Supporting information for

Design of interface structure to enhance the operational temperature range of CuO/Cu-SSZ-13 for concurrent NO_x selective catalytic reduction and CO oxidation

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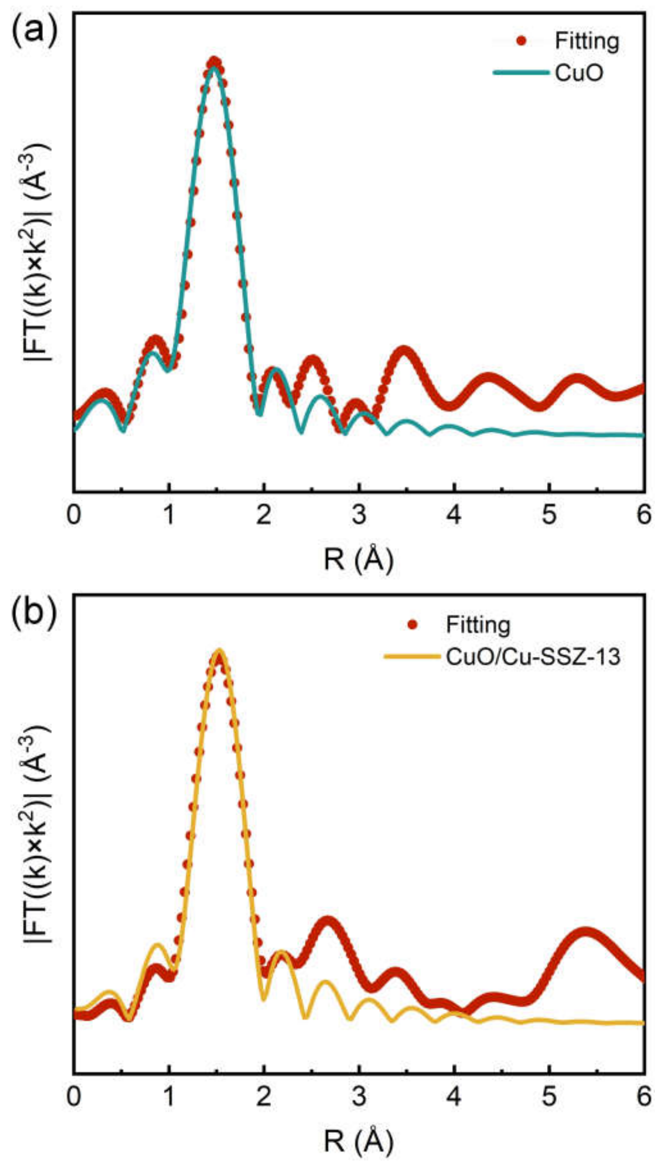

Fig. S1 EXAFS fitting results of (a) self-prepared CuO and (b) CuO/Cu-SSZ-13.

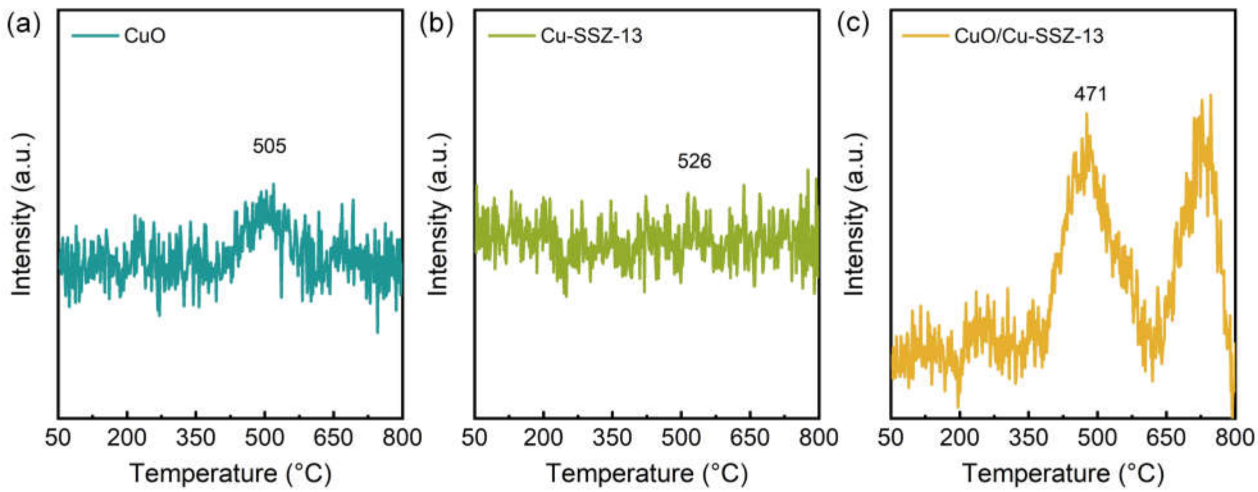

Fig. S2 O_2-TPD-MS curves of self-prepared (a) CuO, (b) Cu-SSZ-13 and (c) CuO/Cu-SSZ-13.

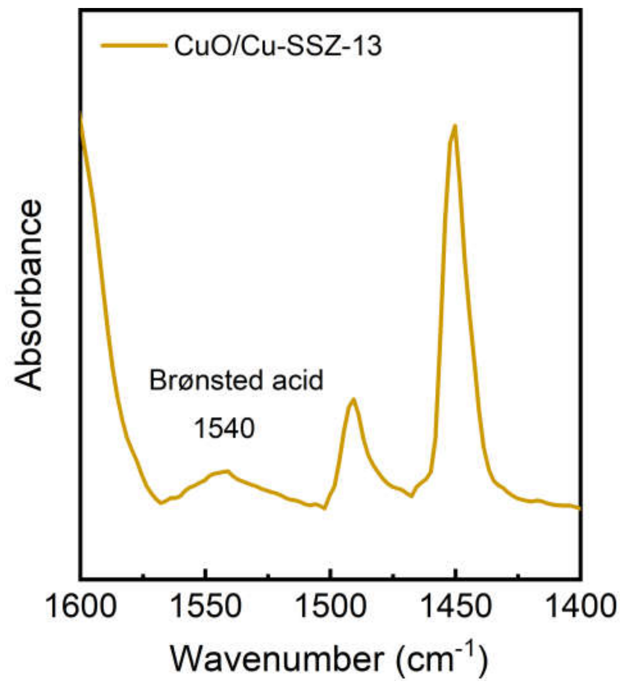

Fig. S3 Py-FTIR spectra of CuO/Cu-SSZ-13 at 150 ºC.

