Electronic Supplementary Material (ESI) for ChemComm. This journal is © The Royal Society of Chemistry 2024

Supporting Information

Construction of a stable radical hydrogen–bonded metal–organic framework by functionalized tetrathiafulvalene linkers

Jian Su, *^{a,b} Xiao Han,^a Si-Wen Ke,^a Xiao-Cheng Zhou,^a Shuai Yuan,^a Mengning Ding,^a and Jing-Lin Zuo*^a

^a State Key Laboratory of Coordination Chemistry, School of Chemistry and Chemical Engineering, Nanjing University, Nanjing 210023, P. R. China.

^b School of Chemistry and Chemical Engineering, Nanjing University of Science and Technology, Nanjing, 210094 P. R. China.

*Email: sujian@njust.edu.cn and zuojl@nju.edu.cn

Table of Content

S1. Experimental Procedures	3
Materials and instrumentation.	3
Measurements.	3
S2. Results and Discussion	6
Scheme S1. The synthesis route of (2-Me)-H4TTFTB.	6
Figure S1. The asymmetric unit of Cd-(2-Me)-H ₂ TTFTB. Displacement ellipsoids are drawn at the 50% probability level	6
Figure S2. X-ray powder diffraction patterns of Cd-(2-Me)-H ₂ TTFTB in different organic solvents or in ai for 24 hours	ir 7
Figure S3. X-ray powder diffraction patterns of Cd-(2-Me)-H2TTFTB in water for 24 hours and 2 months	s 8
Figure S4. The TGA plots of Cd-(2-Me)-H2TTFTB in N2 atmosphere.	8
Figure S5. Cyclic voltammograms of (2-Me)-H4TTFTB performed over four consecutive cycles at scan rat of 100 mV/s. The experiments were conducted in 0.1 M LiBF4 in DMF electrolyte	te 9
Figure S6. The configuration of TTF motif in Cd- <i>m</i> -TTFTB, Cd ₂ TTFTB, and Cd-(2-Me)-H ₂ TTFTB	10
Figure S7. The EPR spectra (110 K) of MOFs Cd-(2-Me)-H2TTFTB and Cu-H2TTFTB	10
Figure S8. Solid-state diffuse reflectance spectrum of Cd-(2-Me)-H2TTFTB	11
Figure S9. Tauc plot of Cd-(2-Me)-H2TTFTB.	12
Figure S10. The magnetic $\chi_M T$ plot of Cd-(2-Me)-H ₂ TTFTB.	12
Figure S11. The IR spectra for (2-Me)-H4TTFTB and Cd-(2-Me)-H2TTFTB.	13
Figure S12. Photographs of Cd-(2-Me)-H2TTFTB, Cd2TTFTB, and Cd- <i>m</i> -TTFTB.	13
Figure S13. The heating and cooling cycle under different energy power 808 nm laser with the samples Cd2TTFTB and Cd- <i>m</i> -TTFTB	of 14
Table S1. Crystal data and structure refinement parameters for compound Cd-(2-Me)-H2TTFTB	15
Table S2. Selected bond lengths (Å) and angles (°) of Cd-(2-Me)-H2TTFTB.	16
Table S3. The central C-C and C-S bond length in Cd-(2-Me)-H2TTFTB, Cd-m-TTFTB, and Cd2TTFTB	17
Table S4. The photothermal properties in this work compared with previous results of pristine MOFs in t literature.	he 18
References	19

S1. Experimental Procedures

Materials and instrumentation.

All the reagents and solvents were commercially available and used as received.

