

Supporting Information

Pristine conductive metal-organic framework film as a cost-effective counter electrode for dye-sensitized solar cells

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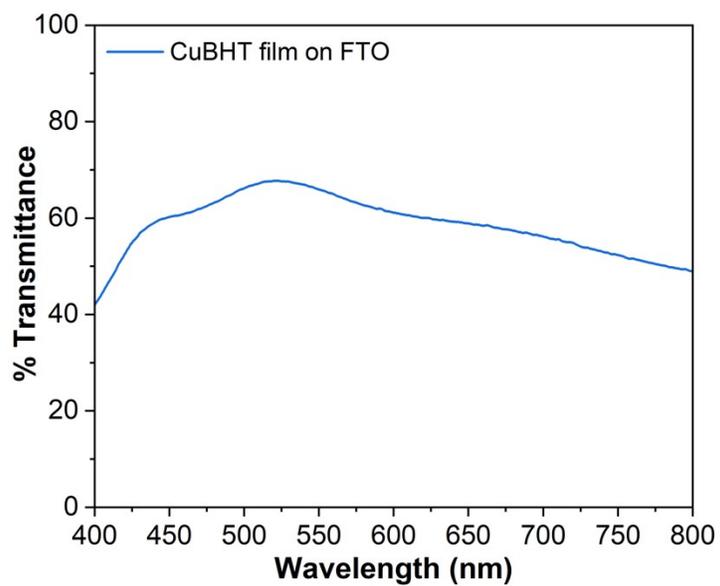


Fig. S1 UV/vis transmittance of CuBHT MOF on FTO.

- **Synthesis of bulk CuBHT MOF powder**

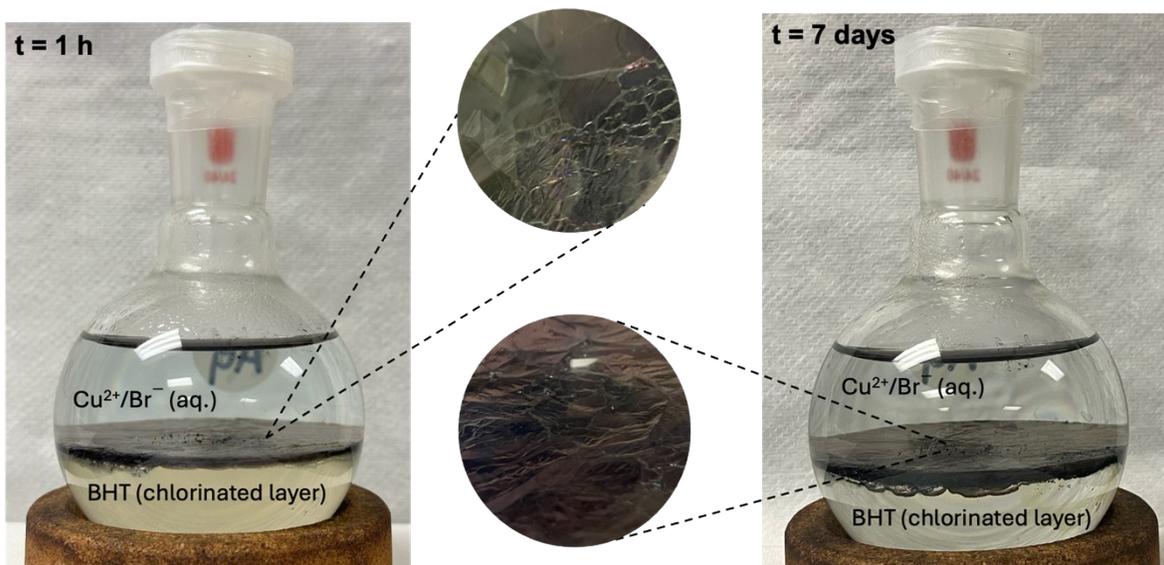


Fig. S2 Photographs showing the progress of bulk CuBHT MOF powder formation at 1 h and 7 days after initiating the interfacial synthesis reaction.

Table S1 High-resolution Cu 2p XPS deconvolution results used for oxidation-state quantification, with binding energies, peak widths, integrated areas, and atomic percentages of Cu⁺ and Cu²⁺ species

	Peak BE	Height CPS	FWHM eV	Area (P) CPS.eV	Atomic %
Cu 2p _{3/2} Cu ⁺	932.17	64557.27	1.26	105428.3	57.34
Cu 2p _{1/2} Cu ⁺	951.94	26122.25	1.6	56577.83	
Cu 2p _{3/2} Cu ²⁺	933.94	21554.78	3.14	78254.35	42.66
Cu 2p _{1/2} Cu ²⁺	953.93	10777.39	3.47	43798.21	
Cu ²⁺ satellite	941.93	3110.83	6.18	26353.14	
Cu ²⁺ satellite	945.76	3945.29	7.76	41261.68	