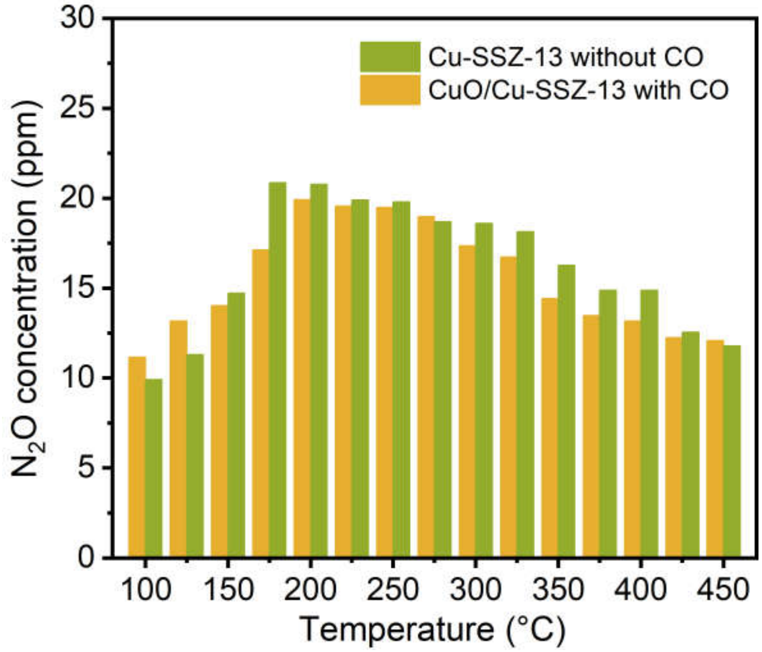

Fig. S4 N_2O concentration of Cu-SSZ-13 and CuO/Cu-SSZ-13.

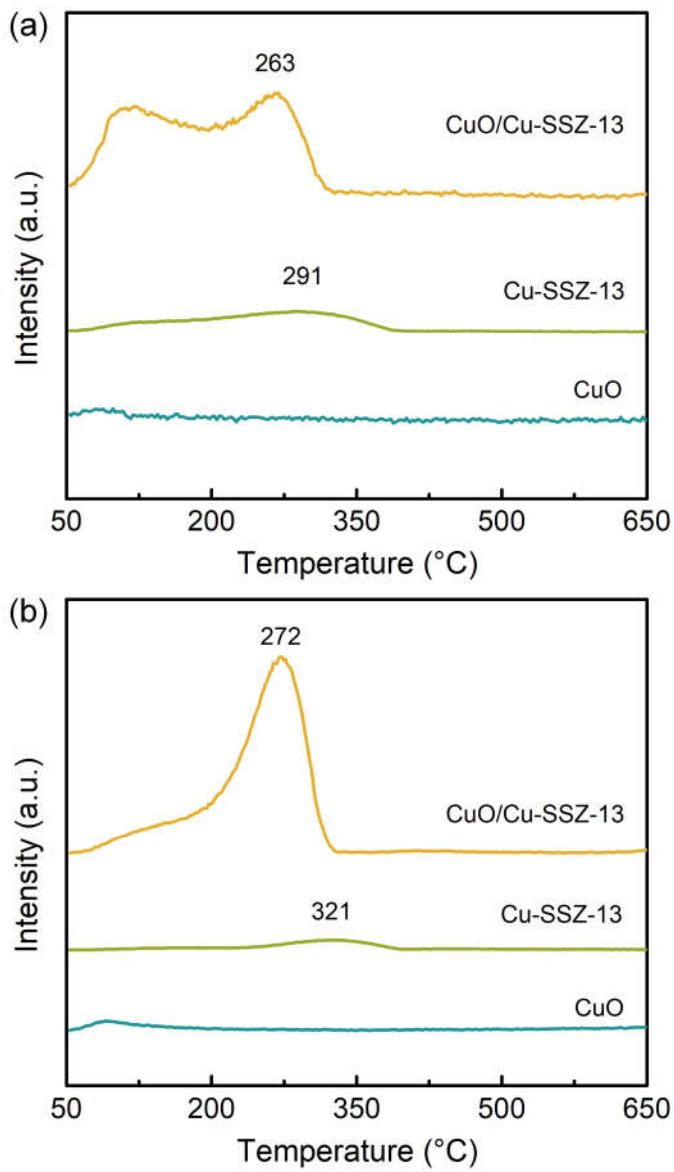

Fig. S5 (a) CO and (b) CO_2 desorption curves of self-prepared CuO, Cu-SSZ-13 and CuO/Cu-SSZ-13 by CO-TPD-MS experiments.

