

Supplementary Information

Solid-Lubrication Properties of Copper Benzene-1,4-Dicboxylate, a Metal–Organic Framework with a Two-Dimensional Layered Crystal Structure

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1. SEM observation

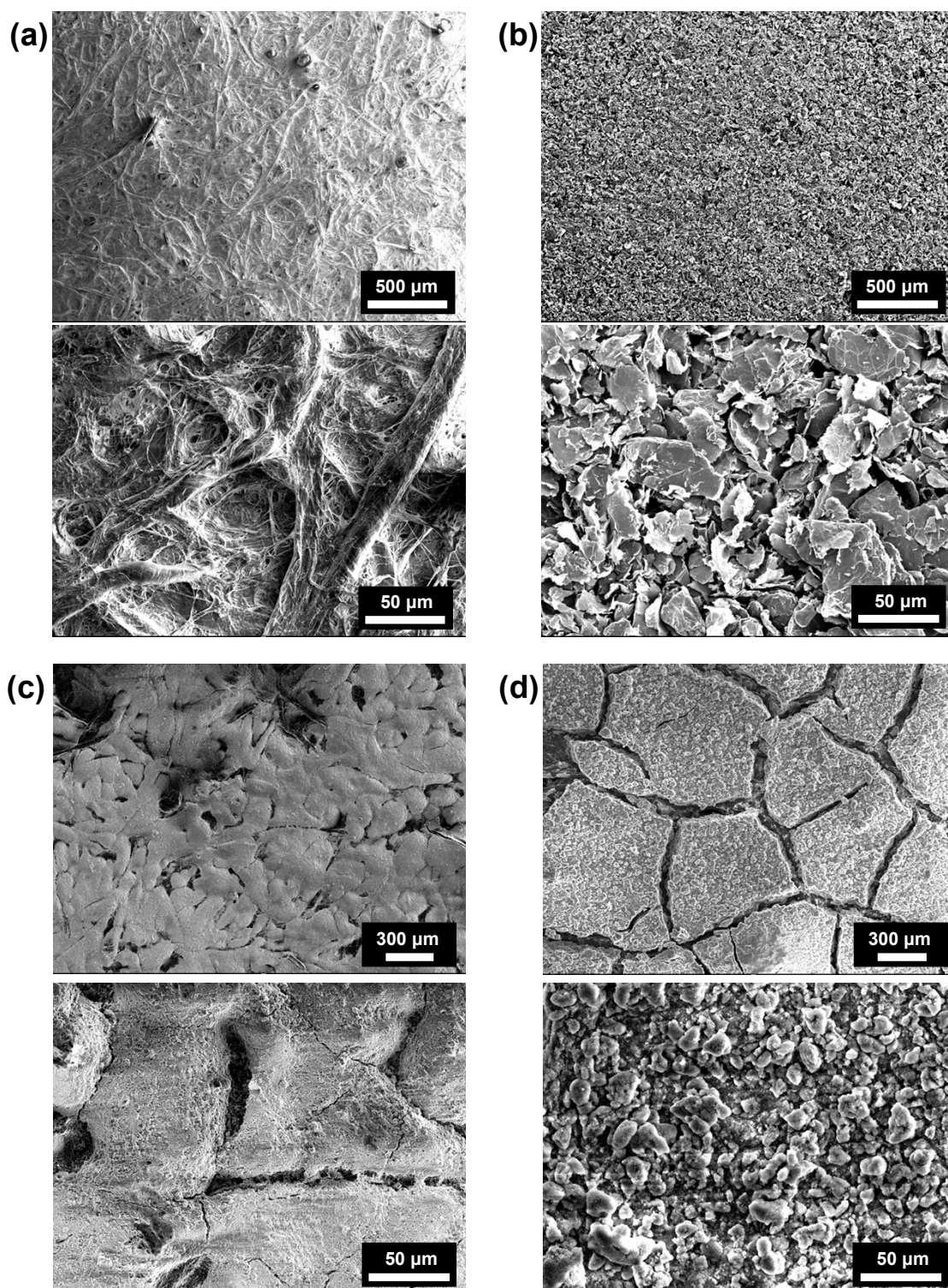


Fig. S1. Scanning electron microscopy (SEM) images of the surface of (a) pristine filter paper, (b) graphite-, (c) PTFE-, and (d) silica-supported specimens.