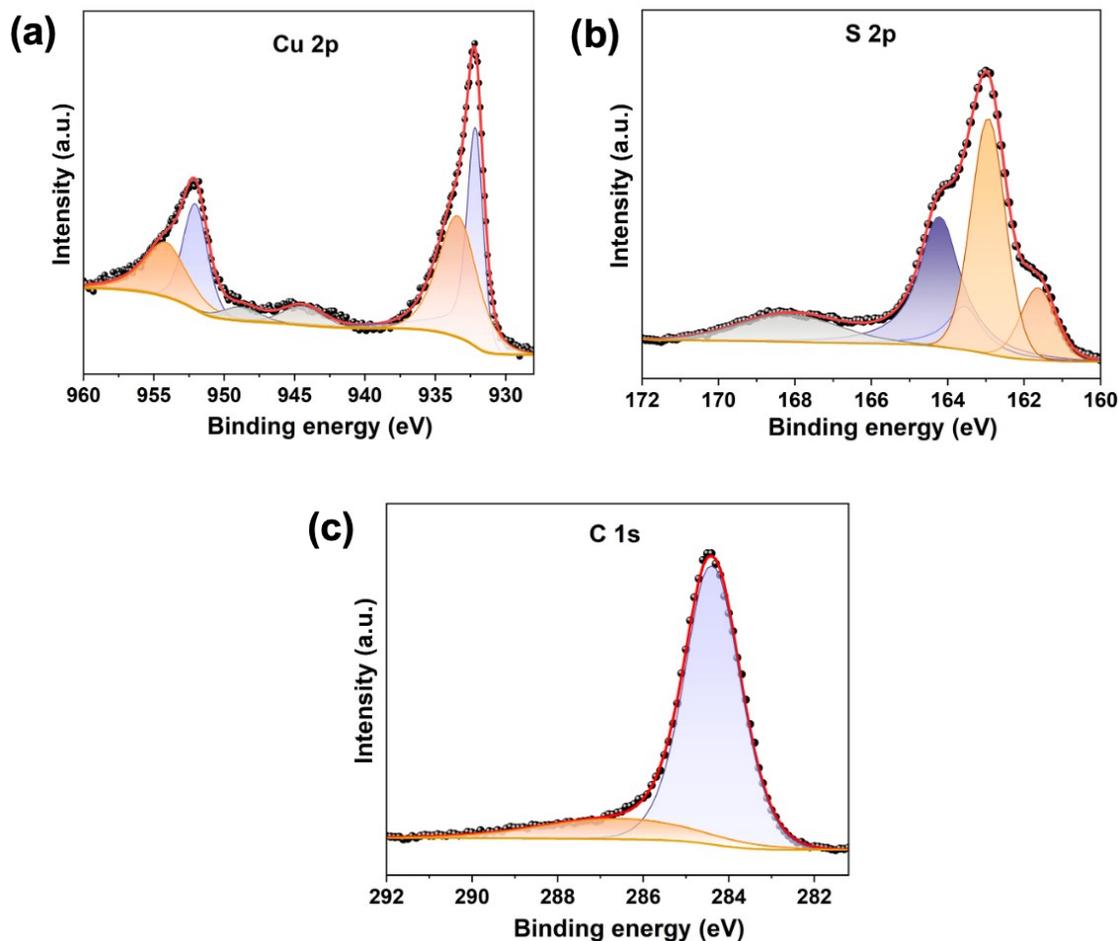


Fig. S3 High-resolution XPS narrow scans of the CuBHT bulk powder for (a) Cu 2p, (b) S 2p, and (c) C 1s regions.

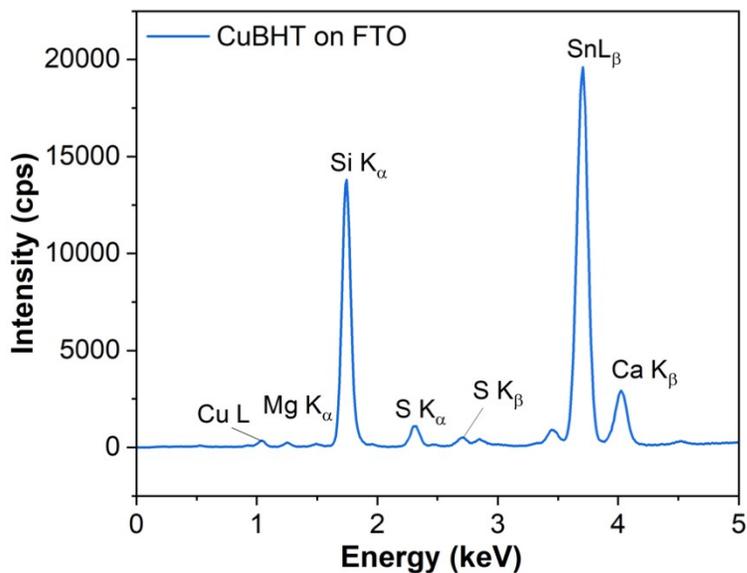


Fig. S4 XRF spectrum of CuBHT film on FTO.