Synthesis of (2-Me)-H₄**TTFTB.** (2-Me)-H₄TTFTB were synthesized similar to 3Me-H₄TTFTB with Methyl-4-bromo-2-methylbenzoate instead of Methyl-3-bromo-2-methylbenzoate.^[1] (2-Me)-H₄TTFTB in red solid was obtained with a yield of 30%. Calcd for C₃₈H₂₈O₈S₄ (Mr= 740.874 g/mol): C, 61.61; H, 3.81 %. Found: C, 62.04; H, 3.73 %. ¹H-NMR (400 MHz, d₆-DMSO) δ 13.11 (s, 4H), 7.72 (d, *J* = 8.1 Hz, 4H), 7.23 (s, 4H), 7.06-7.08 (d, *J* = 8.2 Hz, 4H), 2.43 (s, 12H); ¹³C-NMR (75 MHz, d₆-DMSO) δ 168.39, 140.40, 134.88, 132.10, 131.33, 131.25, 131.20, 129.31, 126.77, and 21.53. ESI-MS m/z calcd for C₃₈H₂₈O₈S₄ [M – H] 739.08, found 739.06.

Synthesis of Cd-(2-Me)-H₂TTFTB, [Cd((2Me)-H₂TTFTB)(H₂O)₃(NO₃)_{0.5}]·EtOH·4H₂O. It follows the dissolution of (2-Me)-H₄TTFTB (0.0075 g, 0.010 mmol) in 0.75 mL DMF and 0.25 mL H₂O before addition of a solution of Cd(NO₃)₂·4H₂O (0.0077 g, 0.025 mmol) in 1.0 mL ethanol and 1.0 mL H₂O. The mixture was heated to 75 °C for 72 h, then allowed to cool to room temperature. The crystalline products were filtered and washed with ethanol three times. Finally, the black block crystals were obtained (yield: 65%).

Measurements.

Fourier transform infrared spectrometry. FT-IR data were recorded on a Vector27 Bruker Spectrophotometer with KBr pellets in the 4000 – 400 cm⁻¹ region.

Nuclear Magnetic Resonance Spectroscopy. ¹H NMR spectra were recorded on 400 MHz spectrometers. Chemical shifts of ¹H NMR spectra were reported in parts per million relative to tetramethylsilane ($\delta = 0$). The following abbreviations were used to describe peak splitting patterns when appropriate: s = singlet and d = doublet. ¹³C NMR spectra were recorded on 75 MHz spectrometers. Chemical shifts were reported in parts per million relative to tetramethylsilane ($\delta = 0$).

Mass spectra (MS) were recorded on a BRUKER VPEXII spectrometer with ESI mode unless otherwise stated.

Elemental analyses (EA) for C and H were performed on Vario ELIII.

Thermogravimetric analysis. TGA data of Cd-(2-Me)-H₂TTFTB were obtained on a STA 449C thermal analysis system with a heating rate of 10 °C min⁻¹ under N₂ atmosphere.

Powder X-ray diffraction. The PXRD data were collected with a scan speed of 5 s·deg⁻¹ on a Bruker Advance D8 (40 kV, 40 mA) diffractometer with Cu radiation (λ = 1.54056 Å) at room temperature. Calculated PXRD patterns were generated using Mercury 3.0.

Electron paramagnetic resonance spectra. EPR spectra were obtained by using a Bruker EMX-10/12 variable-temperature apparatus at 110 K. The EPR spectra of $4.4 \times 10-5$ mol/L (2-Me)-H4TTFTB in DMF was measured at room temperature.

Solid state cyclic voltammetry. Solid state cyclic voltammetry measurements were performed in *n*-Bu₄NPF₆/CH₃CN electrolyte using a CORREST 4-channel electrochemical workstation and three electrode system. The CVs were recorded using a glassy carbon working electrode (3.0 mm diameter), a platinum wire auxiliary electrode and an Ag/AgCl reference electrode. The sample was mounted on the glassy carbon working electrode by dipping the electrode into a paste made of the powder sample in ethanol. Ferrocene was measured as a standard. All potentials are reported in milli-Volts (mV) versus the Fc/Fc⁺ couple.

Solid-state UV-Vis-NIR spectra. Solid-state UV-vis-NIR spectra were measured on a UV-3100 spectrophotometer over the range of 200-900 nm. BaSO₄ was used for the baseline.

