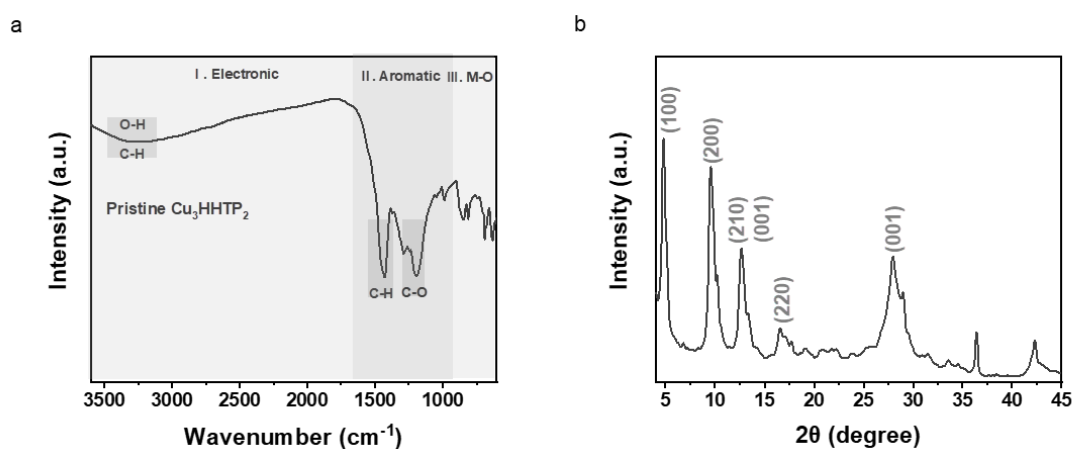


Supporting Information for

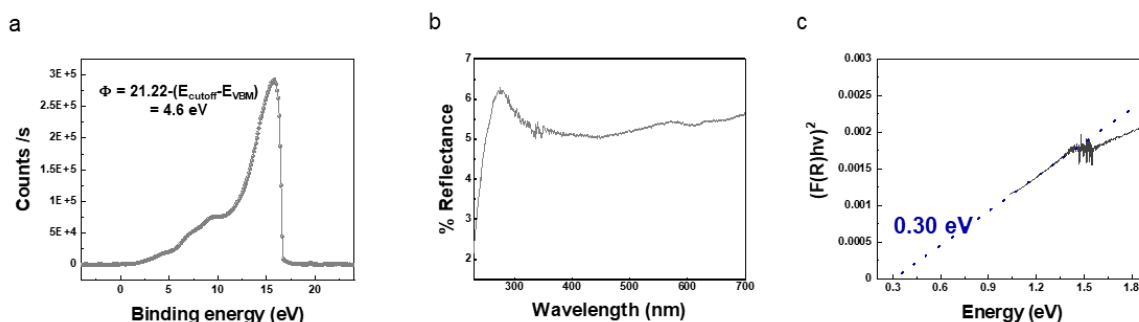
## Laser-Induced and MOF-Derived Metal Oxide/Carbon Composite for Synergistically Improved Ethanol Sensing at Room temperature

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### Supplementary Figures

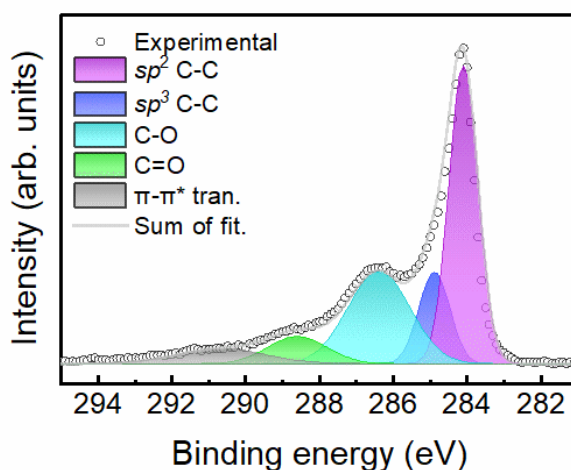


**Fig. S1** **a** Fourier transform infrared (FT-IR) spectroscopy and **b** X-ray diffraction (XRD) pattern of  $\text{Cu}_3\text{HHTP}_2$  MOF. The peaks of  $\text{Cu}_3\text{HHTP}_2$  were in good agreement with previous studies [S1, S2]

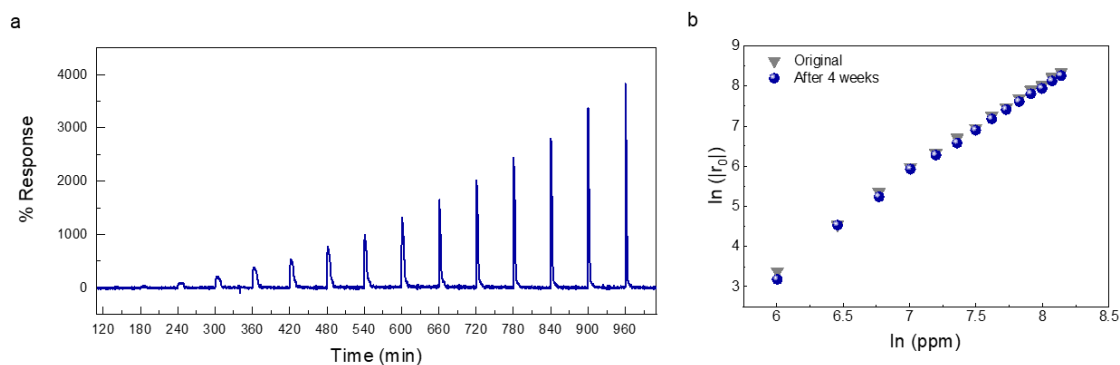


**Fig. S2** Estimation of the energy band diagram of laser-induced graphene. **a** UPS spectrum and work function calculation. **b** UV-vis reflectance spectrum and **c** Tauc plot

Direct investigation of the band structure of the carbon element in the  $\text{CuO}/\text{C}$  composite was challenging. Instead, we hypothesized that this carbon element would have a similar chemical environment to the few-layered  $sp^2$  carbon content reduced graphene oxides (rGO) as observed in Raman spectroscopy and XPS studies. Therefore, we conducted the extraction process of the energy band diagram of rGO-like laser-induced graphene obtained from direct laser irradiation on the carbon-containing substrate (PI) in a manner similar to our previous research [S2].



**Fig. S3** XPS C 1s spectrum of MOF-derived CuO/C



**Fig. S4** Ethanol monitoring performance after four weeks. The sensor for the stability test was stored at room temperature and in air condition. **a** Dynamic response curve with different ethanol concentrations (170-3400 ppm) at room temperature. **b** Linear correlation between the  $\ln(\text{response})$  and  $\ln(\text{concentration})$

## Supplementary References

- [S1] K. W. Nam, S. S. Park, R. dos Reis, V. P. Dravid, H. Kim et al., Conductive 2d metal-organic framework for high-performance cathodes in aqueous rechargeable zinc batteries. *Nat. Commun.* **10**(1), 4948 (2019). <https://doi.org/10.1038/s41467-019-12857-4>
- [S2] H. Lim, H. Kwon, H. Kang, J. E. Jang, H.-J. Kwon. Semiconducting MOFs on ultraviolet laser-induced graphene with a hierarchical pore architecture for NO<sub>2</sub> monitoring. *Nat. Commun.* **14**(1), 3114 (2023). <https://doi.org/10.1038/s41467-023-38918-3>