Table S2 Standardization of interaction time of BHT with $\text{Cu}^{2+}/\text{Br}^-$ layer in the interfacial method during fabrication of Pt-free CEs for DSSCs

- We made three devices (a, b, c) to allow for the formation of a densely packed film with varying times of drop casting the BHT/CB layer: a: 2 min, b: 5 min, and c: 8 min.

Counter Electrode	J_{SC} (mA cm^{-2})	V_{OC} (V)	FF	PCE (%)
a: 2 min	11.70	0.74	70.32	6.10
b: 5 min	12.11	0.74	69.55	6.27
c: 8 min	11.79	0.73	70.29	6.04
Pt reference	11.59	0.74	69.77	6.05
Control device with FTO glass	1.41	0.76	5.34	0.06

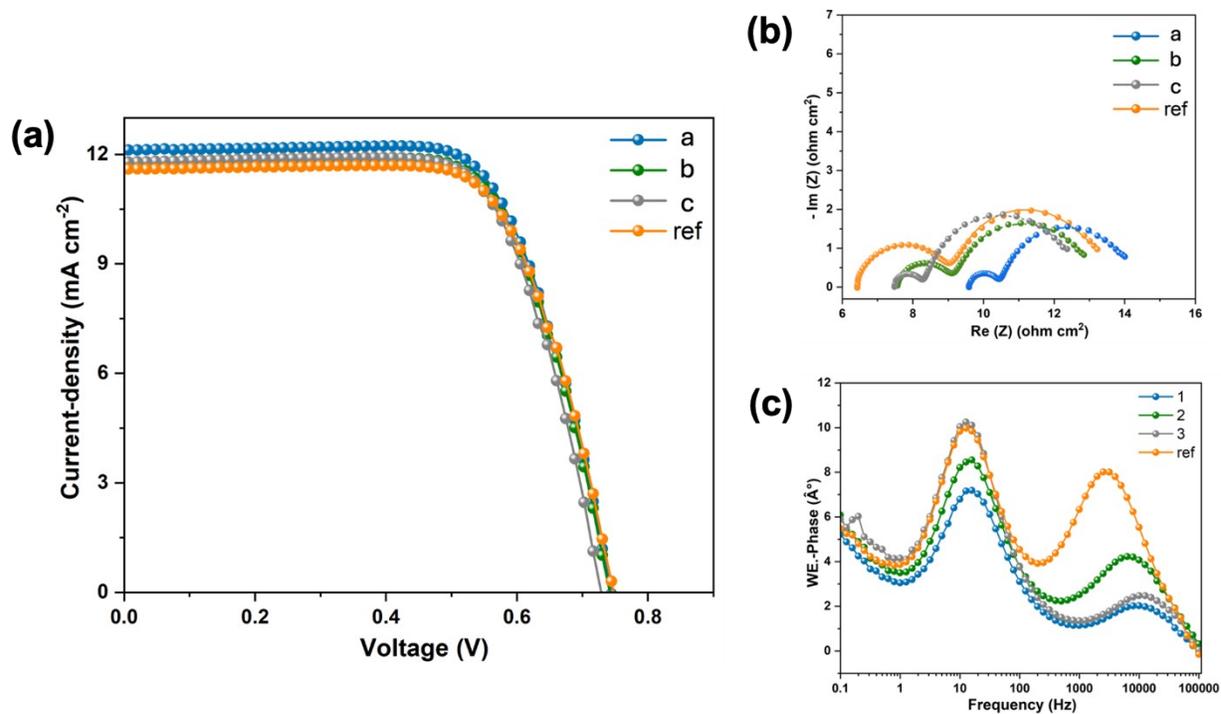


Fig. S5 (a) J-V curves (b) Nyquist plots, and (c) Bode plots of fabricated DSSC devices using Pt counter electrode (reference) and CuBHT MOF films **a-c**.

Equation S1

$$EQE = LHE(\lambda) \cdot \phi_{inj} \cdot \phi_{col}$$

where $LHE(\lambda)$ is the photon harvesting efficiency, ϕ_{inj} is the quantum yield representing the electron injection from excited dye molecules, and ϕ_{col} is the charge-collecting efficiency, i.e., the charge transfer to the photoanode.