

## Supporting Information

# **Hydrophilic Fully Conjugated Covalent Organic Framework for Photocatalytic CO<sub>2</sub> Reduction to CO Nearly 100% by Pure Water**

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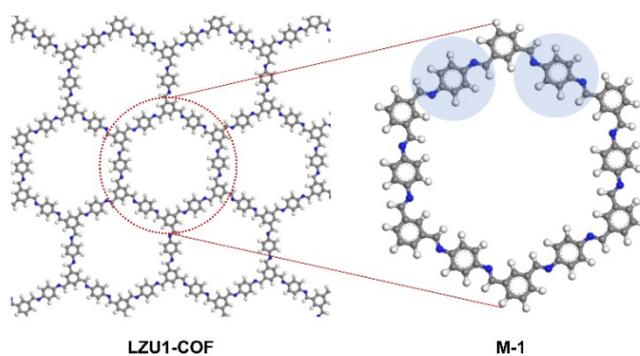
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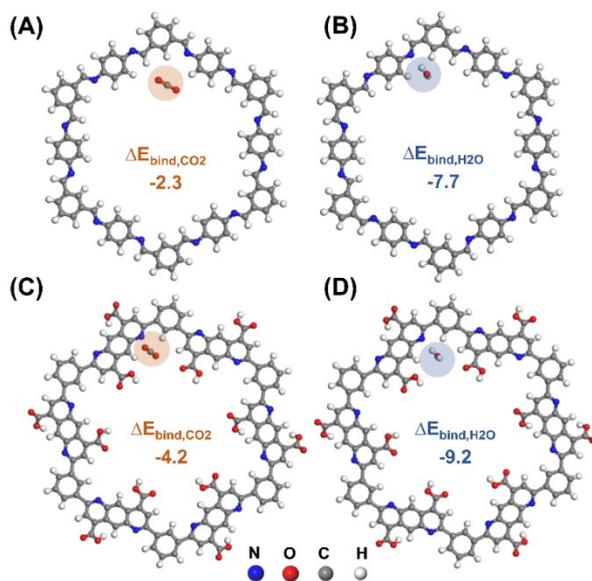
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## 1. Computational Results

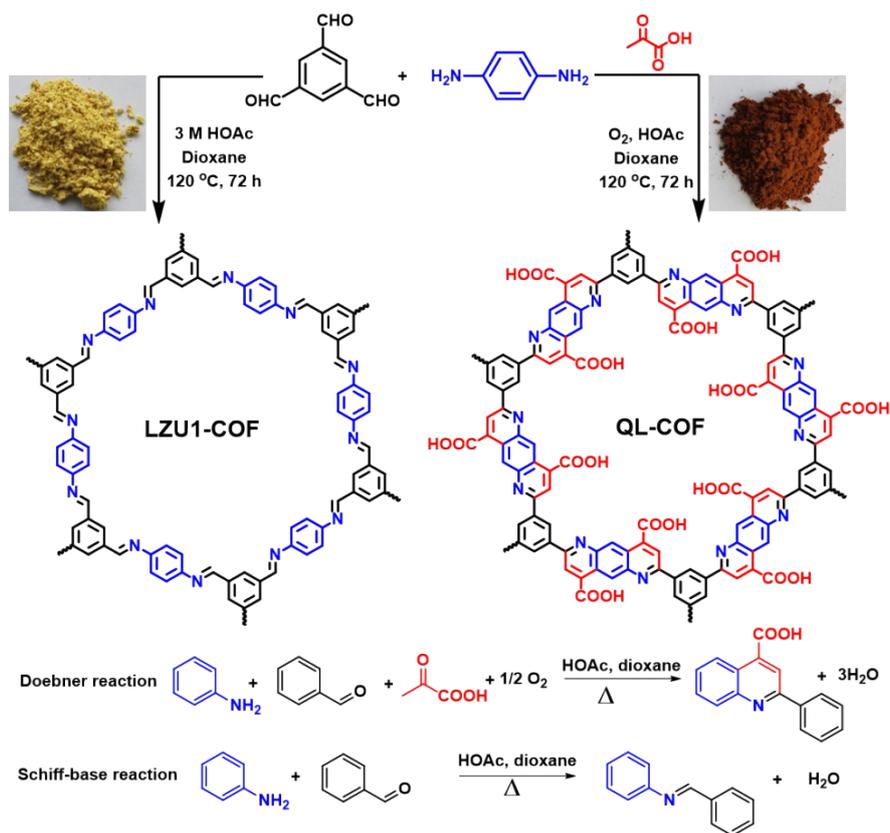
(1) Diagram of building simulation model of LZU1-COF.