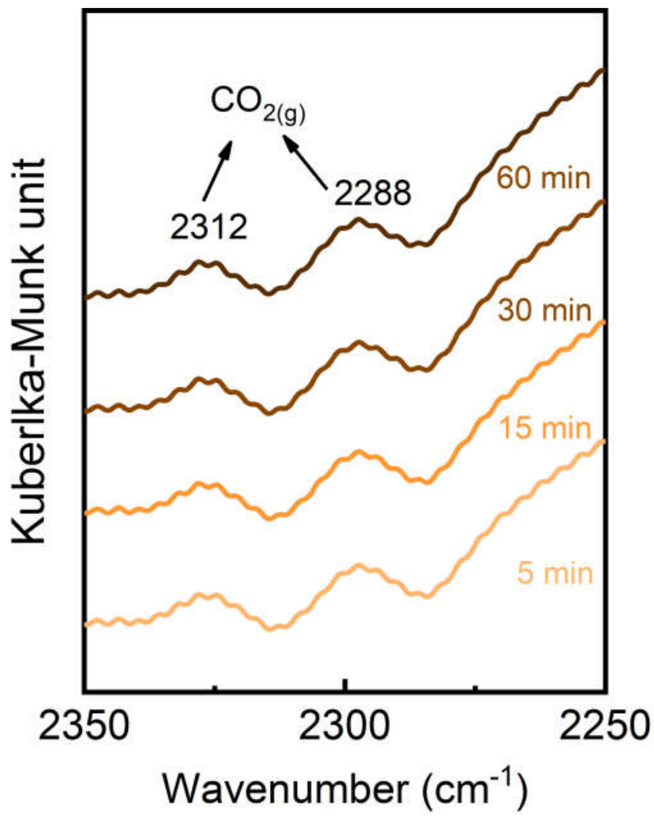

Fig. S6 CO + O_2-*in situ* DRIFTS spectra of CuO/Cu-SSZ-13 for 60 min at 200 ºC.

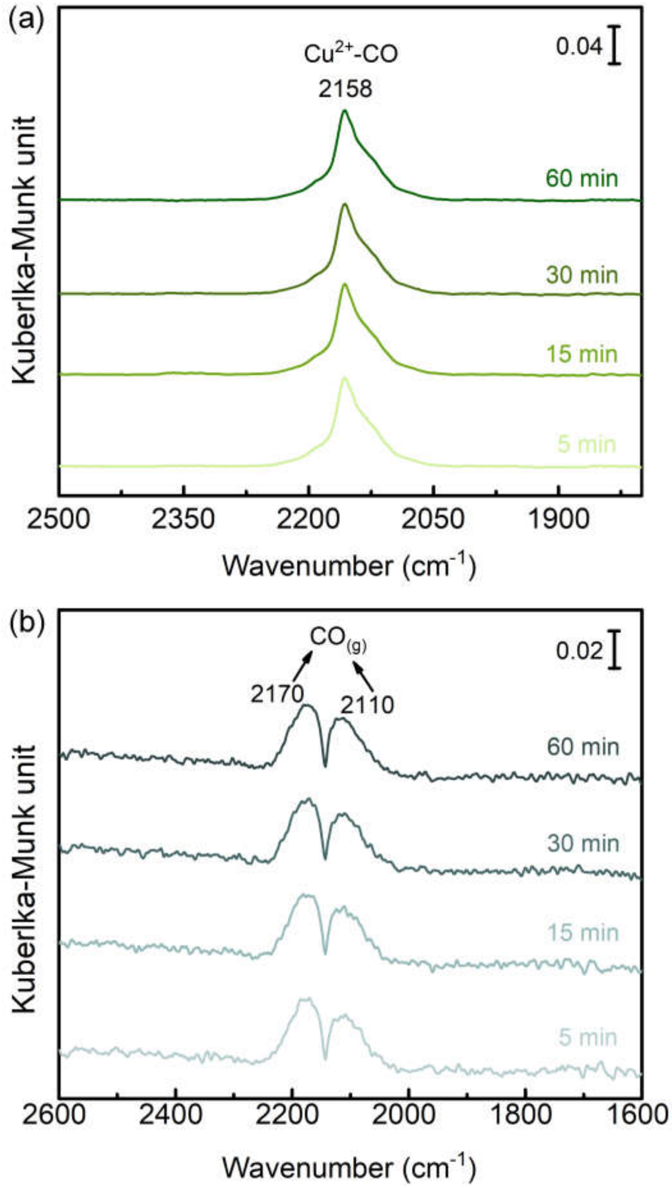

Fig. S7 CO + O_2-*in situ* DRIFTS spectra of (a) Cu-SSZ-13 and (b) CuO for 60 min at 200 ºC.