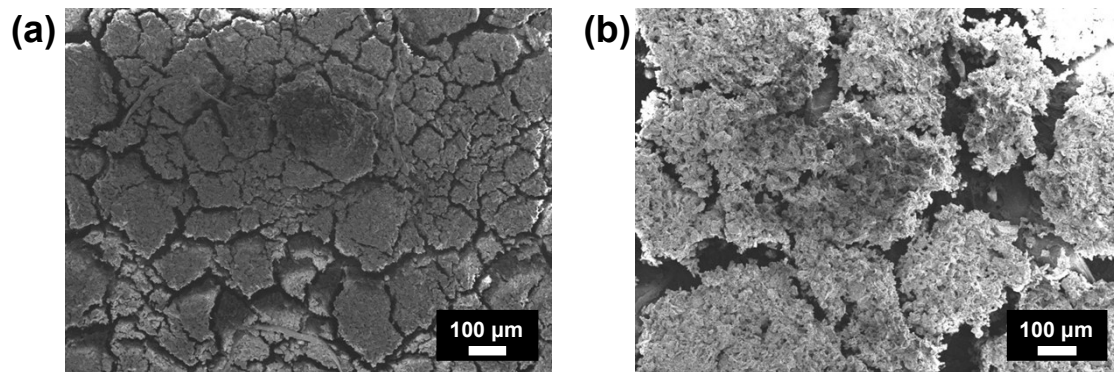


Fig. S2. SEM images of (a) CuBTC- and (d) CuBMC-supported specimens.

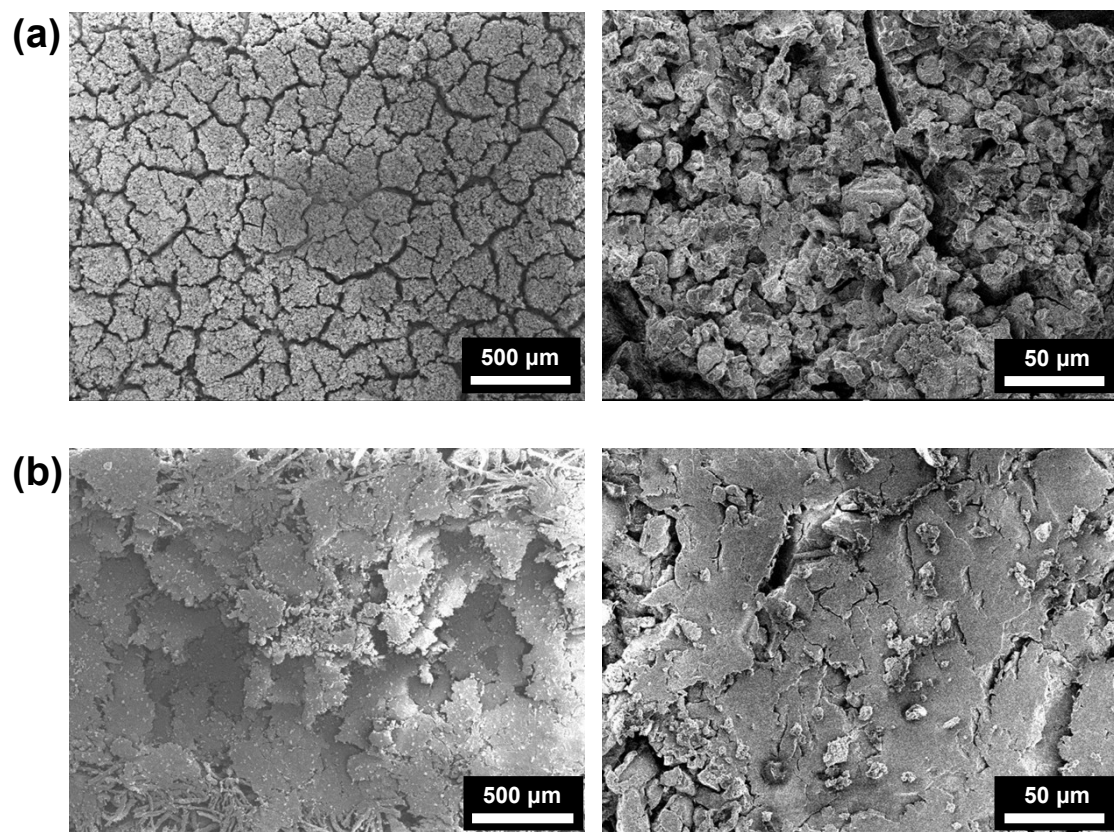


Fig. S3. SEM images of the CuBTC-heat-supported specimens (a) before and (b) after the friction tests.