(2) Other adsorption structures and adsorption energies of CO<sub>2</sub> and H<sub>2</sub>O in LZU1-COF and QL-COF.



### 3. Supplementary Figures



**Figure S1** Schematic and the model reaction equations of the synthesis for **LZU1-COF** and **QL-COF** via schiff-base and Doebner reaction, respectively.

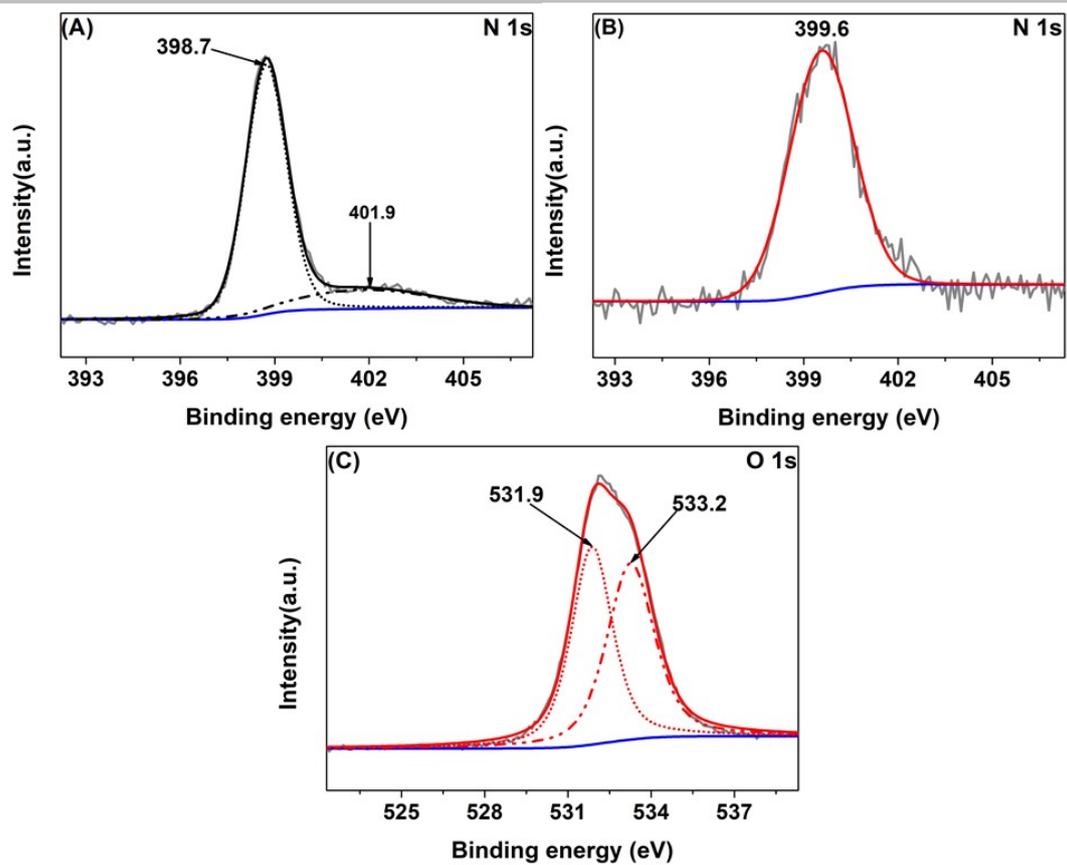


Figure S2 XPS spectra of (A) N1s of the LZU1-COF, (B) N1s and (C) O1s of the QL-COF.

