Supplementary content

Sword-like CuO/CeO$_2$ composites derived from Ce-BTC metal organic framework with superior CO oxidation performance

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Table S1 Physicochemical properties of CuCe-BTC materials

| Catalysts  | BET (m² g⁻¹) | Pore volume (cm³ g⁻¹) | Pore size (nm) |
|------------|--------------|-----------------------|----------------|
| CuCeBTC-2  | 101          | 0.25                  | 1.3~4          |
| CuCeBTC-5  | 120          | 0.28                  | 1.3~4          |
| CuCeBTC-10 | 143          | 0.31                  | 0.5~4          |
| CuCeBTC-20 | 194          | 0.23                  | 0.5~4          |
| Ce-BTC [¹] | 42           | 0.085                 | 1.5~2          |
Table S2 Surface elemental composition and states of CuO/CeO$_2$ catalysts determined by XPS results

| Catalysts   | Surface composition (at.%) | $O_{\text{lat}}$ (%) | $O_{\text{ads}}$ (%) | $O_{\text{OH}}$ (%) | Cu$^{+0}$ (%) | Cu$^{2+}$ (%) |
|-------------|-----------------------------|-----------------------|-----------------------|----------------------|---------------|---------------|
| CuCeO-2     | 4.51 17.97 54.16 23.36     | 60.3                  | 18.2                  | 21.5                 | 48            | 52            |
| CuCeO-5     | 5.07 16.59 53.61 24.73     | 72                    | 17.2                  | 10.8                 | 70            | 30            |
| CuCeO-10    | 5.55 16.94 52.4  25.11     | 69                    | 10.8                  | 20.2                 | 63            | 27            |
| CuCeO-20    | 8.61 15.19 51.13 25.07     | 64                    | 10.3                  | 25.7                 | 54            | 46            |
| CeO$_2$[$^2$] | — 12.27 50.19 37.54       | 91.7                  | —                     | —                    | —             | —             |
Table S3 $\text{H}_2$ consumption amount and reduction temperature of CuO/CeO$_2$ catalysts

| Catalysts | $\alpha$ peak $\text{H}_2$ consumption ($\mu\text{mol g}^{-1}$) | Peak temperature ($^\circ\text{C}$) | $\beta$ peak $\text{H}_2$ consumption ($\mu\text{mol g}^{-1}$) | Peak temperature ($^\circ\text{C}$) | $\gamma$ peak $\text{H}_2$ consumption ($\mu\text{mol g}^{-1}$) | Peak temperature ($^\circ\text{C}$) |
|-----------|----------------------------------------------------------|-----------------------------------|----------------------------------------------------------|-----------------------------------|----------------------------------------------------------|-----------------------------------|
| CuCeO-2   | 373                                                      | 150                               | 907                                                      | 165                               | 619                                                      | 193                               |
| CuCeO-5   | 1030                                                     | 146                               | 1994                                                     | 175                               | 186                                                      | 204                               |
| CuCeO-10  | 1122                                                     | 150                               | 4030                                                     | 176                               | 211                                                      | 214                               |
| CuCeO-20  | 2364                                                     | 182                               | 5791                                                     | 212                               | 346                                                      | 251                               |
Table S4 Catalytic activities for CO oxidation of CuO/CeO$_2$ catalysts derived from MOFs

| Catalysts      | Synthesis method     | Morphology               | Cu content (%) | Space velocity (mL h$^{-1}$ g$^{-1}$) | $T_{100}$(°C) | References |
|----------------|----------------------|--------------------------|----------------|--------------------------------------|--------------|------------|
| CuO/CeO$_2$   | In-situ solvothermal | Sword                    | 4.18           | 18000                                | 100          | This work  |
| CuO-CeO$_2$   | Incipient wetness    | Irregular particle       | -              | 20000                                | 150          | 20         |
| CeO$_2$:Cu$^{2+}$ | In-situ solvothermal method | Nanorods made up of many particles | 10             | 60000                                | 200          | 21         |
| CuO@CeO$_2$   | Incipient wetness    | Irregular spherical      | 30             | 48000                                | 95           | 33         |
Supplementary caption

**Fig. S1** XRD patterns of CeBTC (a), CuBTC (b), CuCeBTC-2 (c), CuCeBTC-5 (d), CuCeBTC-10 (e) and CuCeBTC-20 (f).

**Fig. S2** TG curves of CeBTC (a), CeCuBTC-5 (b), CeCuBTC-10 (c) and CeCuBTC-20 (d).

**Fig. S3** $\text{N}_2$ adsorption-desorption isotherms (A) and corresponding pore size distributions (B) of CeBTC (a), CuCeBTC-2 (b), CuCeBTC-5 (c), CuCeBTC-10 (d) and CuCeBTC-20 (e).

**Fig. S4** SEM images of CeBTC (a), CeCuBTC-2 (b), CeCuBTC-5 (c), CeCuBTC-10 (d) and CeCuBTC-20 (e).

**Fig. S5** $\text{N}_2$ adsorption-desorption isotherms (A) and corresponding pore size distributions (B) of CeO$_2$ (a), CuCeO-2 (b), CuCeO-5 (c), CuCeO-10 (d) and CuCeO-20 (e).

**Fig. S6** XRD results of CuCeO-5 before (a) and after (b) CO oxidation reaction

**Fig. S7** TEM result of CuCeO-5 after CO oxidation reaction

**Fig. S8** Catalytic activities for CO oxidation of CuCeO-2 (A), CuCeO-5 (B), CuCeO-10 (C) and CuCeO-20 (D) reused for three times

**Fig. S9** Catalytic activities for CO oxidation at different space velocities (30000 mL h$^{-1}$ g$^{-1}$ (A), 60000 mL h$^{-1}$ g$^{-1}$ (B)) of CuCeO-2 (a), CuCeO-5 (b), CuCeO-10 (c) and CuCeO-20 (d).
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Fig. S8 Catalytic activities for CO oxidation of CuCeO-2 (A), CuCeO-5 (B), CuCeO-10 (C) and CuCeO-20 (D) reused for three times.
Fig. S9 catalytic activities for CO oxidation at different space velocities (30000 mL h⁻¹ g⁻¹ (A), 60000 mL h⁻¹ g⁻¹ (B)) of CuCeO-2 (a), CuCeO-5 (b), CuCeO-10 (c) and CuCeO-20 (d).