2. Optical microscope and SEM-EDS observation

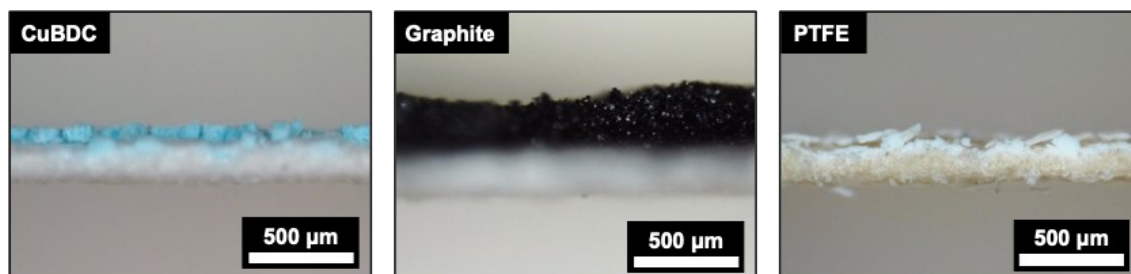


Fig. S4. Optical microscope images of the cross-section of the as-prepared solid lubricant-supported specimen.

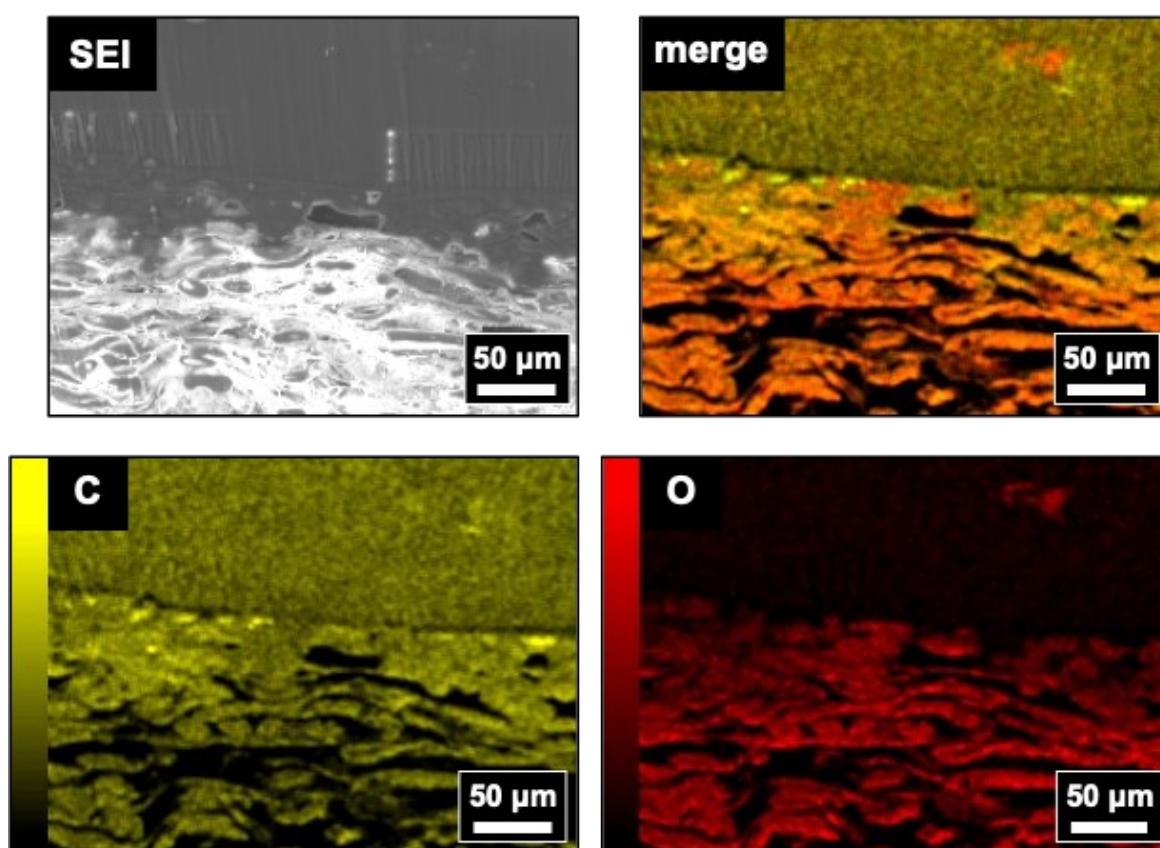


Fig. S5. SEM-EDS elemental mapping of the cross-section of the graphite-supported specimen after a friction test.

