Electronic Supplementary Information (ESI):

Probing A Thermal-enhanced Catalytic Activity of CO Oxidation over Pd/OMS-2 Catalysts

Xin Liu, Qiulin Zhang*, Ping Ning*, Qixian Liu, Zhongxian Song, YanKang Duan

Faculty of Environmental Science and Engineering, Kunming University of Science and Technology, Kunming, 650500, PR China.

Kinetic study

Effects of CO concentrations and temperature on CO oxidation rate at 323 K are shown in **Fig. S1**. Rate of catalytic reaction is calculated as follow:

$$r = c \bullet X \bullet V / m$$

Where r represents reaction rate of CO oxidation (Rate of CO conversion 10^{-6} mol/(g•min)), c is the initial concentration of CO (mol/cm^3), X is the CO conversion (%), V is the reaction mixture flow rate (cm^3/min), m is the catalyst weight (g)

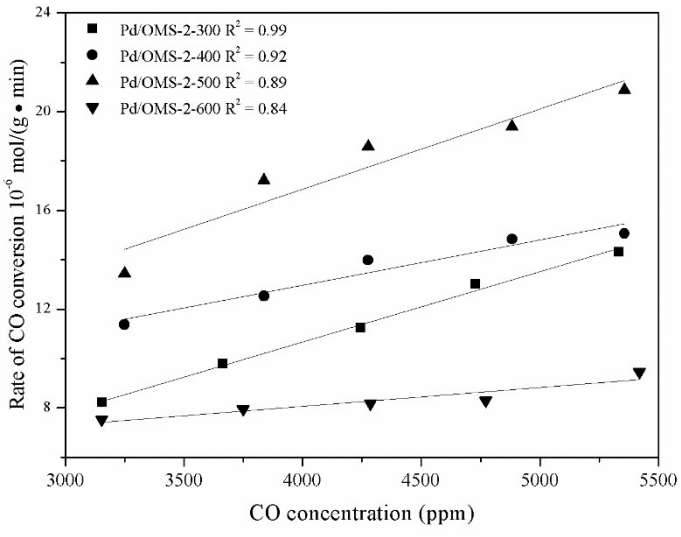


Fig. S1 Effects of CO concentration and temperature on the CO oxidation rate over various catalysts at 323K.