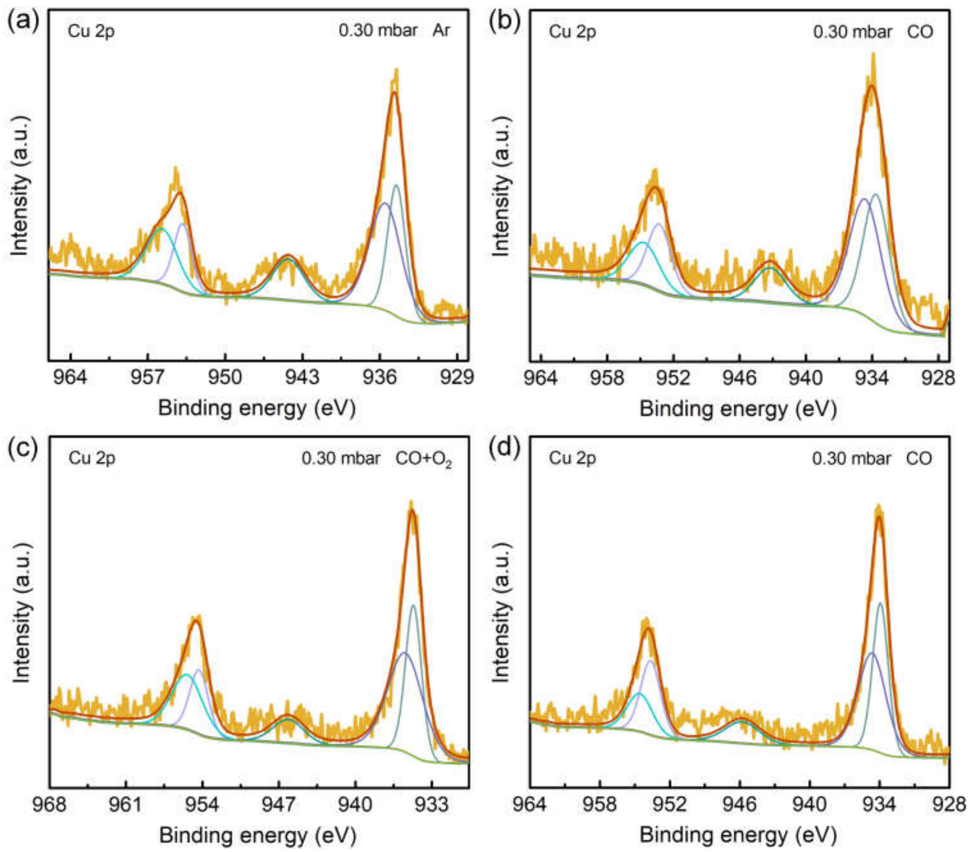

Fig. S8 Cu 2*p* XPS spectra of CuO/Cu-SSZ-13 under (a) Ar, (b) CO, (c) CO + O_2 and (d) CO atmosphere at 200 ºC.

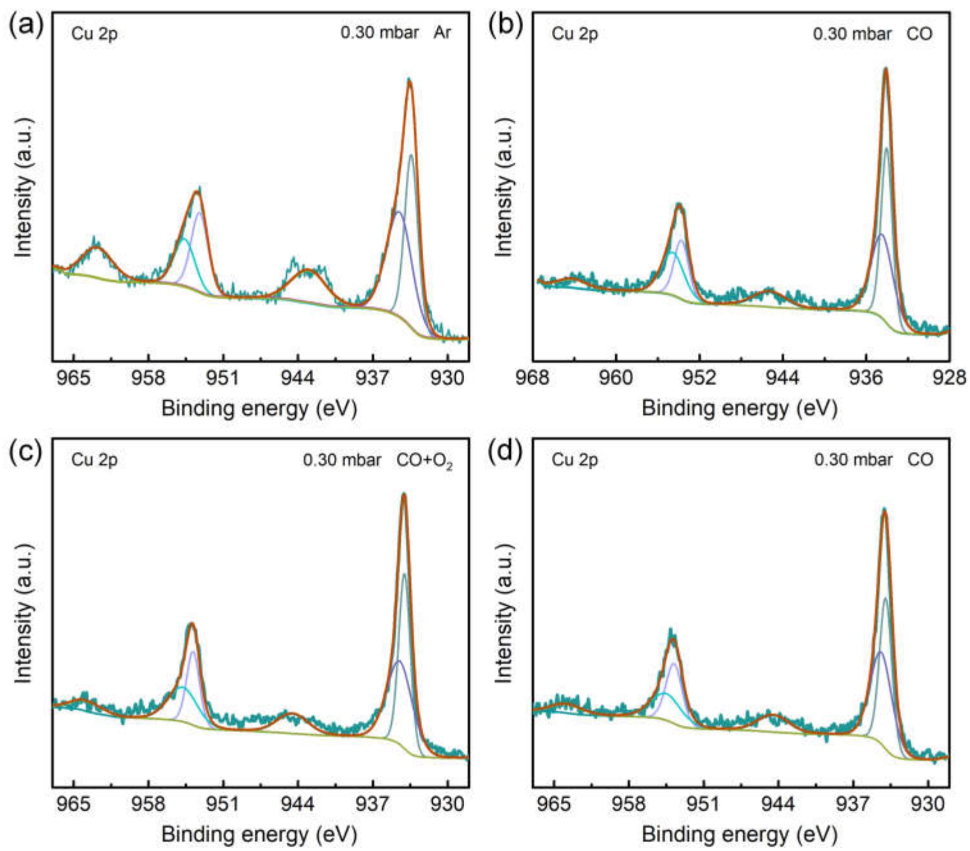

Fig. S9 Cu 2*p* XPS spectra of CuO under (a) Ar, (b) CO, (c) CO + O_2 and (d) CO atmosphere at 200 ºC.