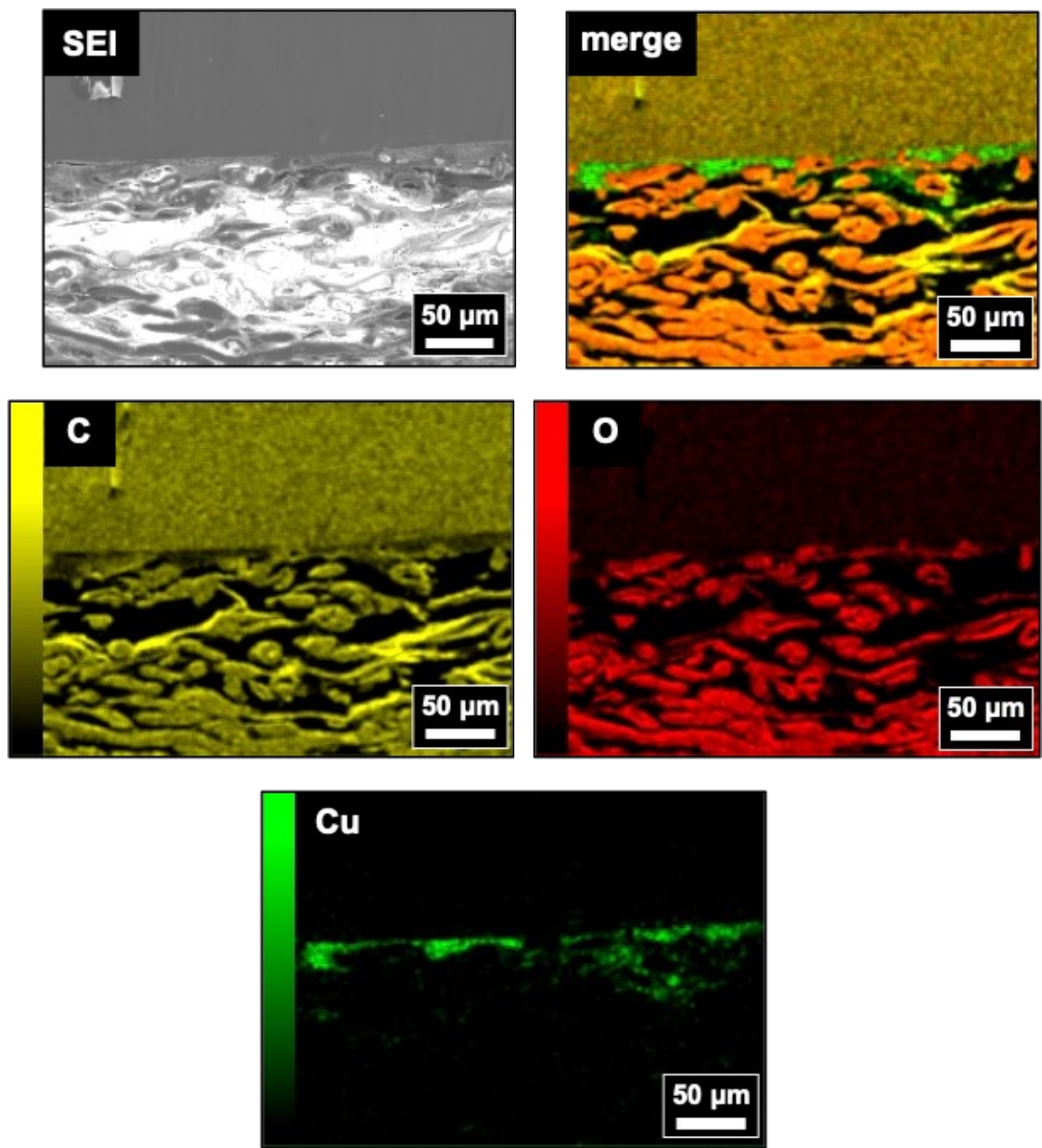


Fig. S6. SEM-EDS elemental mapping of the cross-section of the CuBDC-supported specimen after a friction test.

