Supporting information for

The Synergistic Effect of Oxygen and Water on the Stability of the Isostructural Family of Metal-Organic Frameworks [$Cr_3(BTC)_2$] and [$Cu_3(BTC)_2$]

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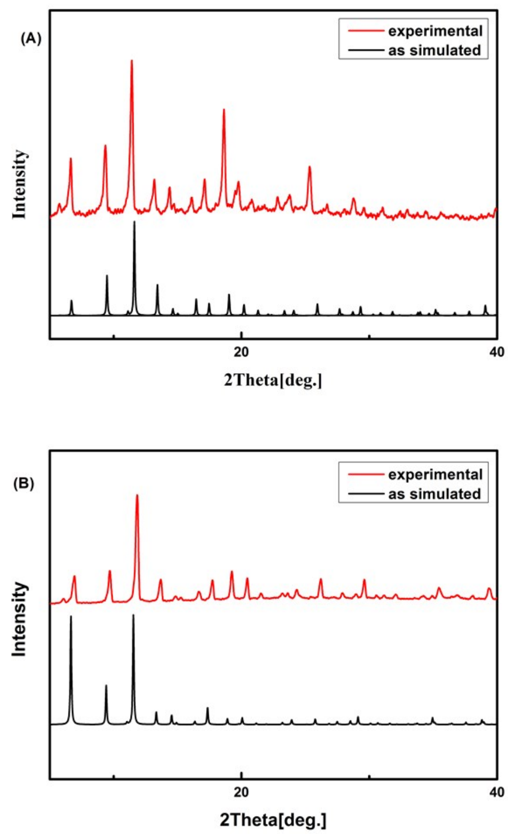


Figure S1. Powder X-ray diffraction patterns of samples and simulations of $Cr_3(BTC)_2$ (A) and $Cu_3(BTC)_2$ (B)

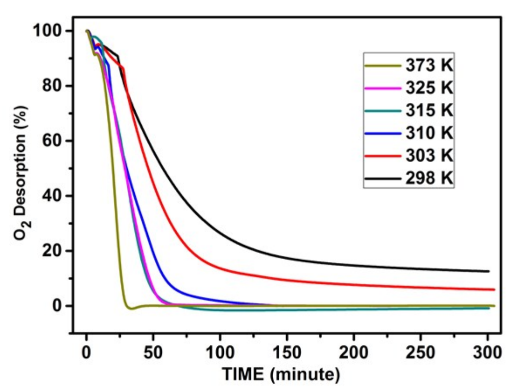
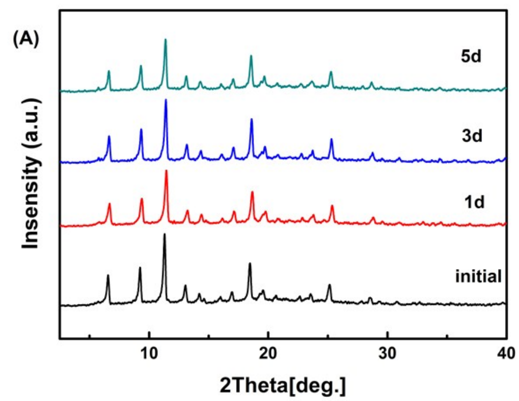


Figure S2. O_2 desorption curve of $Cr_3(BTC)_2$ at different temperature



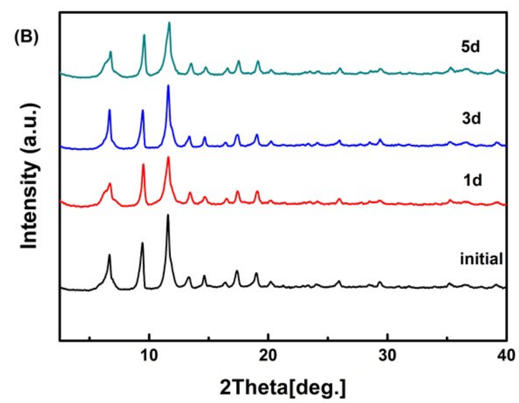


Figure S3. PXRD patterns of the $Cr_3(BTC)_2$ (A) and $Cu_3(BTC)_2$ (B) exposure under oxygen atmosphere for different time

