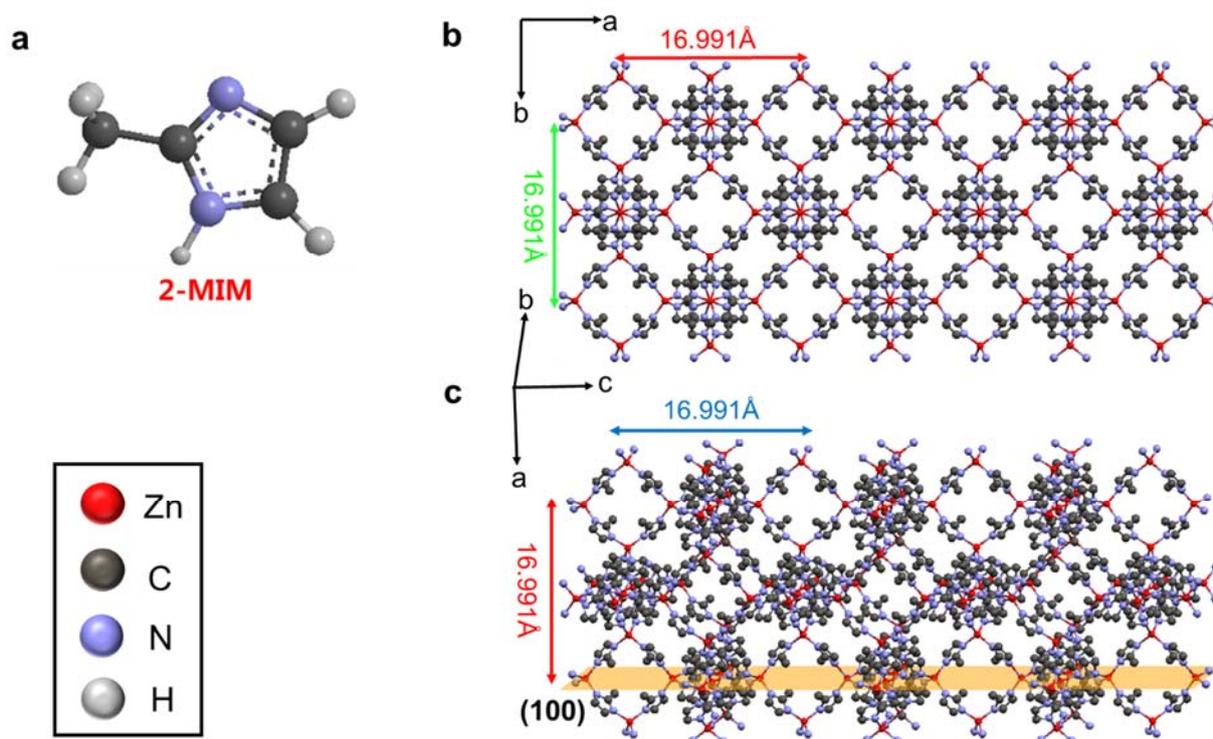


Fig. S2 The crystal structure of ZIF-8. (a) The chemical structure of 2-MIM. (b) The crystal structure of ab plane in ZIF-8 crystal. (c) The structure of ac plane along b axis and (100) plane is marked in yellow. H atoms have been omitted for clarity.¹

Zeolitic imidazolate frameworks (ZIFs) are MOFs materials having a zeolite-like skeleton structure. For the crystal structures of ZIF-8 and ZIF-67 nanosheets, a Zn^{2+} or Co^{2+} metal ion coordinated by four nitrogen atoms from bridging imidazolates to form a 3D topological structure with cubic I-43m space group, and typical non-layered stacking can be observed from either ab plane or ac plane [cell parameters: $a=16.9910 \text{ \AA}$, $b=16.9910 \text{ \AA}$, $c=16.9910 \text{ \AA}$].¹ Since the bond length of the M-IM-M unit in the ZIFs is longer than Si-O-Si unit in the conventional zeolite, the ZIFs materials combine the dual

advantages of MOFs and zeolite, such as higher porosity, structural adjustability and stability.²⁻⁵ ZIF-8 and ZIF-67 nanocrystals usually exhibit 3D regular dodecahedron morphology.^{6,7}