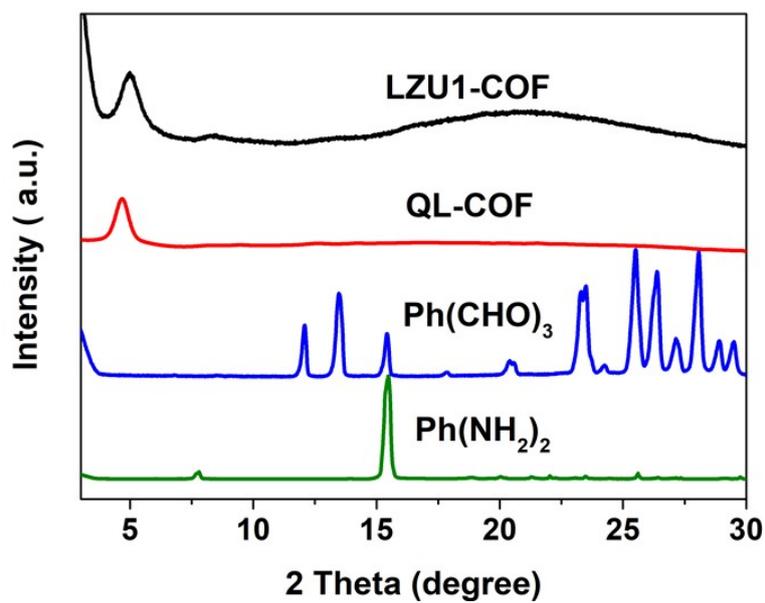
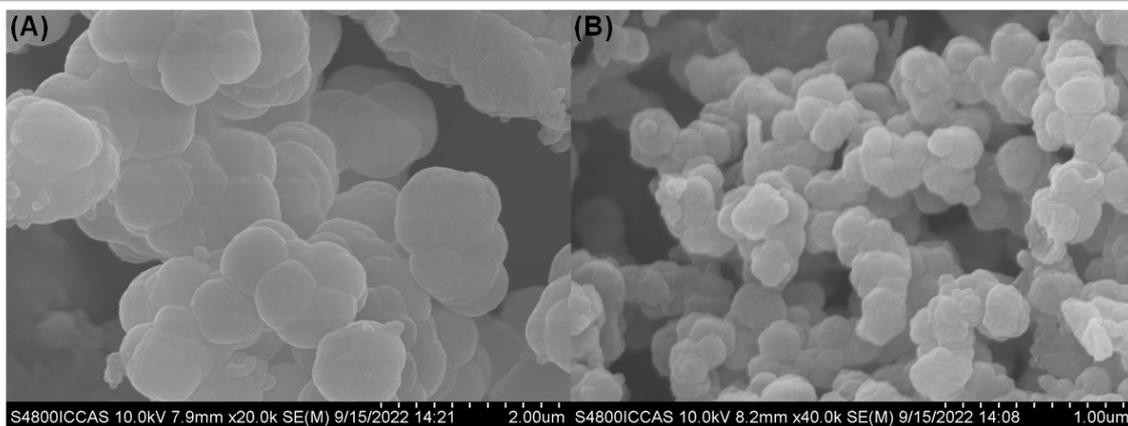
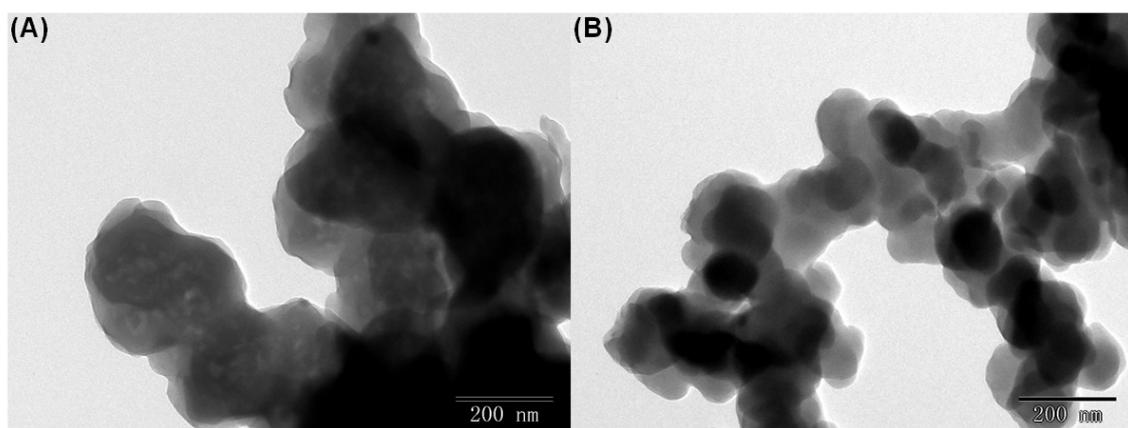