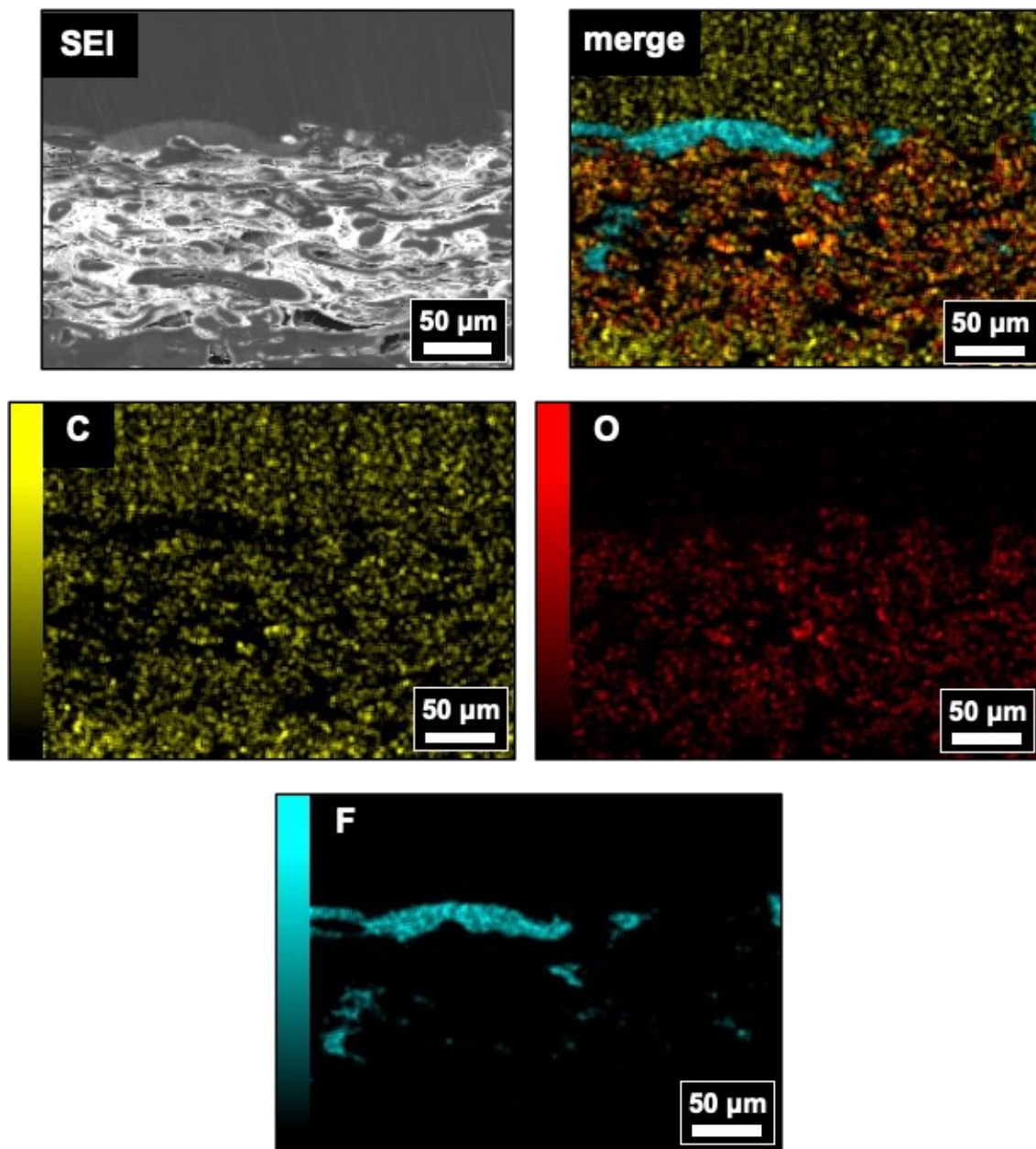


Fig. S7. SEM-EDS elemental mapping of the cross-section of the PTFE-supported specimen after a friction test.