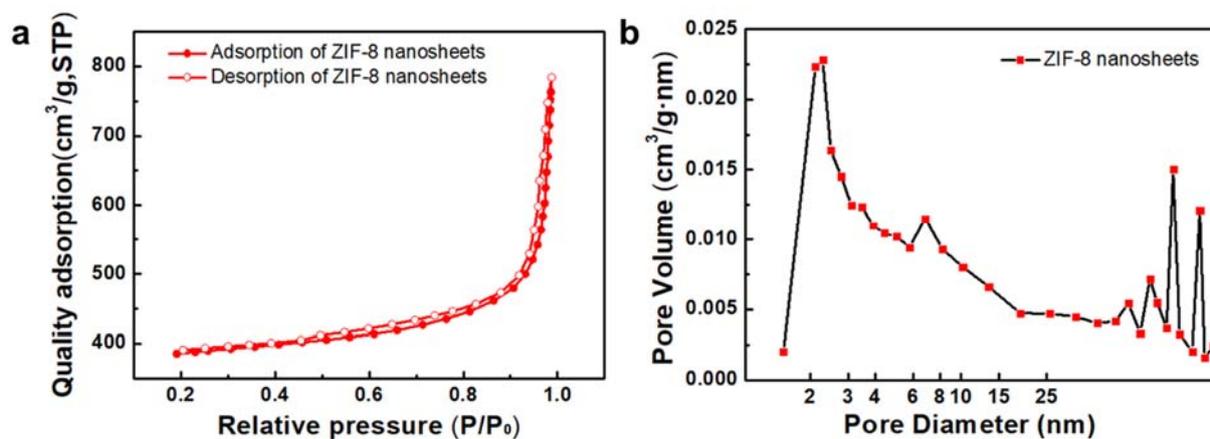


Fig. S3 (a) N₂ adsorption-desorption isotherm curves and (b) the corresponding pore-size distribution of the obtained ZIF-8 NSs.

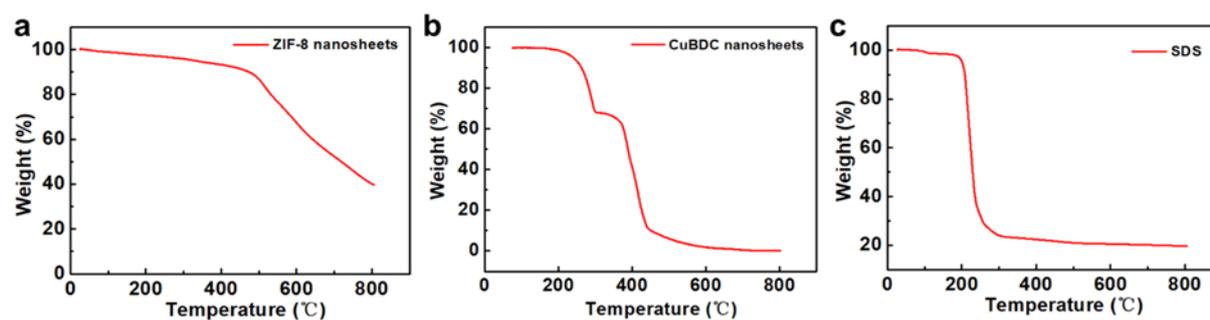


Fig. S4 TGA curves of (a) ZIF-8 NSs, (b) CuBDC NSs, (c) SDS.