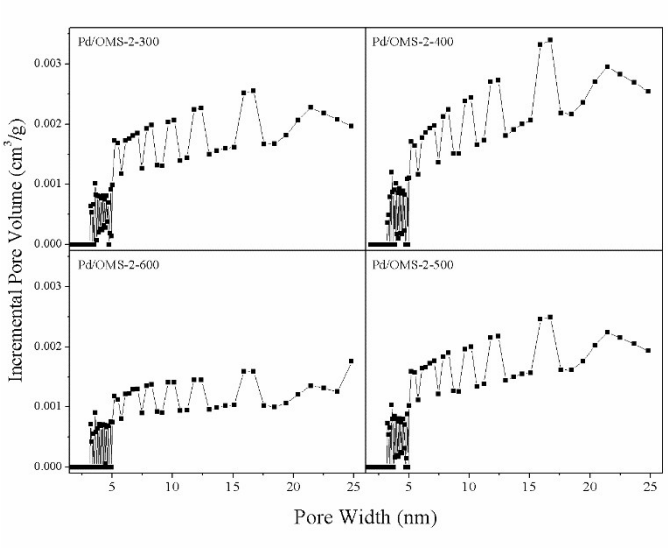


Fig.S2 Pore-size distribution of the various Pd/OMS-2 catalysts

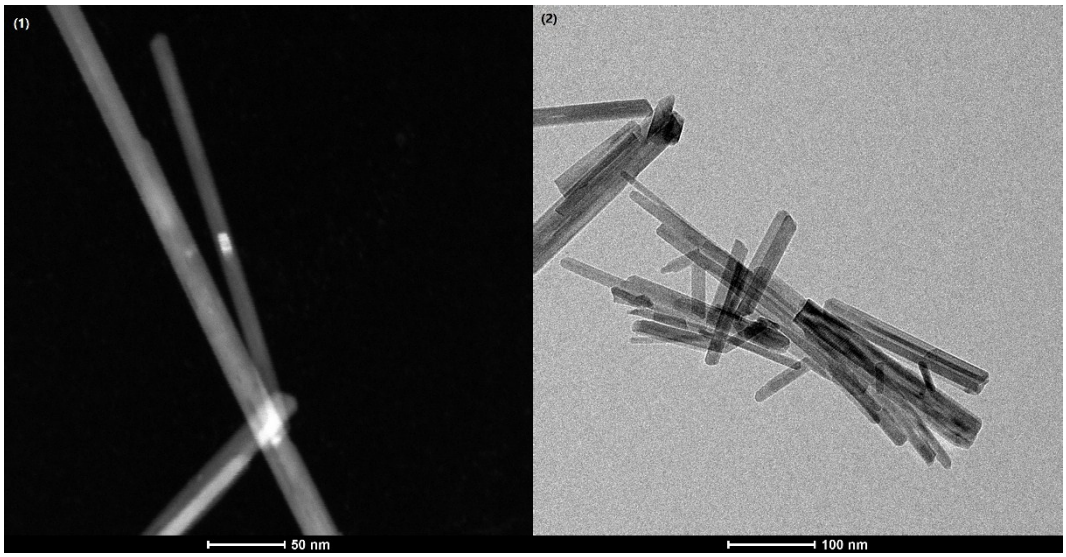


Fig. S3 (1) STEM and (2) TEM images of Pd/OMS-2-300