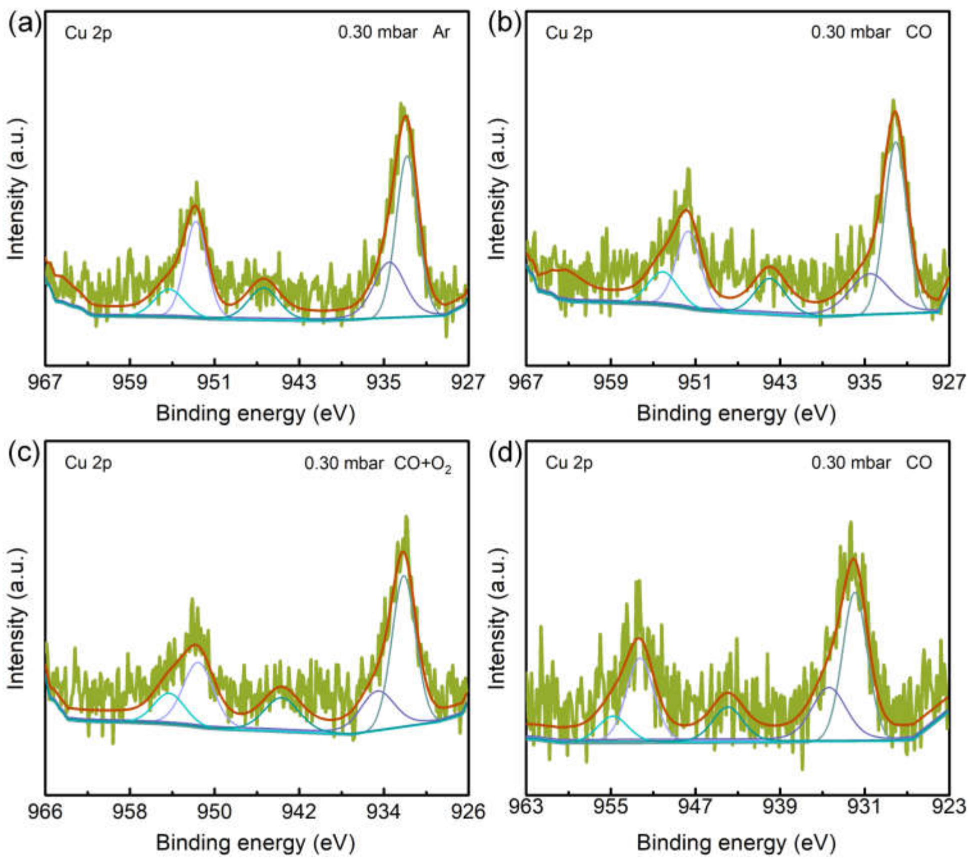

Fig. S10 Cu 2*p* XPS spectra of Cu-SSZ-13 under (a) Ar, (b) CO, (c) CO + O_2 and (d) CO atmosphere at 200 ºC.

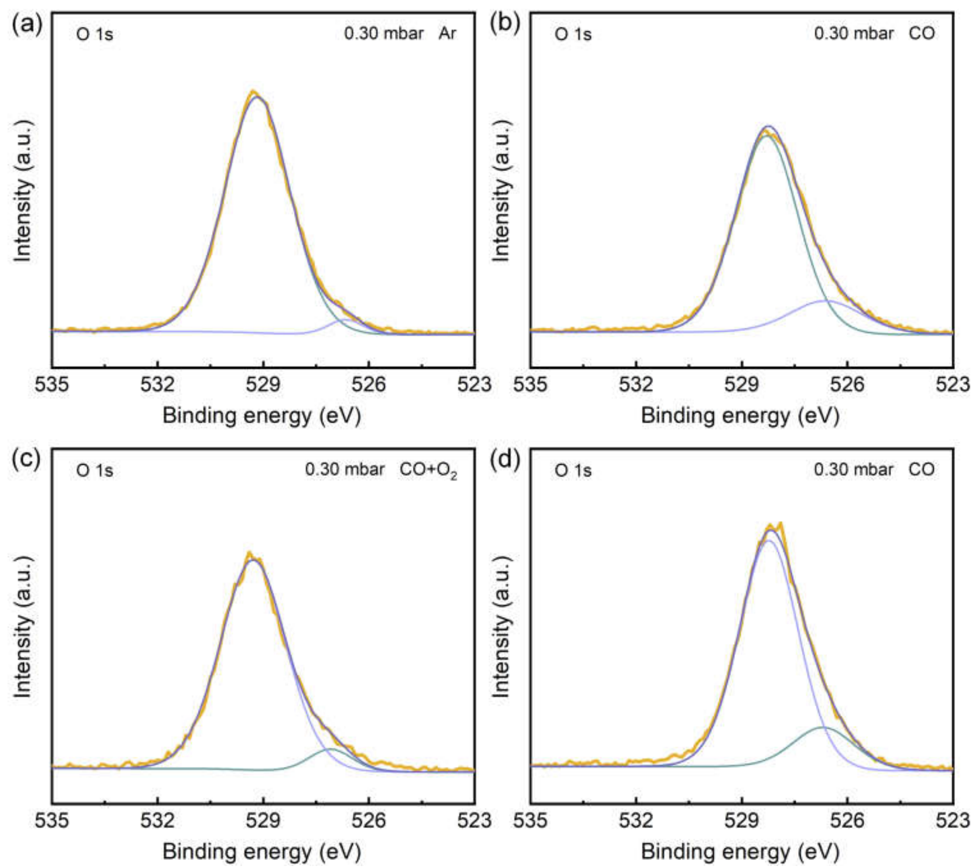

Fig. S11 O 1*s* XPS spectra of CuO/Cu-SSZ-13 under (a) Ar, (b) CO, (c) CO + O_2 and (d) CO atmosphere at 200 ºC.