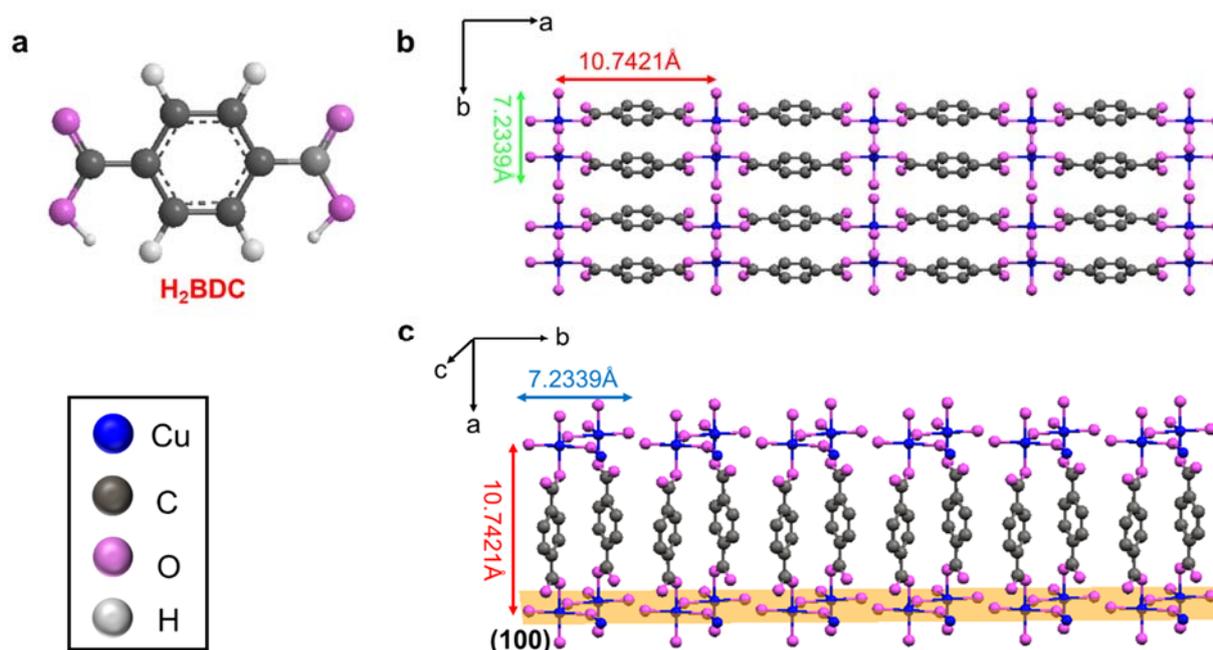


Fig. S5 The crystal structure of CuBDC. (a) The chemical structure of the H₂BDC ligand. (b) The top view of the CuBDC nanosheet structure of ab plane. (c) The structure of ab plane along c axis and (100) plane is marked in yellow. H atoms have been omitted for clarity.⁸

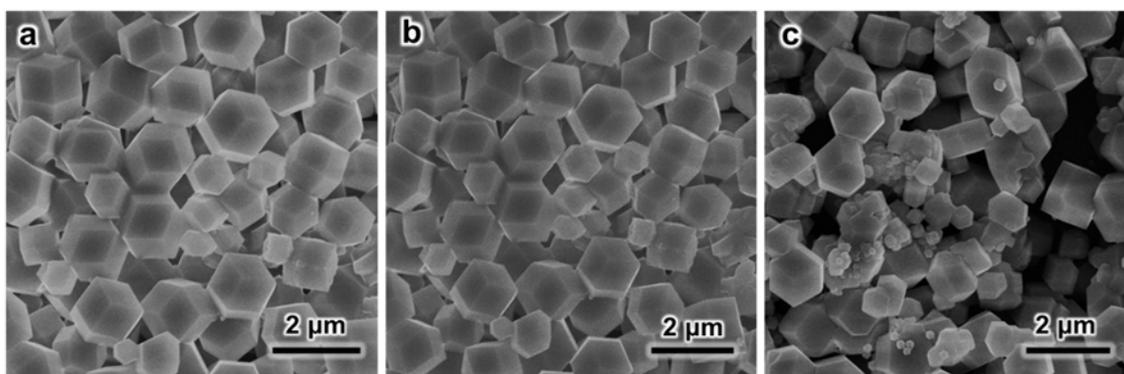


Fig. S6 FESEM images of ZIF-8 nano-dodecahedron in the presence of PVP at the concentrations of (a) 10, (b) 20 and (c) 80 mg•mL⁻¹.

Synthesis of ZIF-8 nanostructures in PVP: 1 mL aqueous solution of ZnAc₂•2H₂O (0.06 g, 0.273 mmol) and 1 mL aqueous solution of PVP (20 mg, 40 mg, 80 mg) were mixed to form a homogeneous solution. Next, 1 mL 2-MIM aqueous solution (0.224 g, 2.73 mmol) was added dropwise to the above mixture under stirring for 20 s. Finally, the mixed solution was left stand for 24 hours at 25 °C. The product was obtained as white precipitate and washed three times by fresh methanol and centrifuged at 8,000 r.p.m. for 3 minutes.