Conductivity test. The conductivity of the samples was obtained from Keithley 2400 source meter on CRX-4K High Performance Closed Cycle Refrigerator-based Probe Station at room temperature. The sample powders were cold-pressed under pressure of 1 Ton into pellets, which were connected by the conductive carbon adhesive with the "two probe method". The conductivity σ could be expressed as, $\sigma = G \cdot L / A$, where L and G are the thickness, electrical conductance of the pellet, respectively, and A is the area of the conductive carbon adhesive. All of the current-voltage (I-V) measurements were performed in ambient conditions by sweeping the voltage from -2 V to 2 V.

Near-infrared photothermal conversion. ~10 mg samples were pressed into thin slices with a diameter of 4 mm and then seted aside in a quartz petri dish. And then the slice of Cd-(2-Me)-H₂TTFTB was spread on a quartz slide at a distance of 8 cm from the 808 nm laser (Hi-Tech Optoelectronics Co., Ltd, Beijing, China). The power density of laser was adjusted between 0.1 and 0.7 W cm⁻². The infrared camera (Fotric 255 Pro Thermal Imaging Camera) was used to capture the infrared videos of the MOF sample when the illumination was on/off. The infrared photos and real-time temperatures for the MOF sample were extracted from the video by AnalyzIR software.

X-Ray Crystallographic Analysis. Data of Cd-(2-Me)-H₂TTFTB was collected on a Bruker D8 Venture diffractometer outfitted with a PHOTON-100 CMOS detector using monochromatic microfocus Mo- K_{α} radiation (λ = 0.71073 Å) that was operated at 50 kV and 40 mA at 173 K by a chilled nitrogen flow controlled by a KRYOFLEX II low temperature attachment. The raw data collection and reduction were done using APEX3 software.^[2] Adsorption corrections were applied using the SADABS routine. The structures were solved by direct methods and refined by fullmatrix least-squares on F² using the SHELXTL software package.^[3] Non-hydrogen atoms were refined with anisotropic displacement parameters during the final cycles. The SHELXTL restraint instruction ISOR was applied to these disordered groups to keep their geometries and atomic displacement parameters reasonable. Some restraints, like DELU, ISOR, DFIX were added to the terminal carboxylate and methyl groups for a better geometry configuration. Hydrogen atoms of (2-Me)-H₂TTFTB²⁻ and water molecules were calculated in ideal positions with isotropic displacement parameters. The hydrogen atoms at O10 and O11 are not well defined in difference-map plots and were refined with the AFIX 3 commands. Some guest molecules of DMF and H₂O for Cd-(2-Me)-H₂TTFTB were highly disordered and were not successfully located or refined. The diffuse electron densities resulting from these residual solvent molecules were removed from the data set using the SQUEEZE routine of PLATON and refined further using the data generated.^[4] It shows nearly 120 electrons were squeezed out including the disordered ethanol and water molecules, the disordered nitrate ion and the heave atom effect coming from the Cd and S atoms. The contents of the solvent region are represented in the unit cell contents in crystal data. Attempts to precisely calculate the solvent molecules were unsuccessful due to the heave atom effect coming from the Cd and S atoms. Therefore, the content of solvent molecules was calculated from TGA. The proposed formula was [Cd((2Me)-H₂TTFTB)(H₂O)₃(NO₃)_{0.5}]·EtOH·4H₂O. The X-ray crystallographic data reported in this article has been deposited at the Cambridge Crystallographic Data Centre (CCDC), under deposition number CCDC 2195767 for Cd-(2-Me)-H₂TTFTB.

These data can be obtained free of charge from the Cambridge Crystallographic Data Centre via www.ccdc.cam.ac.uk/data_request/cif. All relevant data supporting the findings of this study are available from the corresponding authors on request.

S2. Results and Discussion



Scheme S1. The synthesis route of (2-Me)-H₄TTFTB.



Figure S1. The asymmetric unit of Cd-(2-Me)-H₂TTFTB. Displacement ellipsoids are drawn at the 50% probability level.