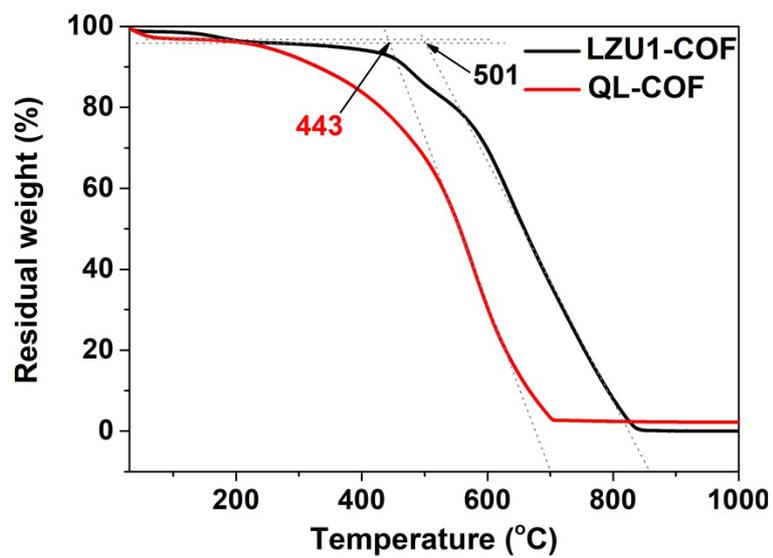
Figure S3 Powder X-ray diffraction spectra of the LZU1-COF, QL-COF, Ph(CHO)<sub>3</sub>, and Ph(NH<sub>2</sub>)<sub>2</sub>.



**Figure S4** SEM images of (A) LZU1-COF and (B) QL-COF.



**Figure S5** TEM images of (A) LZU1-COF and (B) QL-COF.



**Figure S6** TGA analysis on the polymers under air, with a ramping rate of 10 °C min.

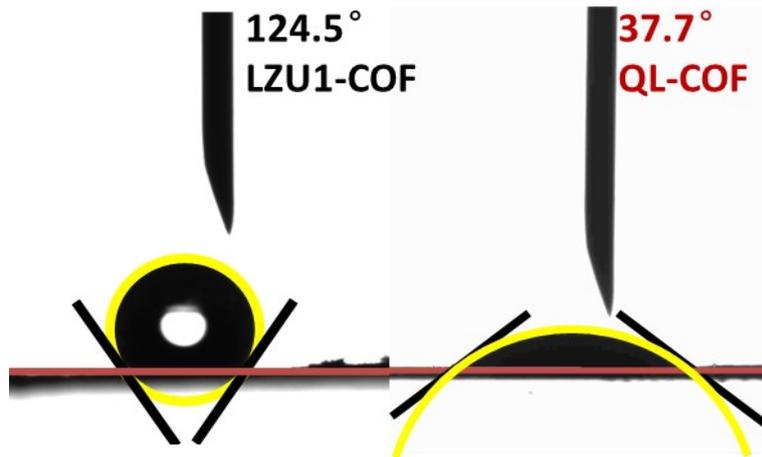


Figure S7 H<sub>2</sub>O contact angles for LZU1-COF and QL-COF.

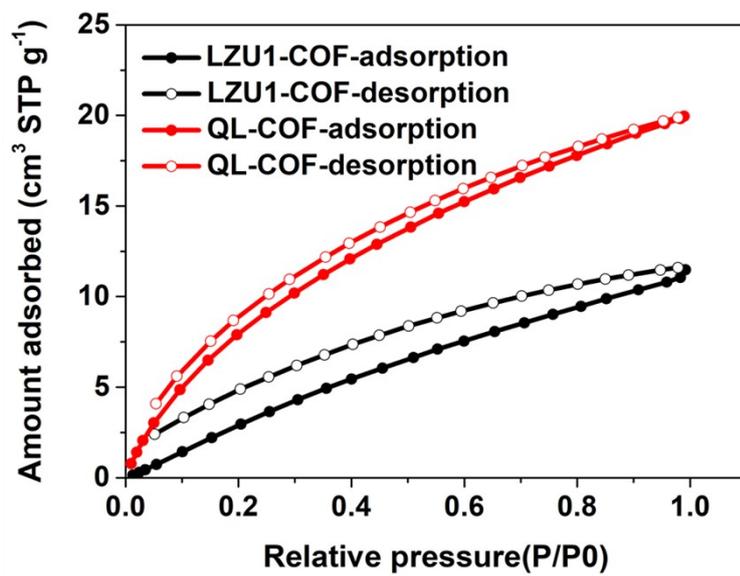


Figure S8 Adsorption (filled) and desorption (empty) isotherms of CO<sub>2</sub> at 273 k for LZU1-COF and QL-COF.