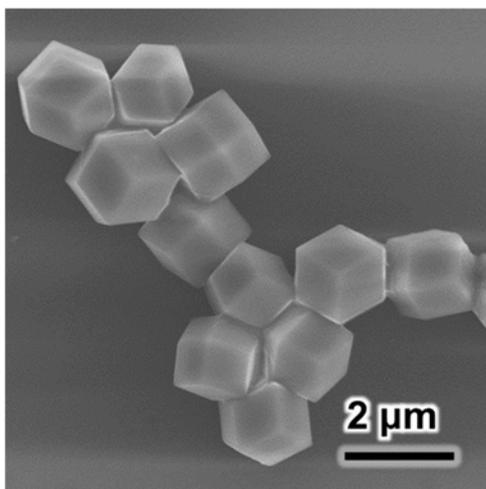


Fig. S7 FESEM images of ZIF-67 nano-dodecahedrons in the presence of PVP.

Synthesis of ZIF-67 nanostructures in PVP: 1 mL aqueous solution of $\text{CoAc}_2 \cdot 2\text{H}_2\text{O}$ (0.048 g, 0.193 mmol) and 1 mL aqueous solution of PVP (20 mg) were mixed to form a homogeneous solution. Next, 1 mL 2-MIM aqueous solution (0.224 g, 2.73 mmol) was added dropwise to the above mixture under stirring for 20 s. Finally, the mixed solution was left stand for 24 hours at 25 °C. The product was obtained as white precipitate and washed three times by fresh methanol and centrifuged at 8,000 r.p.m. for 3 minutes.

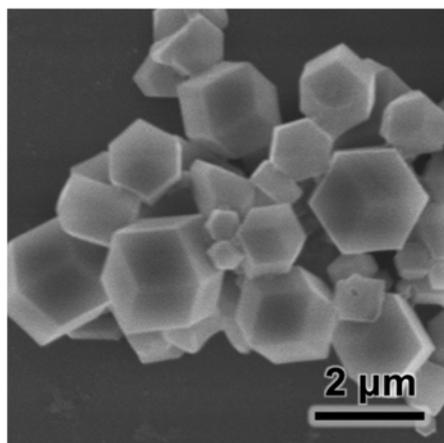


Fig. S8 The FESEM image of ZIF-8 nano-dodecahedrons synthesized without surfactant.

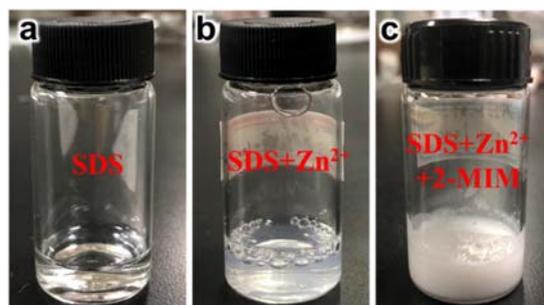


Fig. S9 The photographs of (a) 45.5 mM aqueous solution of SDS, (b) SDS and zinc acetate mixture (c) the reaction system after adding 2-MIM ligand in the presence of SDS.