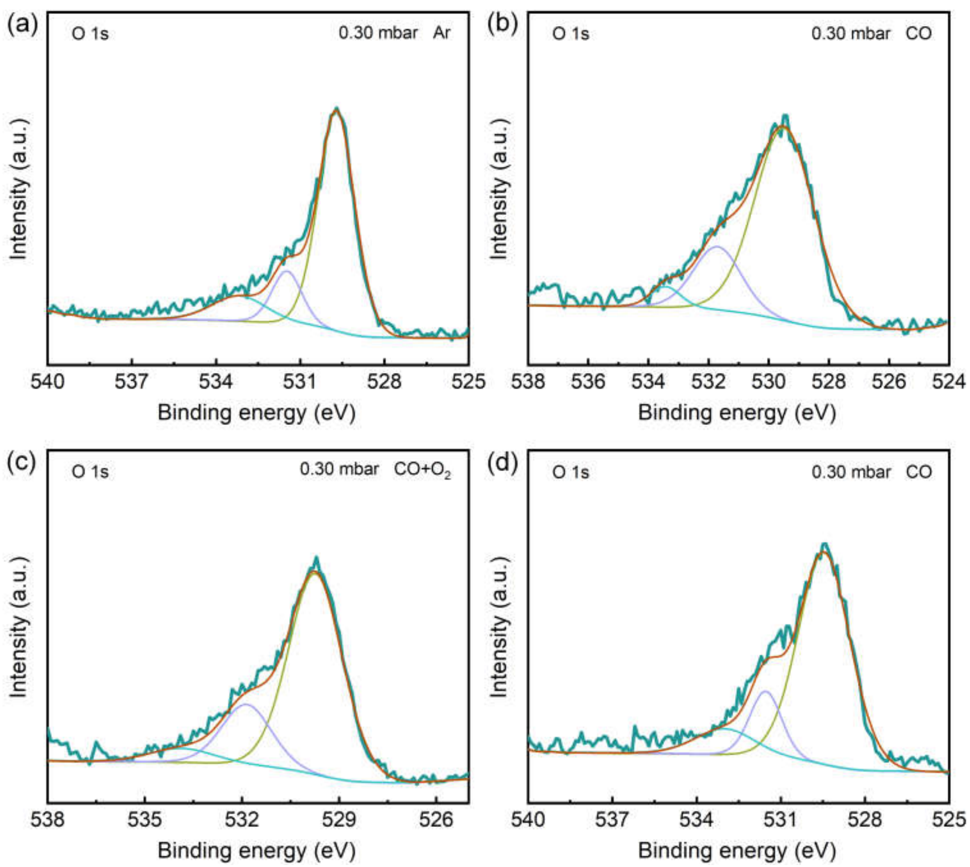

Fig. S12 O 1*s* XPS spectra of CuO under (a) Ar, (b) CO, (c) CO + O_2 and (d) CO atmosphere at 200 ºC.

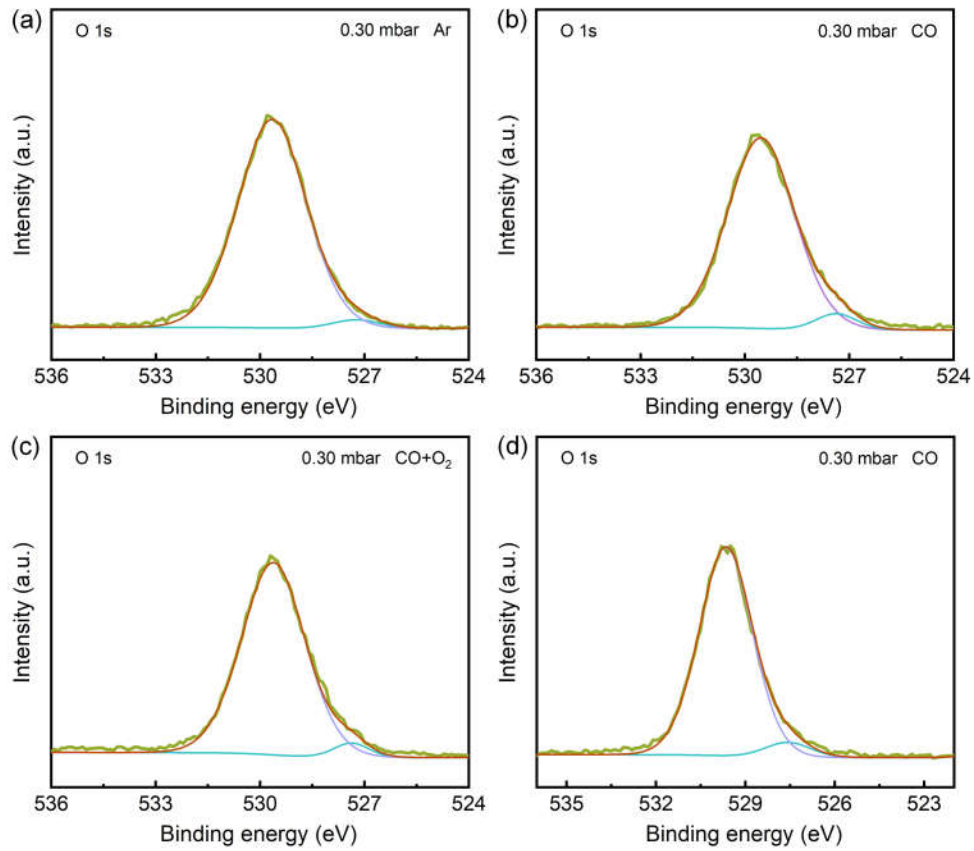

Fig. S13 O 1*s* XPS spectra of Cu-SSZ-13 under (a) Ar, (b) CO, (c) CO + O_2 and (d) CO atmosphere at 200 ºC.

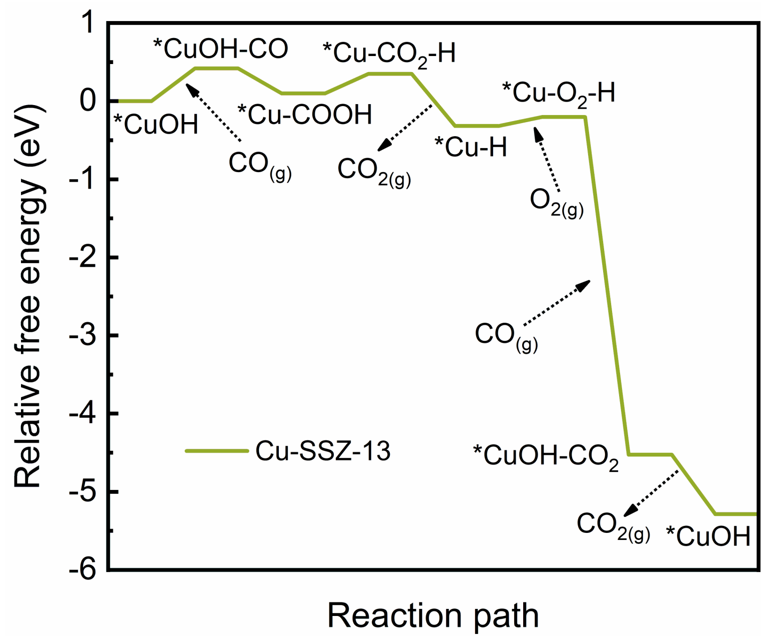

Fig. S14 The free energy change diagram of the CO oxidation process over Cu-SSZ-13 at 200 ºC.