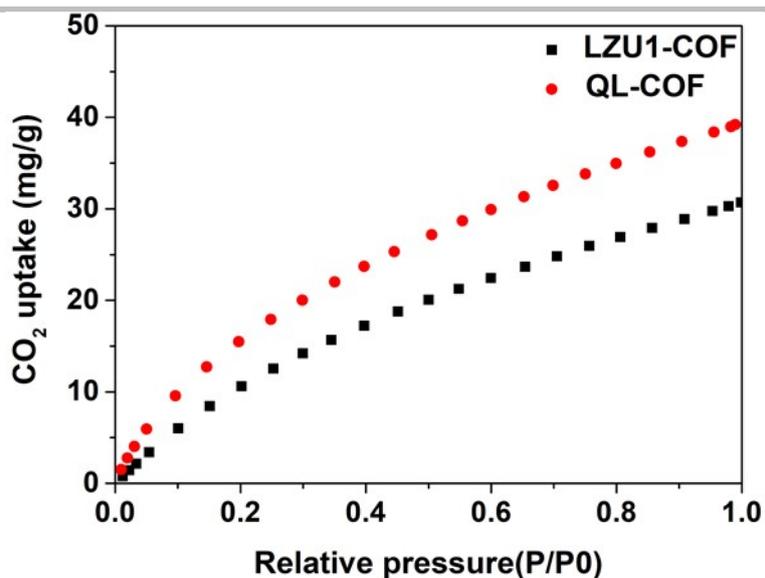


Figure S9 CO<sub>2</sub> adsorption isotherms of LZU1-COF and QL-COF at 273 K.

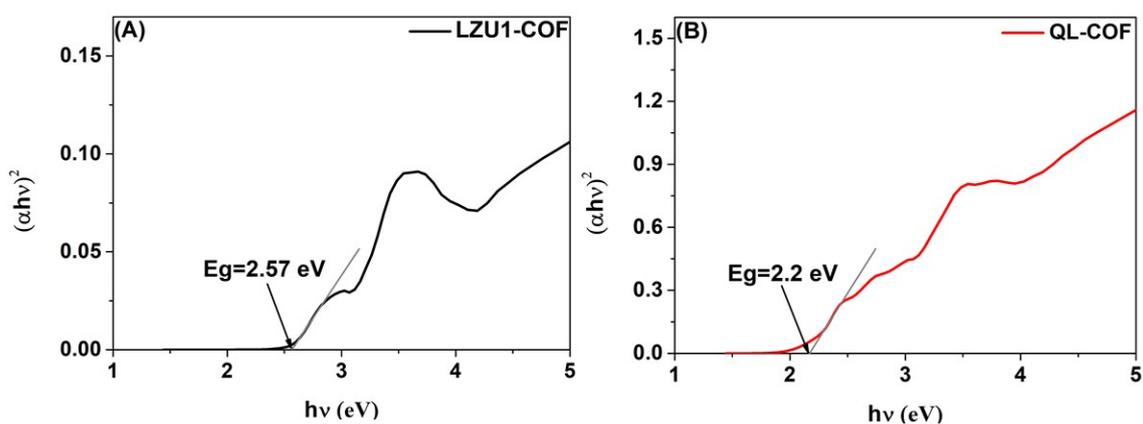


Figure S10 Tauc plots together with the bandgaps: (A) LZU1-COF and (B) QL-COF.