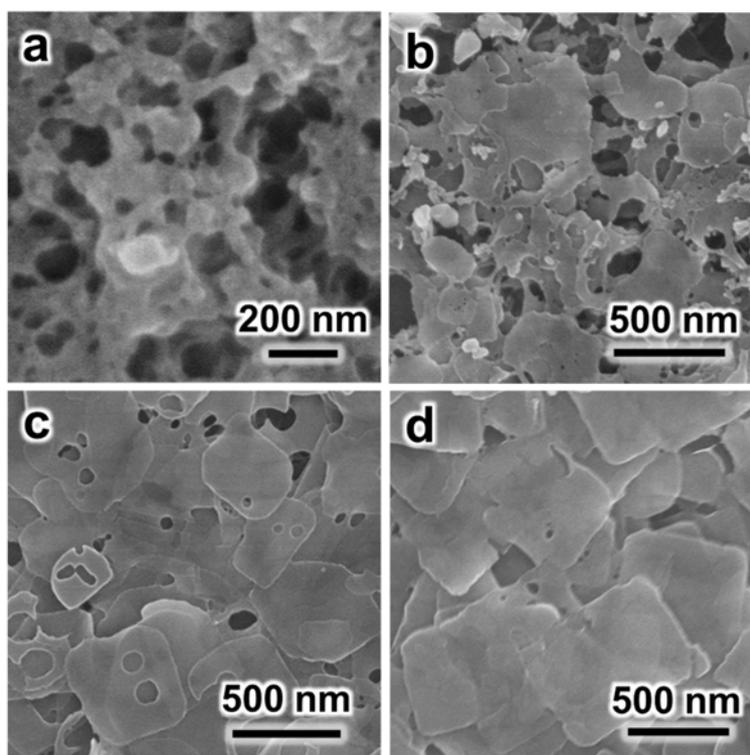


Fig. S10 FESEM images of ZIF-8 products at (a) 0 minute, (b) 2 hours, (c) 4 hours and (d) 24 hours after the ligand added in SDS and $\text{ZnAc}_2 \cdot 2\text{H}_2\text{O}$ mixture solution.

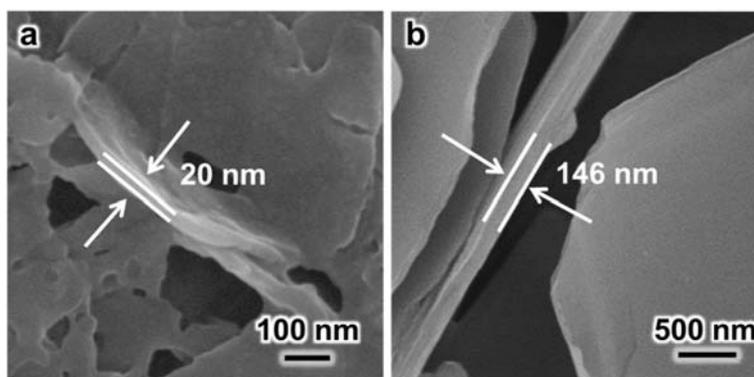


Fig. S11 Enlarged FESEM images of Fig. 6 with tagged thickness of (a) ZIF-67 and (b) ZnTCPP NSs.

