Electronic Supplementary Material (ESI) for RSC Advances

Three dimensionally ordered macroporous Au/CeO_2 catalysts synthesized via different methods for enhanced CO preferential oxidation in H_2-rich gases

Yang Liu,[a] *Baocang Liu,*[a,b] *Qin Wang,*[a] *Long Yang,*[a] *Changyan, Li,*[a,b] *Wenting Hu,*[a] *Yongxin Liu,*[a] *Peng Jing,*[a] *Wenzhi Zhao,*[a,b] *and Jun Zhang*[a,b,c*]

[a] College of Chemistry and Chemical Engineering, Inner Mongolia University, Hohhot 010021, P.R. China

[b] College of Life Sciences, Inner Mongolia University, Hohhot 010021, P.R. China

[c] Inner Mongolia Key Lab of Nanoscience and Nanotechnology, , Hohhot 010021, P.R. China

* Corresponding author: J. Zhang, Tel.: 0086 471 4992175; Fax: 0086 471 4992278; Email: cejzhang@imu.edu.cn

Table S1. The BET property of 3DOM CeO_2 supports.

Supports	Precursors	Chelating ligands	S_{BET} (m^3/g)	V_p (cm^3/g)	D_p (nm)
CeO_2-CA-$CeCl_3$	$CeCl_3$	Citric acid	44	0.16	-
CeO_2-OA-$CeCl_3$	$CeCl_3$	Oxalic acid	84	0.28	-
CeO_2-CA-$Ce(NO_3)_3$	$Ce(NO_3)_3$	Citric acid	73	0.16	3.6
CeO_2-OA-$Ce(NO_3)_3$	$Ce(NO_3)_3$	Oxalic acid	101	0.18	3.8

Table S2. Summary of CO conversion and CO_2 selectivity on 3DOM 3 wt.% Au/CeO_2 catalysts according to Figure 9.

Catalysts	Temperature (°C)	CO conversion (%)	CO_2 selectivity (%)
Au/CeO_2-CA- $CeCl_3$	25	53.3	100
	50	73.6	50.8
	80	68.8	39.8
	120	64.3	37.1
	200	58.1	33.6
Au/CeO_2-CA- $Ce(NO_3)_3$	20	47.0	100
	40	76.0	97.0
	80	83.0	48.0
	120	75.5	43.2
	200	67.0	40.3
Au/CeO_2-OA- $CeCl_3$	25	89.5	67.2
	50	84.9	62.5
	80	73.7	43.1
	120	68.1	39.7
	200	50.7	29.5
Au/CeO_2-OA- $Ce(NO_3)_3$	25	96.0	100
	50	90.1	59.9
	80	88.3	59.3
	120	86.6	60.6
	200	85.2	56.2

Table S3. CO conversion and CO_2 selectivity over 3DOM Au/CeO_2-OA-Ce$(NO_3)_3$ catalysts with different Au content.

Catalysts	Temperature (°C)	CO conversion (%)	CO_2 selectivity (%)
1 wt. % Au/CeO_2-OA-Ce$(NO_3)_3$	25	71.3	70.2
	40	86.1	62.5
	80	72.7	42.5
	120	67.9	39.7
	200	52.2	29.8
2 wt.% Au/CeO_2-OA-Ce$(NO_3)_3$	25	62.2	100
	50	84.0	55.3
	80	74.3	42.6
	120	70.6	38.6
	200	50.8	29.2
3 wt.% Au/CeO_2-OA-Ce$(NO_3)_3$	25	96.0	100
	50	90.1	59.9
	80	88.3	59.3
	120	86.6	60.6
	200	85.2	56.2
4 wt.% Au/CeO_2-OA-Ce$(NO_3)_3$	25	81.9	100
	50	87.4	63.4
	80	75.3	47.1
	120	718	47.3
	200	78.1	48.3

Table S4. Reaction rate and turnover frequency (TOF) of 3DOM 3 wt.% Au/CeO_2-OA-$Ce(NO_3)_3$ catalysts.