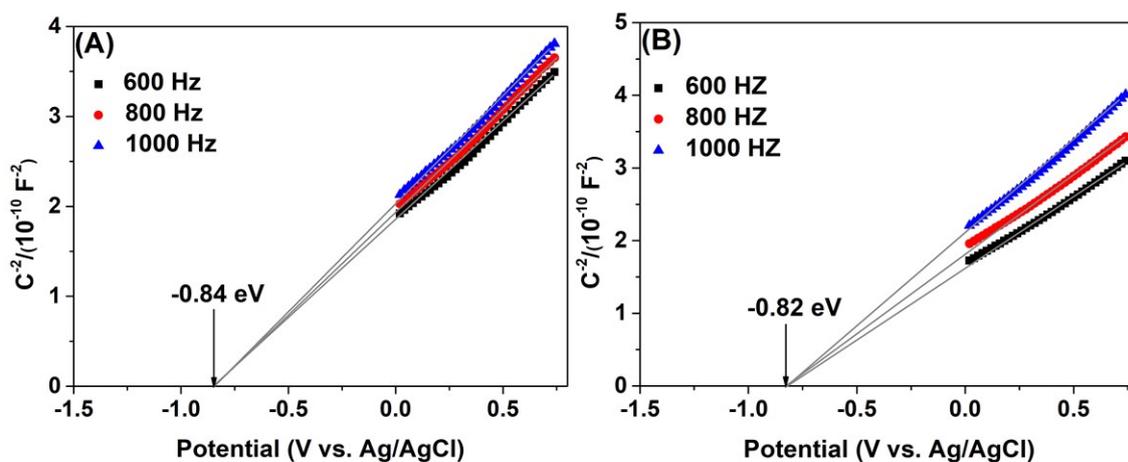
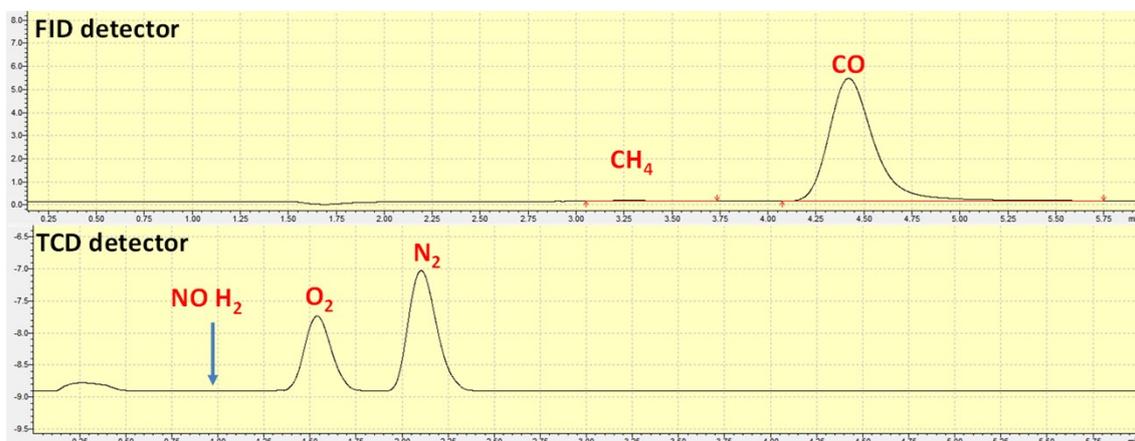
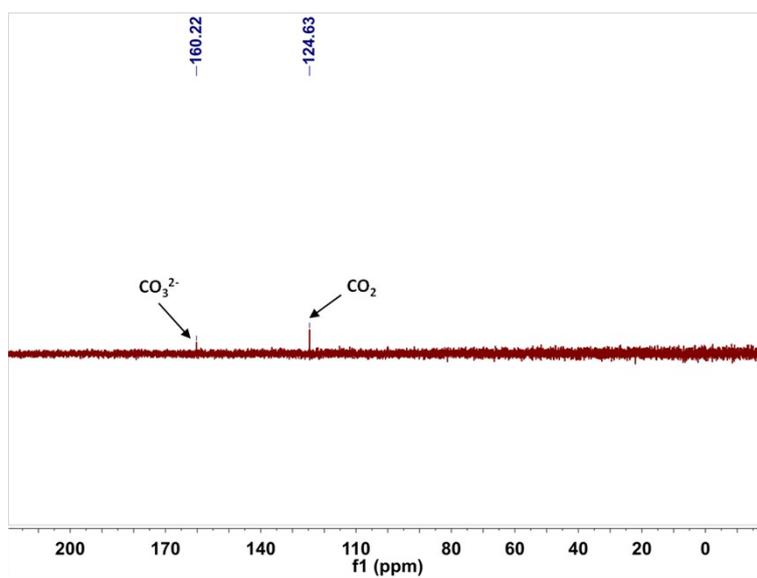