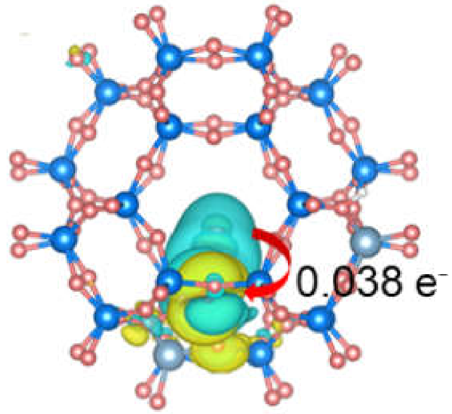

Fig. S15 Charge density difference and Bader charge of Cu-SSZ-13 for CO adsorption.

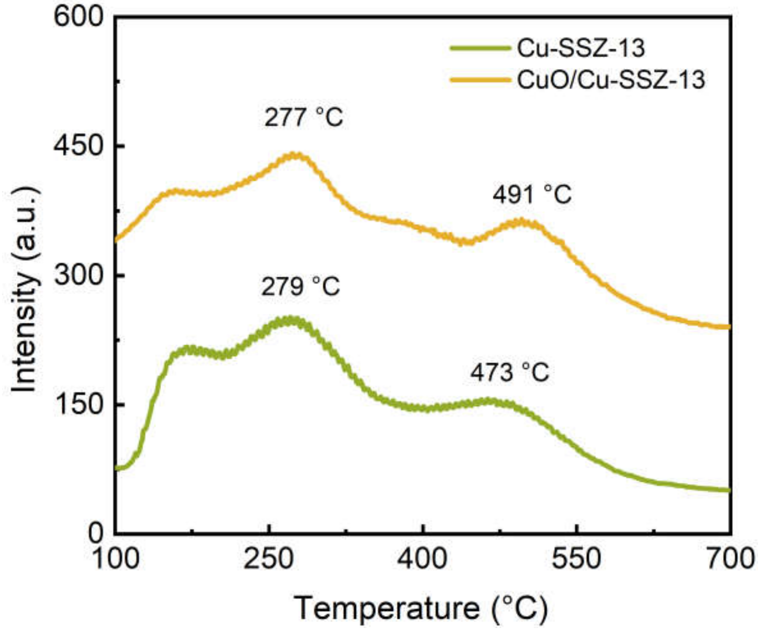

Fig. S16 NH_3 desorption curves of (a) Cu-SSZ-13 by NH_3 + O_2-TPD-FTIR experiment and (b) CuO/Cu-SSZ-13 by CO + NH_3 + O_2-TPD-FTIR experiment.

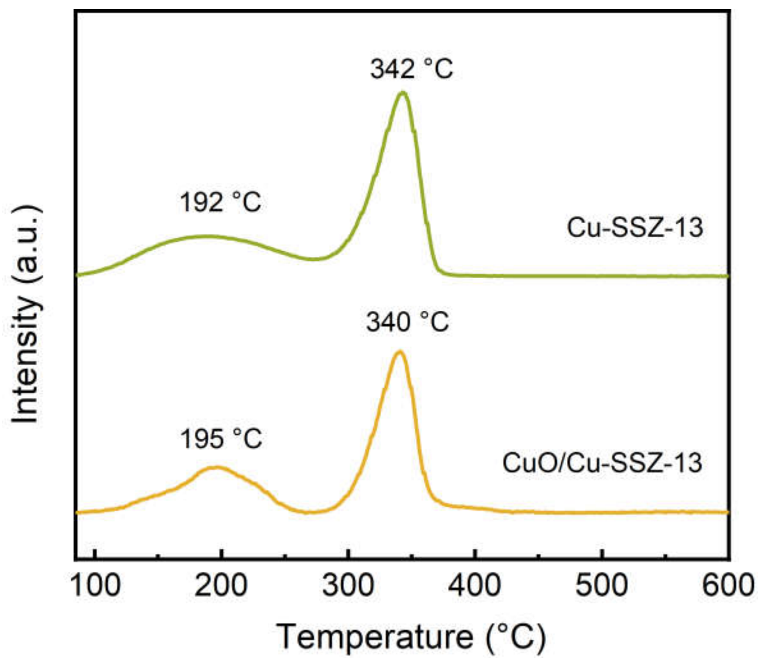

Fig. S17 NO desorption curves of (a) Cu-SSZ-13 by NO + O_2-TPD-FTIR experiment and (b) CuO/Cu-SSZ-13 by CO + NO + O_2-TPD-FTIR experiment.

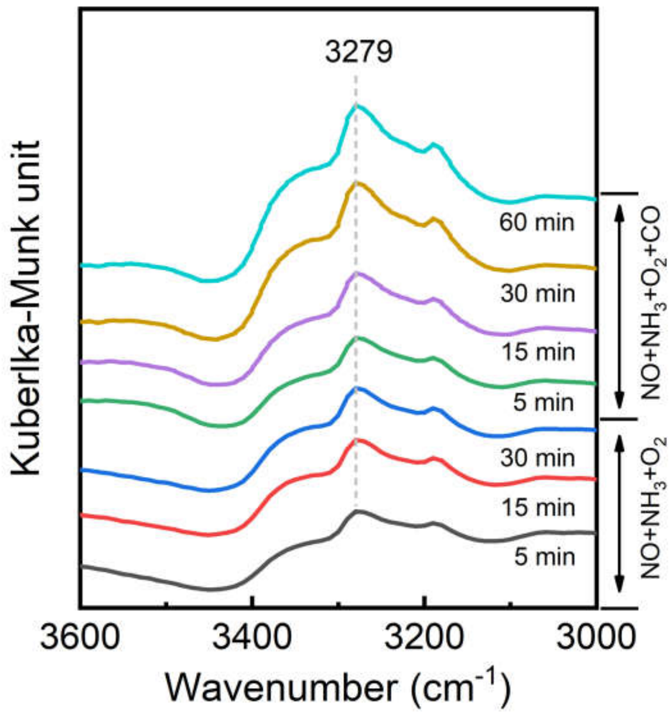

Fig. S18 The NH_3 + NO + O_2 + CO-*in situ* DRIFTS spectra of CuO/Cu-SSZ-13 in the range of 3600-3000 cm^{-1}.