The asymmetric unit contains one Cd(II) ion, one $(2-Me)-H_2TTFTB^{2-}$, three coordinated water molecules, and one free water molecule. Additionally, through the magnetic susceptibility data, electron paramagnetic resonance and Fourier transform infrared spectrometry, $1/2 \text{ NO}_3^-$ ions were found for the charge equalization. And, the TGA result reveals the existence of one free ethanol and 4 free water molecules. Considering all these informations, the proposed formula was [Cd((2Me)-H_2TTFTB)(H_2O)_3(NO_3)_{0.5}]-EtOH-4H_2O.



Figure S2. The reported crystal structure of Cd₂TTFTB.^[5] The coordination environments of Cd1 (a) and Cd2 (b) ions in Cd₂TTFTB. (c) The coordination environment of TTFTB⁴⁻ in Cd₂TTFTB. The three-dimensional structure of Cd₂TTFTB in the *c* direction.



Figure S3. X-ray powder diffraction patterns of Cd-(2-Me)-H₂TTFTB in different organic solvents or in air for 24 hours.



Figure S4. X-ray powder diffraction patterns of Cd-(2-Me)-H₂TTFTB in water for 24 hours and 2 months.





Thermogravimetric analysis of Cd-(2-Me)-H₂TTFTB was conducted from room temperature to 800 °C under N₂ atmosphere. The weight losses about 12.1% at 103 °C (calcd 11.2% for four H₂O and one ethanol), 5.3% at 180 °C (calcd 5.1% for three coordinated H₂O) correspond to the release of coordinated H₂O. A plateau up to ca. 300 °C was followed, implying that Cd-(2-Me)-H₂TTFTB was stable up to 300 °C. After the plateau, Cd-(2-Me)-H₂TTFTB began to decompose.



Figure S6. X-ray powder diffraction patterns of Cd-(2-Me)-H₂TTFTB after treated under 200 °C for 1 hour.



Figure S7. Cyclic voltammograms of (2-Me)-H₄TTFTB performed over four consecutive cycles at scan rate of 100 mV/s. The experiments were conducted in 0.1 M LiBF₄ in DMF electrolyte.



Figure S8. The configuration of TTF motif in Cd-*m*-TTFTB, Cd₂TTFTB, and Cd-(2-Me)-H₂TTFTB.



Figure S9. The EPR spectra (110 K) of MOFs Cd-(2-Me)-H₂TTFTB and Cu-H₂TTFTB.



Figure S10. The absorption and EPR spectra of 4.4×10^{-5} mol/L (2-Me)-H₄TTFTB.



Figure S11. Solid-state diffuse reflectance spectrum of Cd-(2-Me)-H₂TTFTB.

In the solid-state adsorption spectrum, two primary absorption bands are observed in the 200–700 nm region, which can be attributed to the $\pi \rightarrow n^*$ or $\pi \rightarrow \pi^*$ transition of the TTF-based ligand.



Figure S12. Tauc plot of Cd-(2-Me)-H₂TTFTB.



Figure S13. The magnetic $\chi_M T$ plot of Cd-(2-Me)-H₂TTFTB.



Figure S14. The IR spectra for (2-Me)-H₄TTFTB and Cd-(2-Me)-H₂TTFTB.



Figure S15. Photographs of Cd-(2-Me)-H₂TTFTB, Cd₂TTFTB, and Cd-*m*-TTFTB.



Figure S16. The heating and cooling cycle under different energy power 808 nm laser with the samples of Cd₂TTFTB and Cd-*m*-TTFTB.

Table S1. Crystal data and structure refinement parameters for compound Cd-(2-Me)-H₂TTFTB.