3. XPS measurement

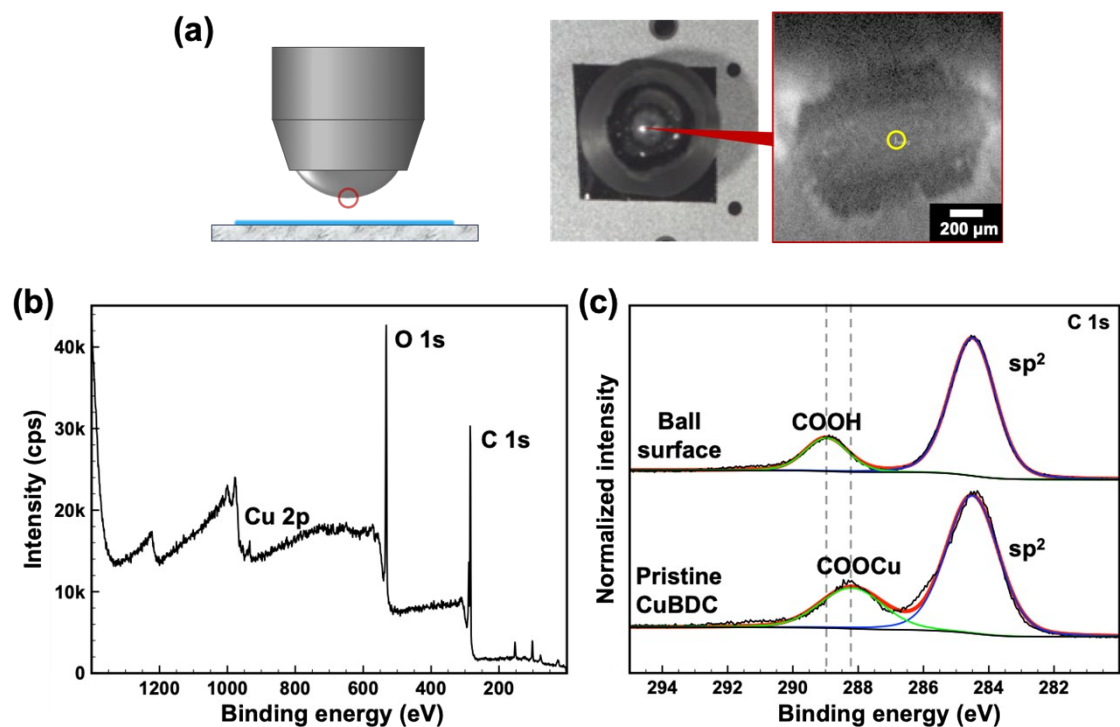


Fig. S8. XPS measurements of the surface of the counterpart: (a) Schematic illustration and optical images of the measurement area (the yellow circle in the microscopic image indicates the X-ray beam diameter for XPS measurement); (b) Survey scan spectrum of the surface of the counterpart; (c) High-resolution C 1s spectra of the surface of the counterpart and pristine CuBDC.