WHSV [a] ***($cm^3\ g_{cat.}^{-1}\ h^{-1}$)***	***Temperature (^oC)***	***$r_{CO} \times 10^4$ ($mol \cdot s^{-1} \cdot g_{Cat.}^{-1}$)***	**TOF (s^{-1})**
Au/CeO_2-CA-$CeCl_3$	25	1.01	0.132
	45	1.39	0.183
	60	1.37	0.179
	80	1.30	0.171
	120	1.21	0.159
	160	1.11	0.146
	200	1.10	0.144
Au/CeO_2-CA-$Ce(NO_3)_3$	20	0.91	0.120
	40	1.45	0.191
	60	1.58	0.208
	80	1.59	0.208
	120	1.45	0.190
	160	1.41	0.185
	200	1.28	0.169
Au/CeO_2-OA-$CeCl_3$	25	1.89	0.248
	40	1.84	0.241
	60	1.73	0.227
	80	1.59	0.209
	120	1.47	0.193
	160	1.28	0.168
	200	1.10	0.144
Au/CeO_2-OA-$Ce(NO_3)_3$	25	1.51	0.199
	40	1.54	0.203
	60	1.52	0.200
	80	1.51	0.198
	120	1.48	0.194
	160	1.50	0.197
	200	1.45	0.191

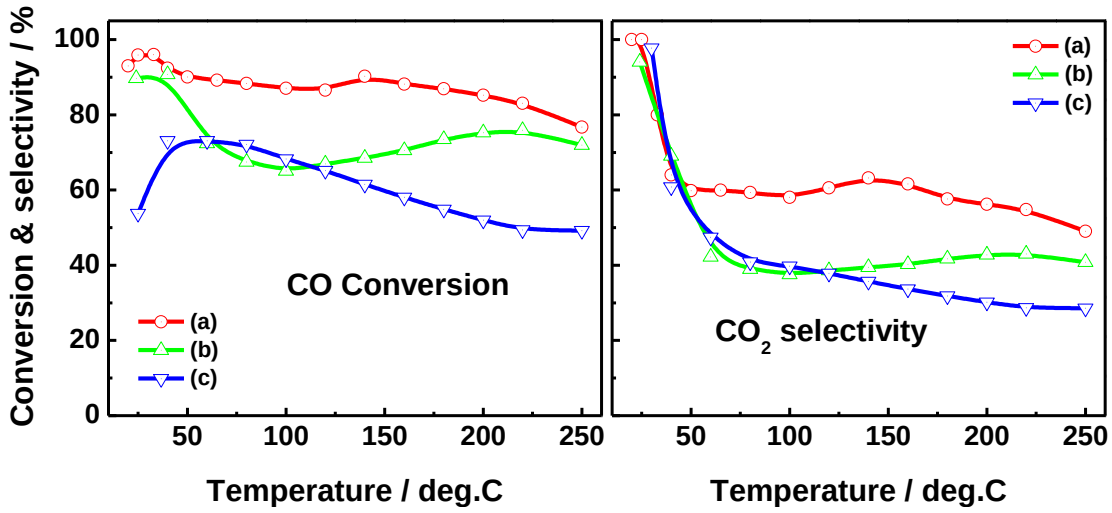

Fig.S1 CO conversion and CO_2 selectivity on 3DOM 3 wt.% Au/CeO_2-OA-Ce$(NO_3)_3$ catalysts with different pore sizes at (a) 200, (b) 400 and (c) 600 nm.

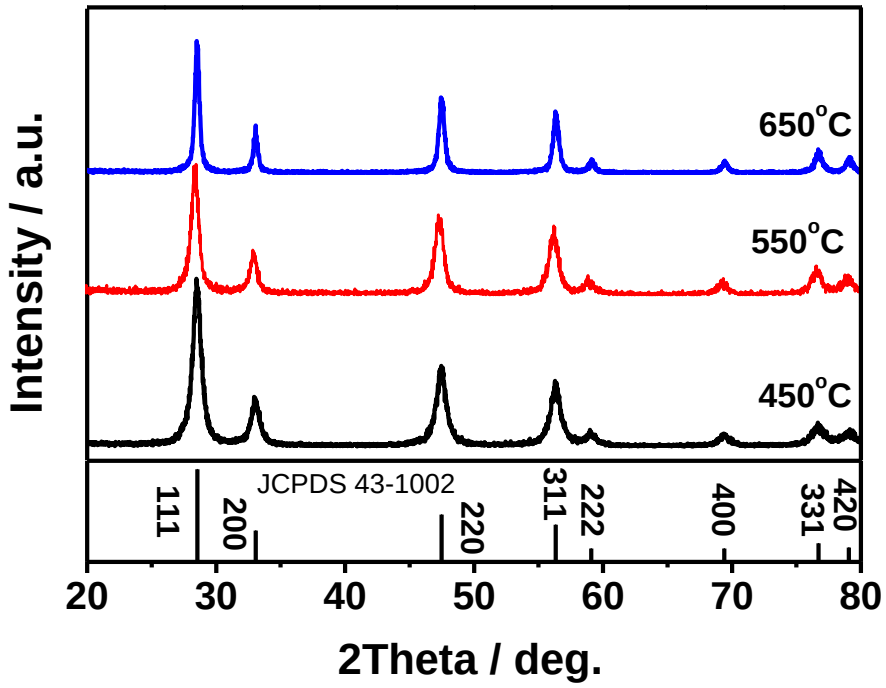

Fig.S2 XRD patterns of 3DOM 3 wt.% Au/CeO_2-OA-$Ce(NO_3)_3$ catalysts synthesized using 3DOM CeO_2 calcined at different temperatures of 450, 550, and 650 °C as supports.