	Cd-(2-Me)-H ₂ TTFTB
Empirical formula	C40H46CdO17.5N0.5S4
Formula weight	1054.46
Temperature (K)	173
Crystal system	Monoclinic
Wavelength (Å)	0.71073
Space group	<i>P</i> 2 ₁ / <i>n</i> (No. 14)
Unit cell dimensions (Å,°)	
а	10.722(3)
b	39.433(11)
с	14.317(4)
α	90
β	97.000(7)
γ	90
Volume (ų)	6008(3)
Z	4
Calculated density (gcm ⁻³)	1.166
F(000)	1960
Absorption coefficient, μ/mm^{-1}	0.558
No. of reflections measured	14334
No. of independent reflections	7903
θ (°)	2.11-22.72
R _{int}	0.0570
R₁, wR₂[l≥2σ (l)] [a]	0.0755/ 0.1934
R1, wR2[all data]	0.1182/ 0.2120
GOF	1.098
Largest diff. peak and hole(eÅ-3)	0.77 / -0.79
CCDC numbers	2195767

 $\label{eq:rescaled} \text{[a] R1 = Σ||F_o| -|F_c||/Σ|F_o|, wR_2= $[\Sigma$w(F_o^2$- F_c^2)^2/Σw(F_o^2$)^2]^{1/2}$.}$

Cd1—O1	2.447(6)	Cd1—O9	2.300(7)
Cd1—O2	2.384(6)	Cd1—O10	2.256(7)
Cd1—O5	2.424(7)	Cd1—O11	2.256(9)
Cd1—O6	2.373(6)		
O1—Cd1—O2	54.6(2)	O5—Cd1—O6	54.5(2)
O1—Cd1—O5	165.6(2)	O5—Cd1—O9	91.0(3)
O1—Cd1—O6	138.4(2)	O5—Cd1—O10	84.4(3)
O1—Cd1—O9	94.2(2)	O5—Cd1—O11	91.7(3)
O1-Cd1-O10A	82.2(2)	O6—Cd1—O9	92.2(3)
O1-Cd1-O11	84.1(3)	O6—Cd1—O10	138.8(3)
O2—Cd1—O5	138.9(2)	O6—Cd1—O11	86.0(3)
O2—Cd1—O6	84.5(2)	O9—Cd1—O10	90.2(4)
O2—Cd1—O9	89.7(2)	O9—Cd1—O11	175.1(3)
O2—Cd1—O10	136.7(2)	O10—Cd1—O11	94.1(4)
O2-Cd1-O11	85.7(3)		

Table S3. The central C-C and C-S bond length in Cd-(2-Me)-H2TTFTB, Cd-m-TTFTB, and Cd2TTFTB.

Cd-(2-Me)-H ₂ TTFTB					
C9—C10	1.353(10)	C19—C20	1.368(10)	C21—C22	1.378(10)
S1—C20	1.756(8)	S1—C22	1.756(7)	S2—C20	1.751(8)
S2—C21	1.771(8)	S3—C9	1.768(7)	S3—C19	1.749(8)
S4—C10	1.775(7)	S4—C9	1.741(8)		
		Cd- <i>m</i> - ⁻	TTFTB		
C17—C18	1.341(4)	C35—C35 ⁱ	1.340(6)	C52—C52 ⁱⁱ	1.341(7)
C8—C9	1.348(4)	C36—C37	1.348(4)	C53—C54	1.350(4)
C19—C20	1.345(4)				
S1—C8	1.761(3)	S1—C17	1.759(3)	S2—C9	1.759(3)
S2—C17	1.749(3)	S3—C18	1.753(3)	S3—C20	1.758(3)
S4—C18	1.758(3)	S4—C19	1.758(3)	S5—C35	1.758(3)
S5—C37	1.760(3)	S6—C35	1.752(3)	S6—C36	1.757(3)
S7—C52	1.755(3)	S7—C54	1.757(3)	S8—C52	1.756(3)
S8—C53	1.754(3)				
		Cd ₂ T	IFTB		
C3—C6	1.317(7)	C4—C5	1.350(8)	C7—C8	1.336(8)
S1—C3	1.755(5)	S1—C4	1.750(6)	S2—C3	1.751(5)
S2—C5	1.758(6)	S3—C6	1.753(5)	S3—C7	1.753(5)
S4—C6	1.760(5)	S4—C8	1.759(6)		

Symmetry transformations used to generate equivalent atoms: (i) -x, -y+1, -z; (ii) 2-x, -y+1, 1-z.