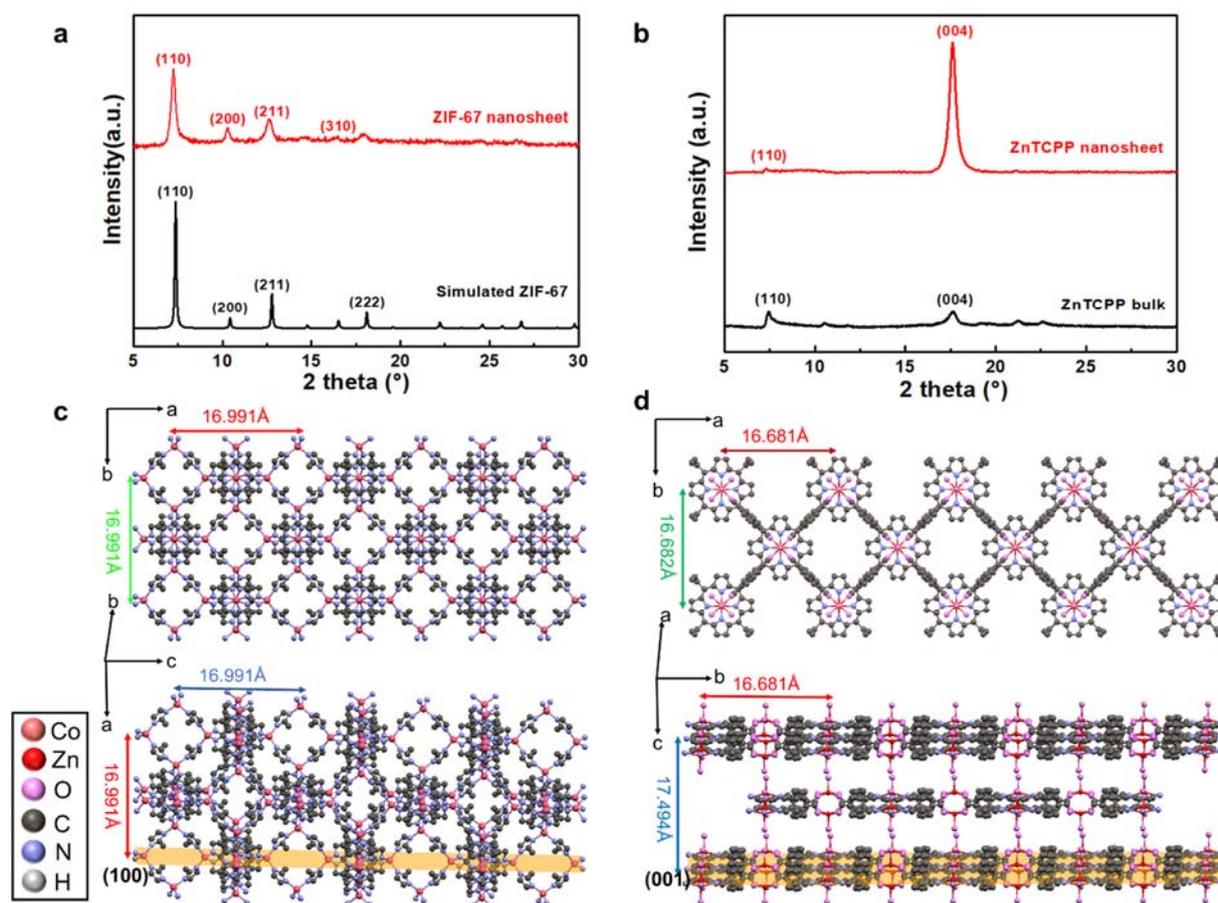


Fig. S12 XRD patterns and corresponding simulated XRD patterns of (a) ZIF-67 and (b) ZnTCPP nanosheets on glass.^{9, 10} (c) The structure of ab plane along c axis of ZIF-67 and ac plane along b axis of ZIF-67, (100) plane is marked in yellow. (CCDC number: 671073).⁹ (d) The top view of the ZnTCPP nanosheet structure of ab plane and the structure of bc plane along a axis of ZnTCPP, (001) plane is marked in yellow. H atoms have been omitted for clarity.¹⁰

Synthesis of bulk Zn-TCPP MOFs: a mixture of $\text{Zn}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ (8.9 mg, 0.03 mmol), TCPP (7.9 mg, 0.01 mmol), pyrazine (1.6 mg, 0.02 mmol), DMF (1.5 mL) and ethanol (0.5 mL) was added into a small capped vial, and heated at 80 °C for 24 h. The resulting dark purple crystals were washed with ethanol.

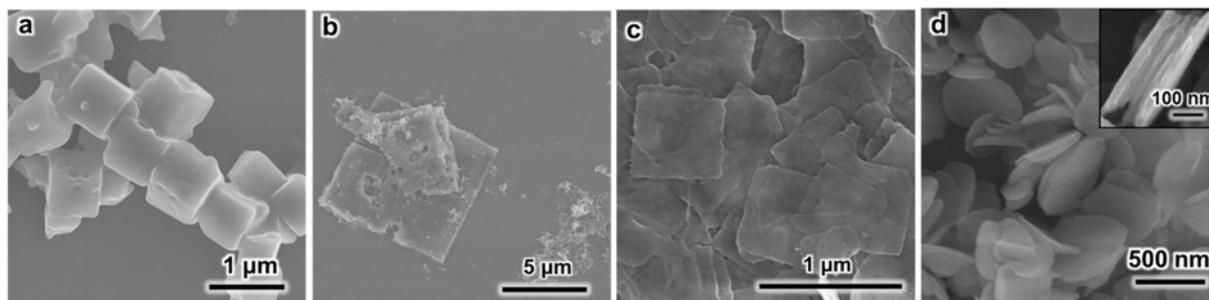


Fig. S13 FESEM images of ZIF-67 at SDS concentrations of (a) 4, (b) 16 and (c) 91 mM, respectively. (d) FESEM images of ZnTCPP at SDS concentrations of 1 mM. The insets are the cross-sectional FESEM images of the MOF nanosheets.

References.

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