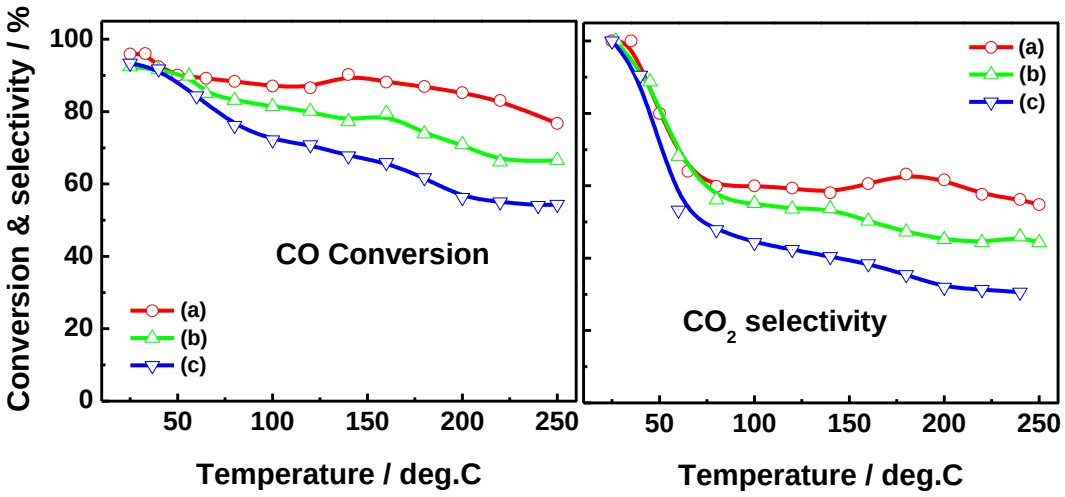

Fig.S3 CO conversion and CO_2 selectivity on 3DOM 3 wt.% Au/CeO_2-OA-Ce$(NO_3)_3$ catalysts synthesized using 3DOM CeO_2 calcined at different temperatures of (a) 450, (b) 550, and (c) 650 °C as supports.

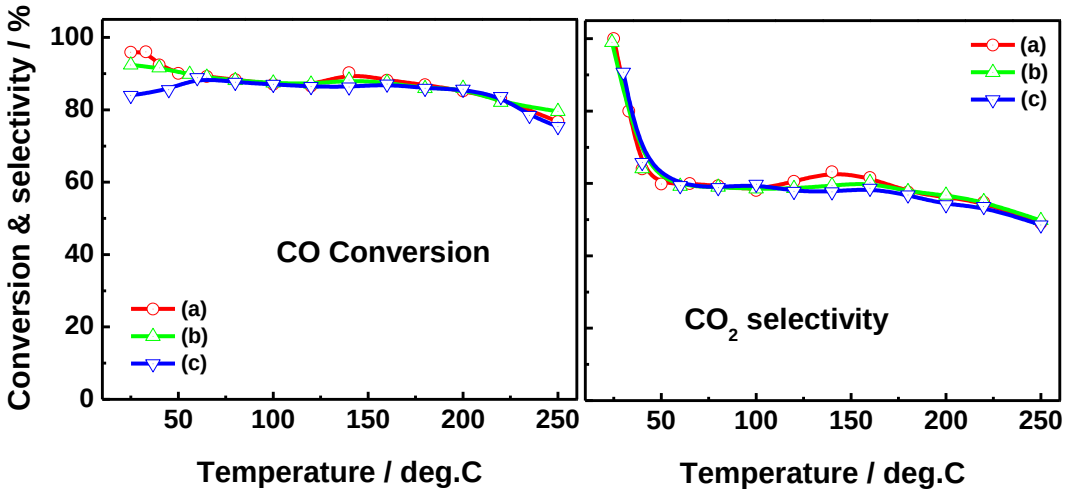

Fig.S4 CO conversion and CO_2 selectivity on 3DOM 3 wt.% Au/CeO_2-OA-Ce$(NO_3)_3$ catalyst at different weight hourly space velocities of (a) 30000, (b) 60000, and (c) 90000 $cm^3 \cdot g_{cat}^{-1} \cdot h^{-1}$.