			-		
Ref	Samples	Light source	Light Intensity	Temperature ranges	Added temperature
This Work	Cd-(2-Me)-H ₂ TTFTB	808 nm NIR laser	0.7 W cm ⁻²	28-164.9 °C	136.9 °C in 15 s
This Work	Cd-(2-Me)-H ₂ TTFTB	808 nm NIR laser	0.7 W cm ⁻²	28-178.1 °C	150.1 °C in 90 s
This Work	Cd ₂ TTFTB	808 nm NIR laser	0.7 W cm ⁻²	33.1-110.2 °C	77.1 °C in 15 s
This Work	Cd ₂ TTFTB	808 nm NIR laser	0.7 W cm ⁻²	33.1-131.1 °C	98 °C in 90 s
This Work	Cd- <i>m</i> -TTFTB	808 nm NIR laser	0.7 W cm ⁻²	31.3-93.3 °C	62 °C in 90 s
This Work	Cd- <i>m</i> -TTFTB	808 nm NIR laser	0.7 W cm ⁻²	31.3-112.1 °C	80.8 °C in 15 s
[6]	Dy-2D-MOF	1 sun light	0.1 W cm ⁻²	29.2-63.9	34.7 °C in 4 min
[7]	HKUST-1	UV-Vis irradiation (300-650 nm)	0.5 W cm ⁻²	25.0-124.7	99.3 °C in 30 min
[7]	UiO-66	UV-Vis irradiation (300-650 nm)	0.5 W cm ⁻²	25.5-57.3	31.8 °C in 30 min
[7]	UiO-66-NH ₂	UV-Vis irradiation (300-650 nm)	0.5 W cm ⁻²	25.0-148.6	123.6 °C in 30 min
[7]	ZIF-8	UV-Vis irradiation (300-650 nm)	0.5 W cm ⁻²	26.1-70.5	44.4 °C in 30 min
[7]	ZIF-67	UV-Vis irradiation (300-650 nm)	0.5 W cm ⁻²	26.4-127.7	101.3 °C in 30 min
[7]	Fe-MIL-NH ₂	UV-Vis irradiation (300-650 nm)	0.5 W cm ⁻²	27.6-143.4	115.8 °C in 30 min
[7]	IR-MOF-3	UV-Vis irradiation (300-650 nm)	0.5 W cm ⁻²	26.4-118.6	92.2 °C in 30 min
[7]	CPO-27-Zn	UV-Vis irradiation (300-650 nm)	0.5 W cm ⁻²	26.8-145.0	118.2 °C in 30 min
[7]	CPO-27-Ni	UV-Vis irradiation (300-650 nm)	0.5 W cm ⁻²	26.0-166.7	140.7 °C in 30 min
[7]	CPO-27-Mg	UV-Vis irradiation (300-650 nm)	0.5 W cm ⁻²	24.1-135.8	111.7 °C in 30 min
[7]	COF-TAPB-BTCA	UV-Vis irradiation (300-650 nm)	0.5 W cm ⁻²	26.6-141.4	114.8 °C in 30 min
[8]	La-MV-MOF	808 nm NIR laser	2 W cm ⁻²	23.1-111.1 °C	88 °C in 10 s
	(crystals)				
[8]	La-MV-MOF	808 nm NIR laser	2 W cm ⁻²	23.1-145.0 °C	121.9 °C in 200 s
	(film)				
[9]	Tri-PMDI-TTF	808 nm NIR laser	0.7 W cm ⁻²	15-80 °C	65 °C in 200 s
[10]	CR-TPE-T	808 nm NIR laser	0.2 W cm ⁻²	22-38 °C	~16 °C in 12 s
[10]	CR-TPE-T	808 nm NIR laser	0.4 W cm ⁻²	22-59 °C	~37 °C in 12 s
[10]	CR-TPE-T	808 nm NIR laser	0.6 W cm ⁻²	22-76 °C	~54 °C in 30 s
[10]	CR-TPE-T	808 nm NIR laser	0.8 W cm ⁻²	22-97 °C	~75 °C in 30 s
[10]	CR-TPE-T	808 nm NIR laser	1.0 W cm ⁻²	22-110 °C	~88 °C in 30 s
[10]	CR-TPE-T	808 nm NIR laser	1.2 W cm ⁻²	22-129 °C	~107 °C in 30 s
[11]	Ag-2D-CPs	800 nm NIR diode laser	0.5 W cm ⁻²	-	24.5 °C in 3 min
[12]	HPCM-4	1 sun light	0.1 W cm ⁻²	~24-41.2	17.8 °C in 60 min
[13]	Cu-CAT-1 MOF	1 sun light	0.1 W cm ⁻²	~25-53.2	28.2 °C in 40 s
[13]	MHS (Cu-CAT-1 MOF)	1 sun light	0.1 W cm ⁻²	~25-55.9	30.9 °C in 40 s
[14]	Dy- <i>m</i> -TTFTB	808 nm NIR laser	0.7 W cm ⁻²	23.0-82.3 °C	59.3 °C in 15 s
[14]	Dy- <i>m</i> -TTFTB	808 nm NIR laser	0.7 W cm ⁻²	22.8-90.1 °C	67.3 °C in 90 s