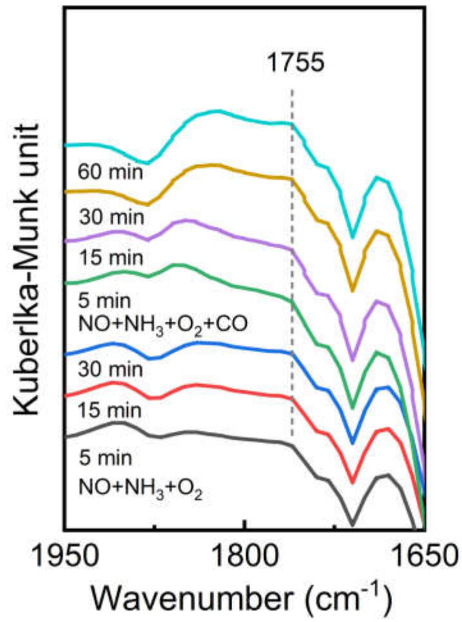

Fig. S19 The NH_3 + NO + O_2 + CO-*in situ* DRIFTS spectra of CuO/Cu-SSZ-13 in the range of 1950-1650 cm^{-1}.

Table S1 EXAFS fitting parameters at the Cu K-edge for CuO/Cu-SSZ-13 and self-prepared CuO.

Sample	Shell	CN^a	R (Å)^b	σ^2 (Å^2)^c	ΔE_0 (eV)^d	R factor
CuO	Cu–O	3.6 ± 0.4	1.91 ± 0.01	0.0036 ± 0.0014	-3.4 ± 0.6	0.0035
CuO/Cu-SSZ-13	Cu–O	3.2 ± 0.4	1.98 ± 0.01	0.0024 ± 0.0016	-0.4 ± 0.7	0.0060

Notes: [a]coordination number, [b]distance between absorber and backscatter atoms, [c]Debye-Waller factor to account for both thermal and structural disorders, [d]inner potential correction.

Table S2 Comparison of T_{90} (CO and NO_x conversions ≥ 90%) and N_2 selectivity ≥ 90% temperature range with reported literature.

Catalyst	Reaction condition	Temperature (ºC) for NO_x/CO cov. ≥ 90% and N_2 sel. ≥ 90%	References
$CuCeZrO_x$-P	$[NO_x] = [NH_3]=500 \times 10^{-6}$, $[O_2] = 9$ vol%, $[CO] = 1000 \times 10^{-6}$, GHSV = 40000 h^{-1}	200–360	1
Pd-V_2O_5-MnO_3/TiO_2	$[NO_x] = [NH_3]=500 \times 10^{-6}$, $[O_2] = 5$ vol%, $[CO] = 2000 \times 10^{-6}$, GHSV = 30000 h^{-1}	240–360	2
CuSmOTi	$[NO_x] = [NH_3] = 500 \times 10^{-6}$, $[O_2] = 5$ vol%, $[CO] = 1000 \times 10^{-6}$, GHSV = 60000 h^{-1}	175–275	3
CuMgFeO	$[NO_x] = [NH_3] = 600 \times 10^{-6}$, $[O_2] = 5$ vol%, $[CO] = 1200 \times 10^{-6}$, GHSV = 60000 mL g^{-1} h^{-1}	200–300	4
$CuMnO_x$	$[NO_x] = [NH_3] = 600 \times 10^{-6}$, $[O_2] = 5$ vol%, $[CO] = 1000 \times 10^{-6}$, GHSV = 30000 h^{-1}	200–250	5
Pd/$CeNbTiO_x$	$[NO_x] = [NH_3] = 500 \times 10^{-6}$, $[O_2] = 5$ vol%, $[CO] = 2000 \times 10^{-6}$, GHSV = 30000 h^{-1}	240–320	6
Sm/MnO_x	$[NO_x] = [NH_3] = 500 \times 10^{-6}$, $[O_2] = 11$ vol%, $[CO] = 1000 \times 10^{-6}$, GHSV = 60000 h^{-1}	200–275	7
Ta-CeO_2/SnO_2	$[NO_x] = 500 \times 10^{-6}$, $[NH_3] = 520 \times 10^{-6}$, $[O_2] = 10$ vol%, $[CO] = 5000 \times 10^{-6}$, GHSV = 25000 h^{-1}	325–450	8
30Cu/Ce0.3Ti0.7	$[NO_x] = [NH_3] = 500 \times 10^{-6}$, $[O_2] = 5$ vol%, $[CO] = 2000 \times 10^{-6}$, GHSV = 40000 h^{-1}	148–218	9
CuO/V_2O_5-WO_3/TiO_2	$[NO_x] = [NH_3] = 500 \times 10^{-6}$, $[O_2] = 5$ vol%, $[CO] = 2000 \times 10^{-6}$, GHSV = 40000 h^{-1}	220–275	10
CuO/Cu-SSZ-13	$[NO_x] = [NH_3] = 500 \times 10^{-6}$, $[O_2] = 5$ vol%, $[CO] = 3000 \times 10^{-6}$, GHSV = 60000 h^{-1}	200–425	This work

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