4. PXRD data

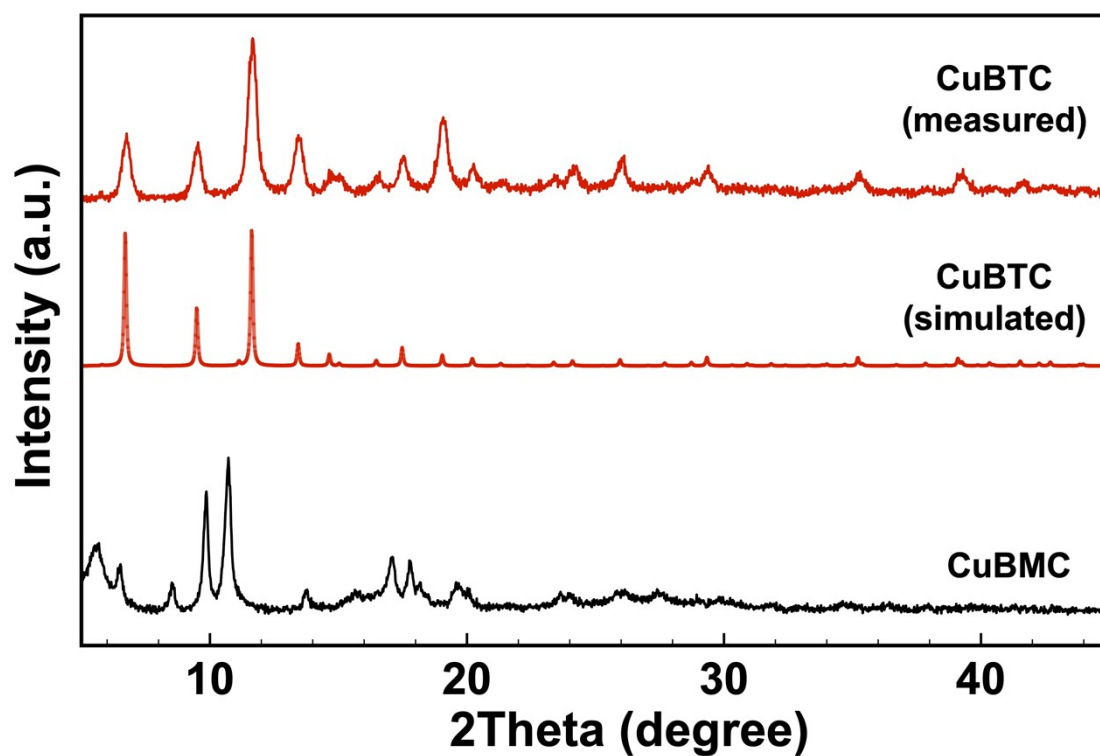


Figure S9. Powder X-ray diffraction (PXRD) patterns of CuBTC (measured and simulated) and CuBMC.

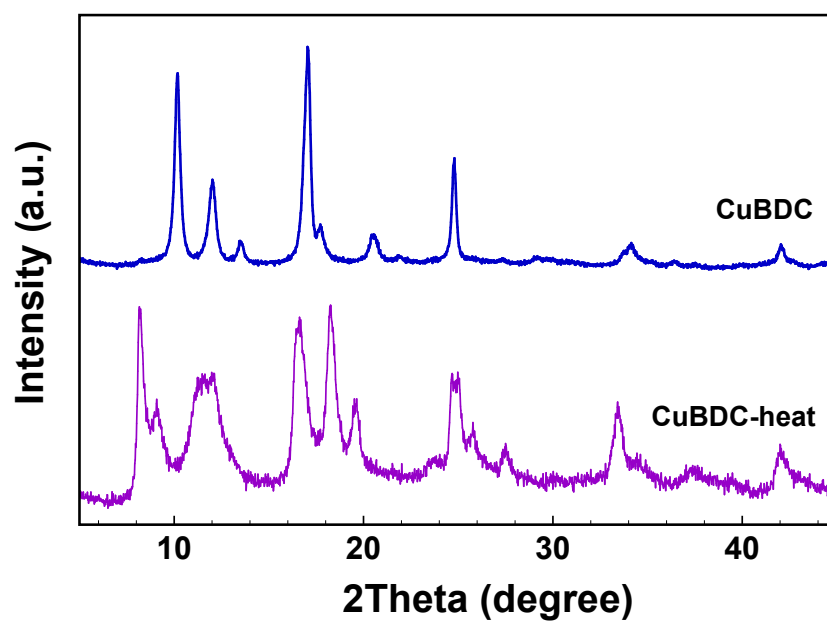


Figure S10. PXRD patterns of CuBDC and CuBDC-heat.