Table S4. The photothermal properties in this work compared with previous results of pristine MOFs in the literature.

References

- [1] J. Su, S. Yuan, T. Wang, C. Lollar, J. L. Zuo, J. W. Zhang, H. C. Zhou, Chem. Sci. 2020, 11, 1918-1925.
- [2] C. H. Görbitz, Acta Cryst. B 1999, 55, 1090-1098.
- [3] G. M. Sheldrick, Acta Cryst. A 2007, 64, 112-122.
- [4] A. L. Spek, J. Appl. Crystallogr. 2003, 36, 7-13.
- [5] S. S. Park, E. R. Hontz, L. Sun, C. H. Hendon, A. Walsh, T. Van Voorhis, M. Dincă, J. Am. Chem. Soc. 2015, 137, 1774-1777.
- [6] J. Su, N. Xu, R. Murase, Z. M. Yang, D. M. D'Alessandro, J. L. Zuo, J. Zhu, Angew. Chem. Int. Ed. 2021, 60, 4789-4795.
- [7] J. Espin, L. Garzon-Tovar, A. Carne-Sanchez, I. Imaz, D. Maspoch, ACS Appl. Mater. Interfaces 2018, 10, 9555-9562.
- [8] S. Wang, S. Li, J. Xiong, Z. Lin, W. Wei, Y. Xu, Chem. Commun. 2020, 56, 7399-7402.
- [9] D. Wang, X. Kan, C. Wu, Y. Gong, G. Guo, T. Liang, L. Wang, Z. Li, Y. Zhao, Chem. Commun. 2020, 56, 5223-5226.
- [10] G. Chen, J. Sun, Q. Peng, Q. Sun, G. Wang, Y. Cai, X. Gu, Z. Shuai, B. Z. Tang, Adv. Mater. 2020, 32, e1908537.
- [11] M. Q. Li, M. Zhao, L. Y. Bi, Y. Q. Hu, G. Gou, J. Li, Y. Z. Zheng, Inorg. Chem. 2019, 58, 6601-6608.
- [12] X. Ma, W. Fang, Y. Guo, Z. Li, D. Chen, W. Ying, Z. Xu, C. Gao, X. Peng, Small 2019, 15, 1900354.
- [13] Q. Ma, P. Yin, M. Zhao, Z. Luo, Y. Huang, Q. He, Y. Yu, Z. Liu, Z. Hu, B. Chen, H. Zhang, Adv. Mater. 2019, 31, 1808249.
- [14] J. Su, P. Cai, T. Yan, Z.-M. Yang, S. Yuan, J.-L. Zuo, H. C. Zhou, Chem. Sci. 2022, 13, 1657-1664.