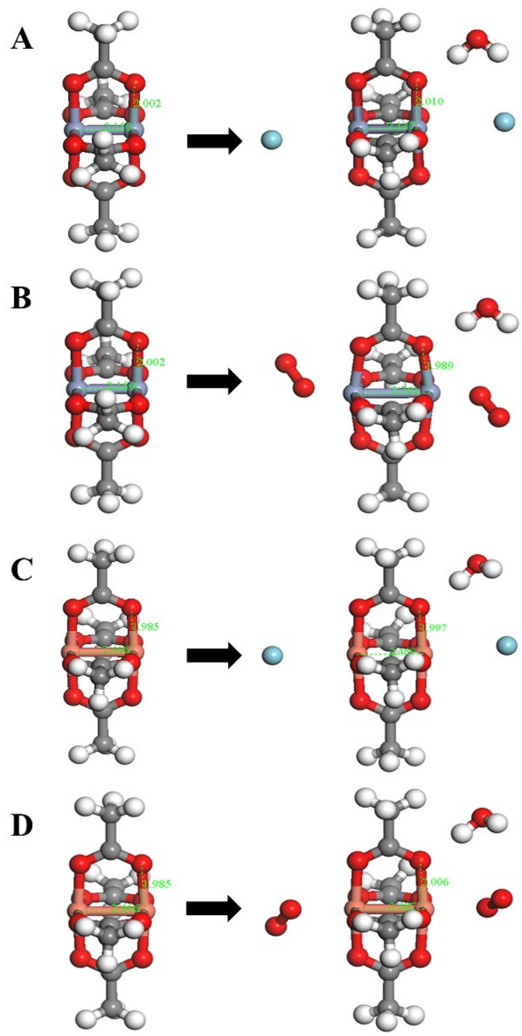


Figure S4. The changes in the bond length in $Cr_3(BTC)_2$ and $Cu_3(BTC)_2$ under the different environments (A. $Cr_3(BTC)_2$ under a H_2O environment; B. $Cr_3(BTC)_2$ in a mixed O_2-H_2O environment; C. $Cu_3(BTC)_2$ under a H_2O environment and D. $Cu_3(BTC)_2$ under a mixed O_2-H_2O environment).

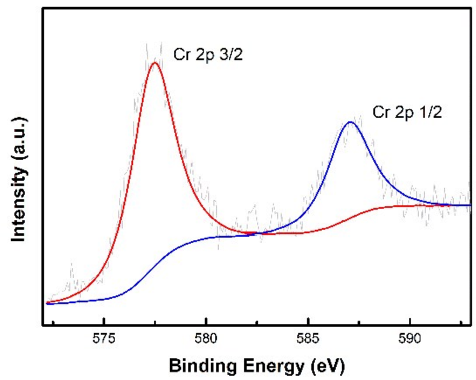


Figure S5. XPS spectrum of Cr in $Cr_3(BTC)_2$ after exposing under oxygen-water atmosphere