5. FT-IR spectra

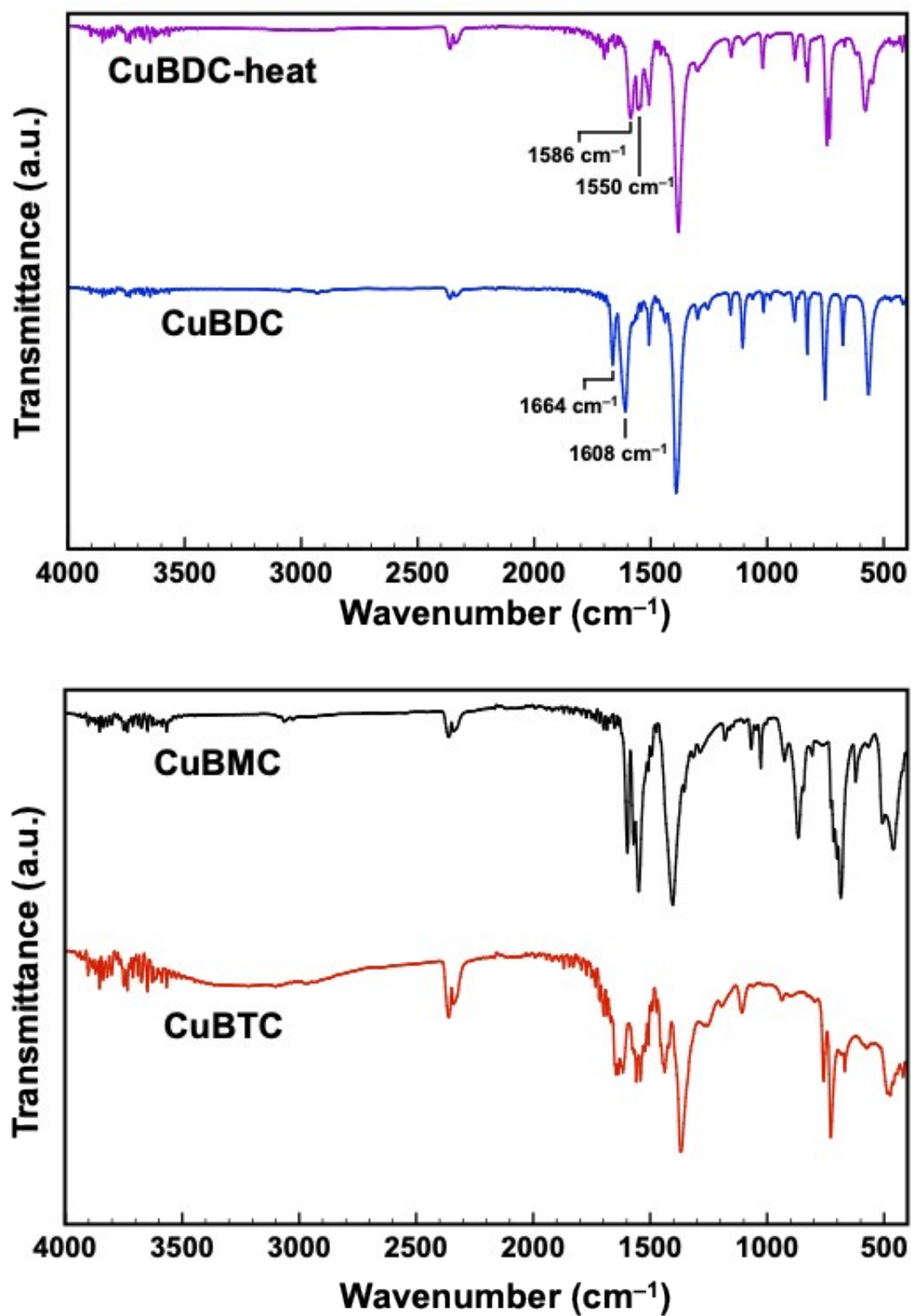


Figure S11. FT-IR spectra of CuBDC, CuBDC-heat, CuBMC, and CuBTC.

6. Effect of the ratio of the starting reagents

To elucidate the effect of the ratio of copper(II) acetate monohydrate and benzene-1,4-dicarboxylic acid on the fabrication of CuBDC, the reaction was carried out where the molar ratio of the metal and ligand was $[M]:[L] = 1:2$. As a result, the blue powder (CuBDC-2) was obtained whose PXRD pattern was identical to that of CuBDC. Furthermore, the solid lubrication property of CuBDC-2 was evaluated, revealing that the ratio of the starting reagents scarcely affected the lubrication properties of CuBDC.

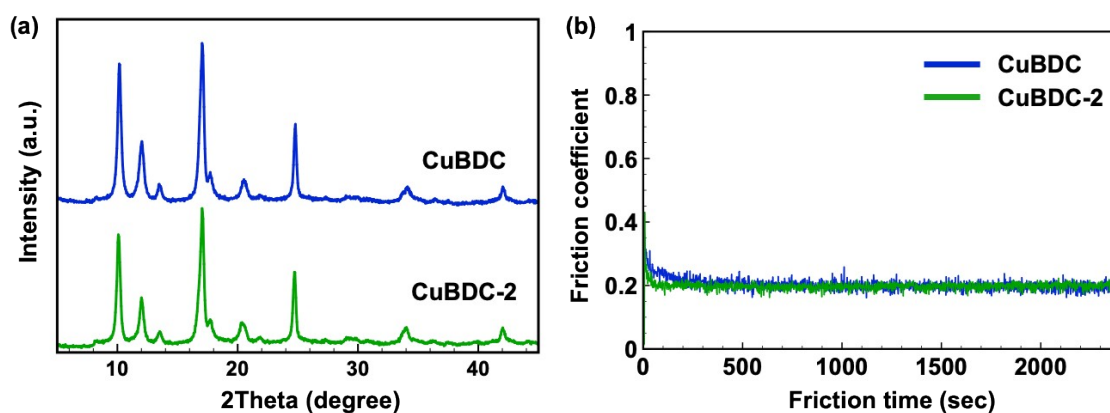


Figure S12. PXRD pattern (a) and friction coefficient vs time curves (b) of CuBDC and CuBDC-2.