Supporting information

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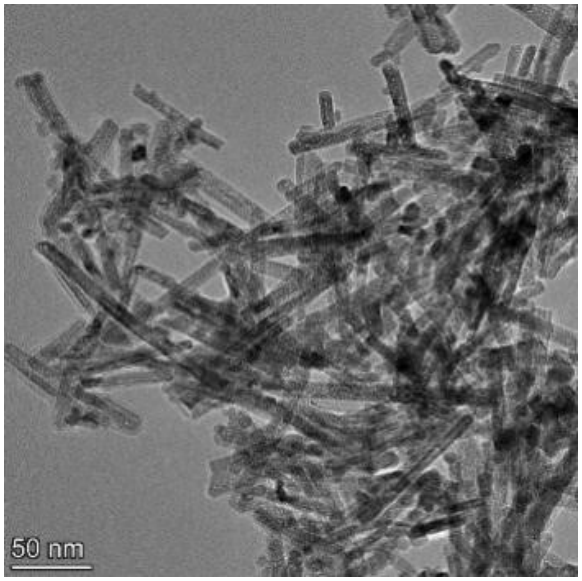

Fig. S1 TEM image of Cu-CeO_2.

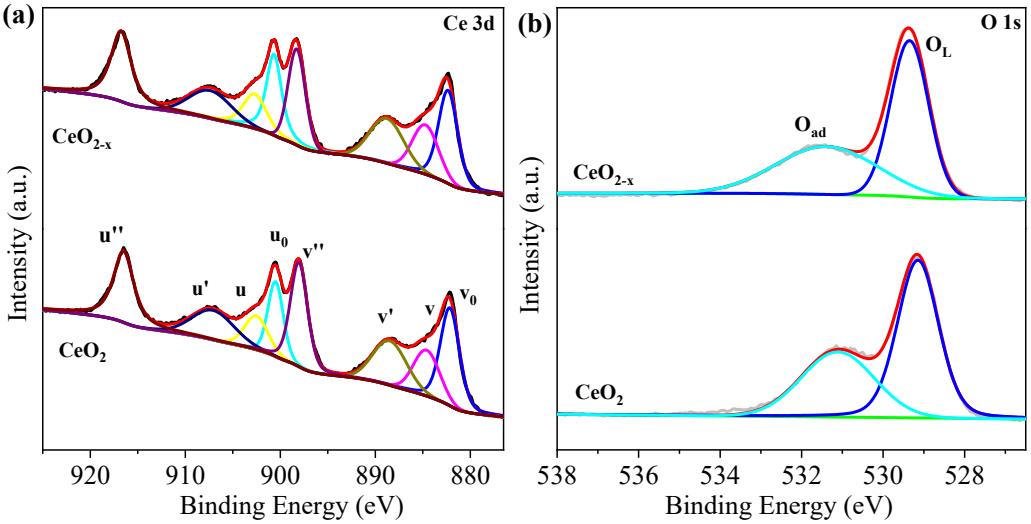

Fig. S2 (a) Ce3d spectra of CeO_2 and CeO_{2-x}. (b) O1s spectra of CeO_2 and CeO_{2-x}.

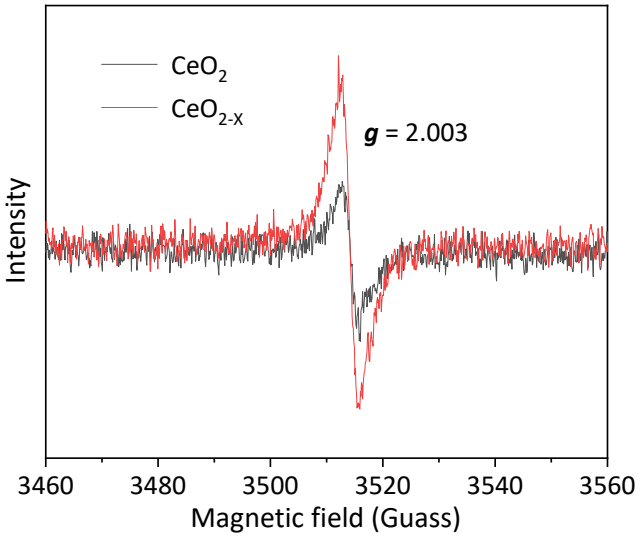

Fig. S3 EPR spectra of CeO_2 and CeO_{2-x}

Table. S1 XPS analysis of CeO_2 and CeO_{2-x}

Sample	CeO_2	CeO_{2-x}
Ce^{3+}/Ce^{4+}	0.80	0.93
$O_{ad}/(O_{ad}+O_L)$	0.40	0.47

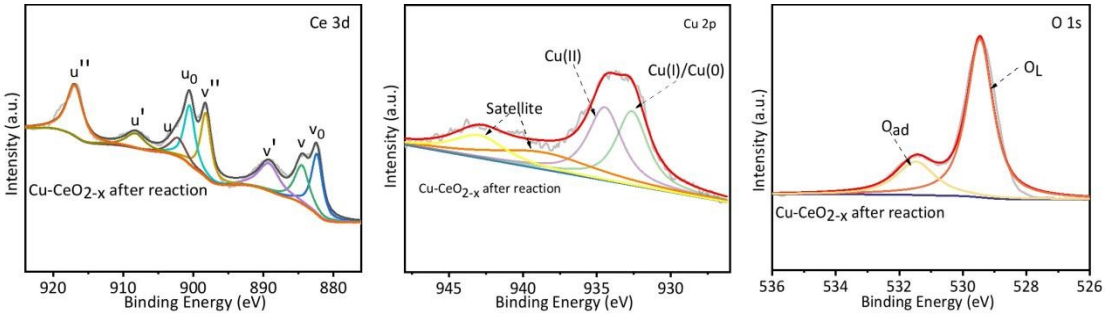

Fig. S4 Ce3d spectra, Cu2p spectra and O1S spectra of Cu-CeO_{2-X} after reaction

Table. S2 XPS analysis of Cu-CeO_{2-x} and Cu-CeO_{2-x} after reaction

Sample	Cu-CeO_{2-x}	Cu-CeO_{2-x} after reaction
Ce^{3+}/Ce^{4+}	0.59	0.58
$O_{ad}/(O_{ad}+O_L)$	0.41	0.40
$(Cu^0+ Cu+)/Cu$	0.84	0.87

Table S3 The performance of various Cu-MO_X catalysts for CO_2 electrochemical reduction

Catalyst	Production	Faradic efficiency	Potential	Current density	Electrolyte	Reference
Cu-CeO_{2-x}	CH_4	52.7%	-1.8 V vs. RHE	24.2 mA cm^{-2}	0.1 M $KHCO_3$	This work
Cu-CeO_2-4%	CH_4	58%	-1.8 V vs. RHE	28 mA cm^{-2}	0.1 M $KHCO_3$	1
Cu/CeO_2-R	CH_4	49.3%	-1.6 V vs. RHE	16.8 mA cm^{-2}	0.1 M $KHCO_3$	2
5-CuO/CeO_2	CH_4	37.8%	-1.27 V vs. RHE	22 mA cm^{-2}	0.1 M $KHCO_3$	3
Cu/CeO_2	CH_4	42%	-0.89 V vs. RHE	51 mA cm^{-2}	1 M KOH	4
$Cu_{0.04}$/CeO_2	CH_4	58%	-1.3 V vs. RHE	7 mA cm^{-2}	0.1 M $KHCO_3$	5
Cu@ZnO	CH_4	52%	-1.4 V vs. RHE	7 mA cm^{-2}	0.1 M $KHCO_3$	6

References

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