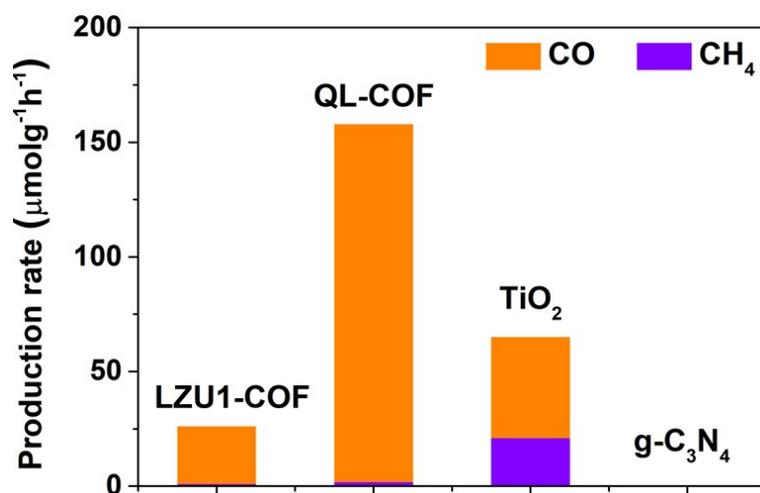
Figure S11 Mott-Schottky plots of (A) LZU1-COF and (B) QL-COF. Electrode in 0.2 M Na<sub>2</sub>SO<sub>4</sub> (pH=6.8).



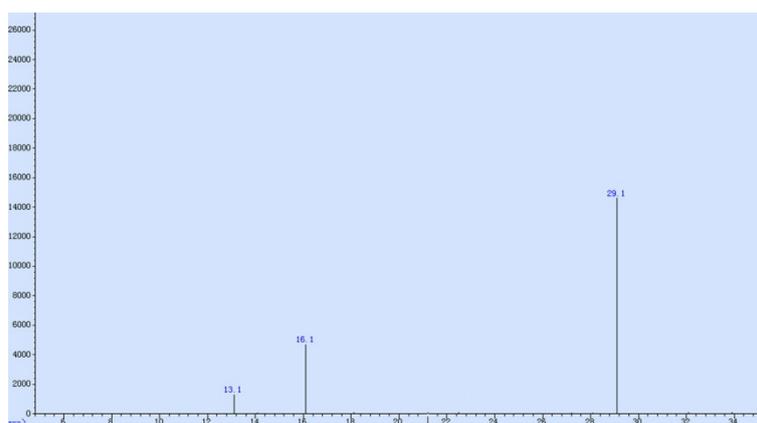
**Figure S12** GC spectrum of the photocatalytic reaction of CO<sub>2</sub> over **QL-COF**. Retention time: 1.522 min (O<sub>2</sub>), 2.088 min (N<sub>2</sub>), 3.259 min (CH<sub>4</sub>) and 4.401 min (CO).



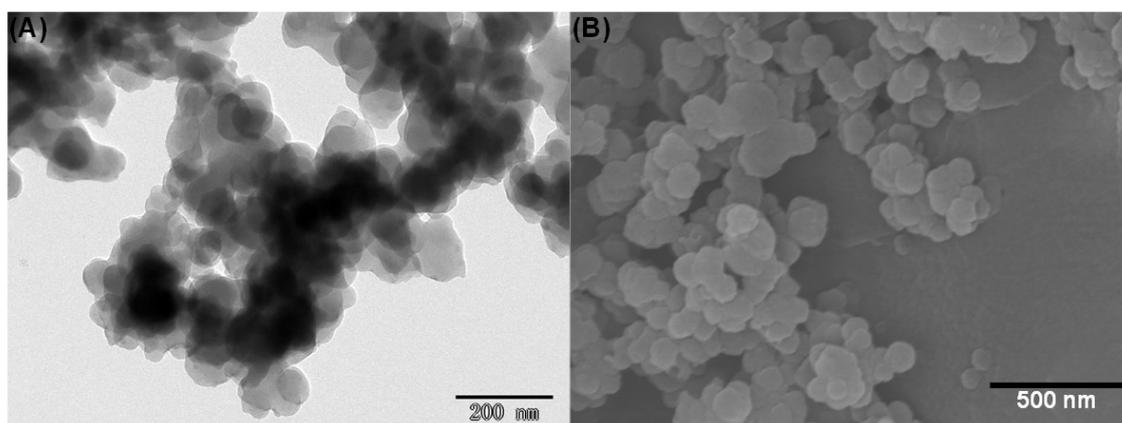
**Figure S13** <sup>13</sup>C NMR spectrum for liquid phase of the photocatalytic reaction of <sup>13</sup>CO<sub>2</sub> over **QL-COF**.