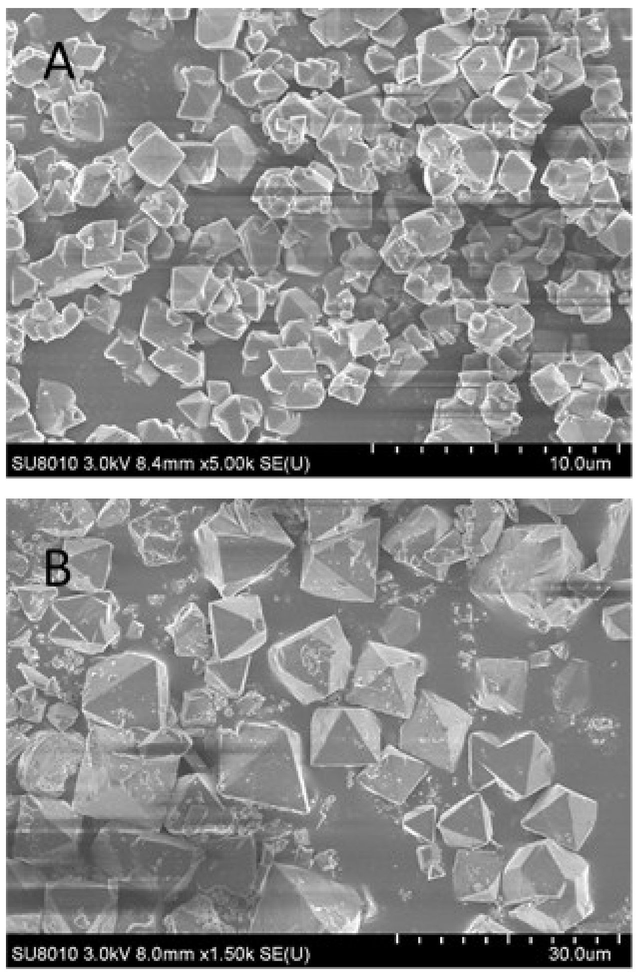


Figure S6 SEM images of $Cr_3(BTC)_2$ (A) and $Cu_3(BTC)_2$ (B)

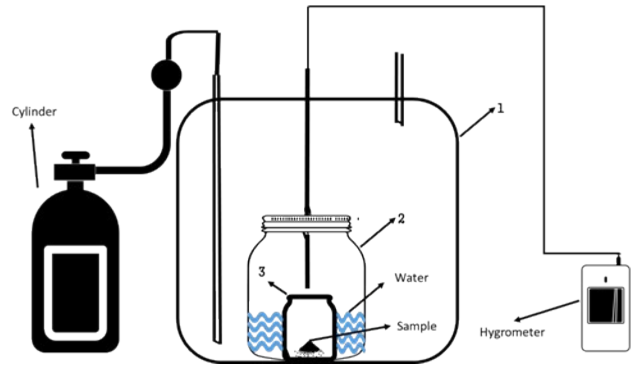


Figure S7. Schematic diagram of stability test

The NO.1 container is filled with the required gas. Some water is placed in container No. 2 and is in a closed state. The sample is the No. 3 container. According to the measurement results, the humidity of the No. 2 container can be guaranteed at 90% -95% RH. Thus, the sample can be in a certain gas and certain relative humidity environment.

Table S1. Comparison of key parameters in oxygen adsorption test of $Cr_3(BTC)_2$

	Activation temperature	Test temperature	Maximum pressure	Oxygen adsorption capacity
Literature[1]	433 K	298 K	1 bar	11 wt%
Our work	393 K	298 K	1 bar	14 wt%

Table S2. Comparison of key parameters in water adsorption test of $Cr_3(BTC)_2$

	Activation temperature	Test temperature	Relative humidity	Water adsorption capacity	Surface area (m^2/g)
Literature[2]	393 K	298 K	80% RH	420cm^3/g	1400
Our work	393 K	298 K	80% RH	355cm^3/g	1067

Table S3. Comparison of key parameters in N_2 adsorption test of $Cr_3(BTC)_2$

	Activation temperature	Activation time	Test temperature	Maximum pressure (P/P_0)	Surface area (m^2/g)
Literature[1]	433 K	48 h	77 K	1	2040 (langmuir)
Our work	393 K	16 h	77 K	1	1403 (BET)

Table S4. Comparison of key parameters in N_2 adsorption test of $Cu_3(BTC)_2$ under water environment

	Activation temperature	Test temperature	Maximum pressure (P/P_0)	Surface area(m^2/g)		
				initial	After water	loss
Literature[3]	423 K	77 K	1	1270	945	26%
Literature[4]	/	77 K	1	1340	647	48%
Our work	393 K	77 K	1	1067	922	13%

References

1. L. J. Murray, M. Dinca, J. Yano, S. Chavan, S. Bordiga, C. M. Brown and J. R. Long, J. Am. Chem. Soc., 2010, 132, 7856-7857.
2. Y. Chen, C. Yang, X. Wang, J. Yang and J. Li, Chem. Eng. J., 2017, 313, 179-186
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