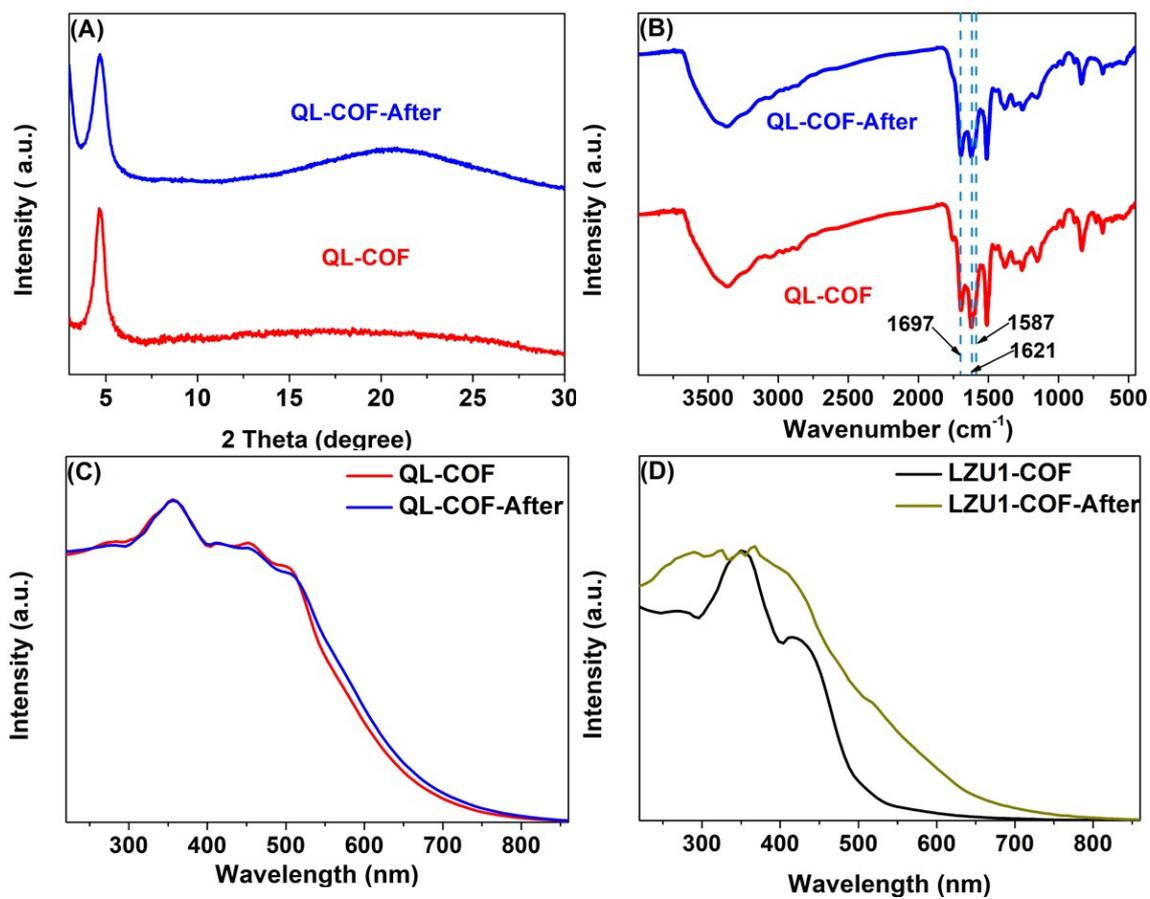
**Figure S14** Average production rates from CO<sub>2</sub> photoreduction over LZU1-COF, QL-COF, TiO<sub>2</sub> and g-C<sub>3</sub>N<sub>4</sub> for 5 h.



**Figure S15** GC-MS spectrum of <sup>13</sup>CO generated from the photocatalytic reaction of <sup>13</sup>CO<sub>2</sub> over QL-COF.



**Figure S16** (A) TEM and (B) SEM images of QL-COF-After.



**Figure S17** (A) XRD, (B) FT-IR and (C) UV-Vis light absorption spectra of **QL-COF** and **QL-COF-After**. (D) UV-Vis light absorption spectra of **LZU1-COF** and **LZU1-COF-After**.