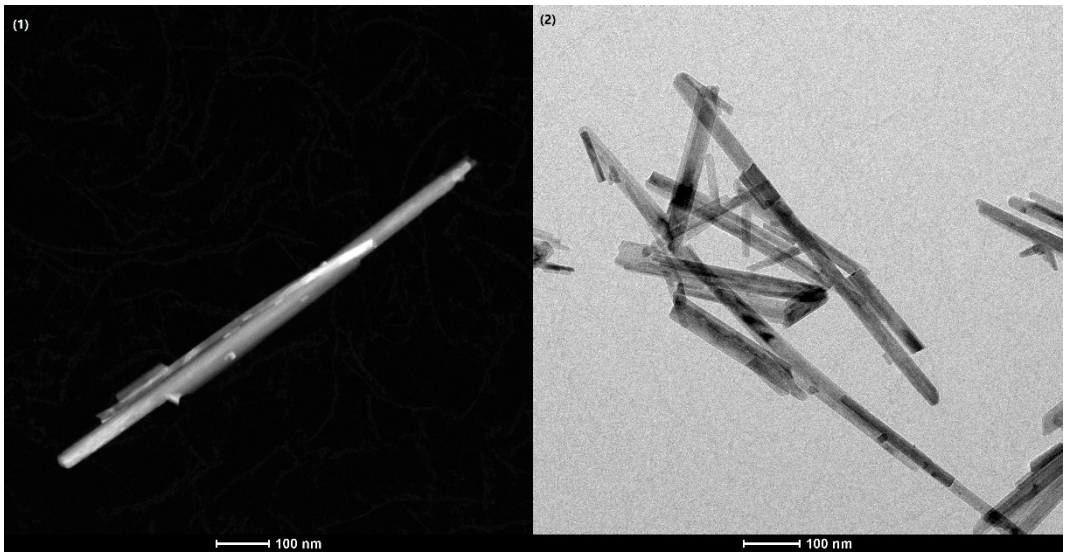


Fig. S4 (1) STEM and (2) TEM images of Pd/OMS-2-400

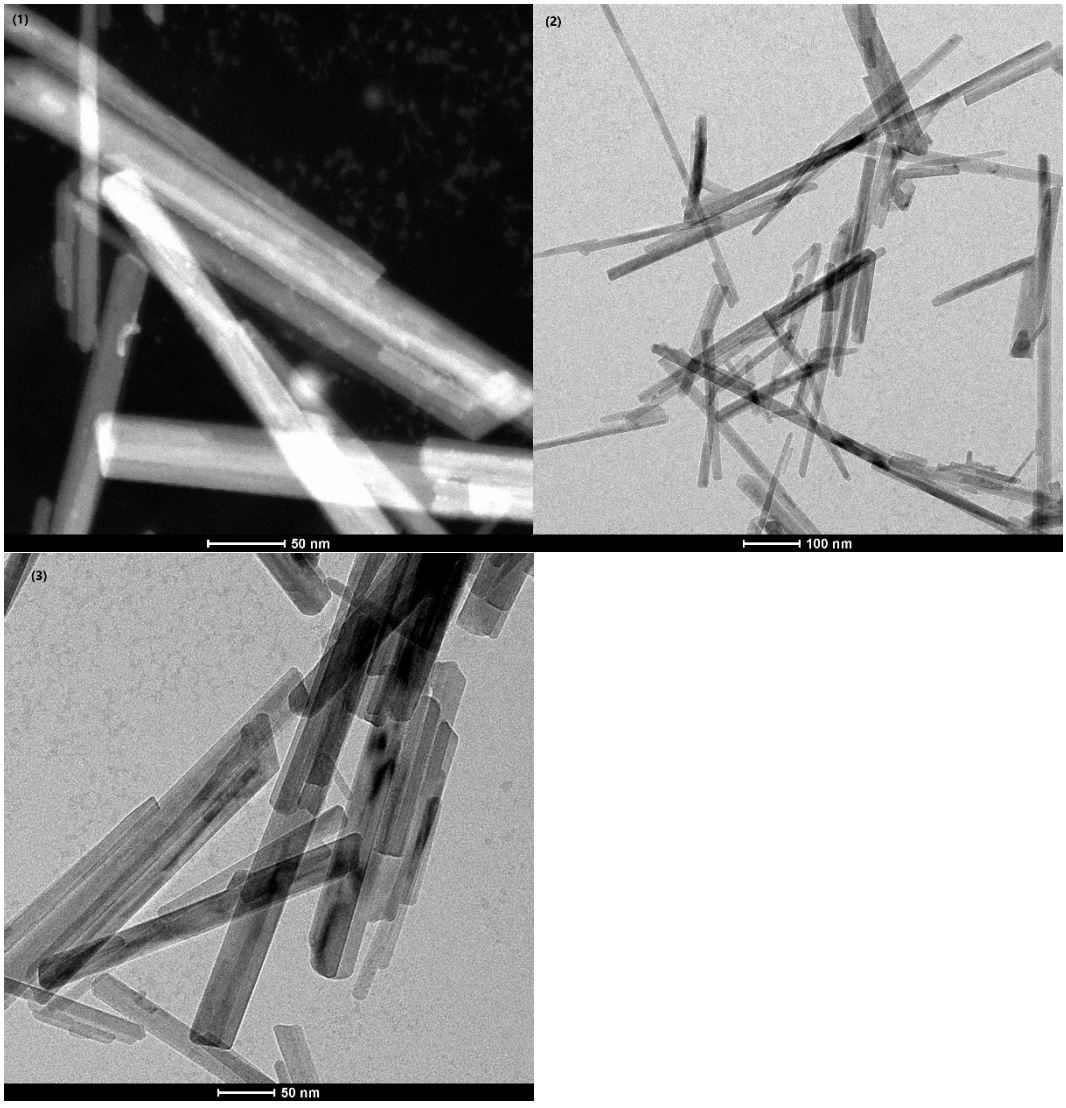


Fig. S5 (1) STEM and (2), (3) TEM images of Pd/OMS-2-500

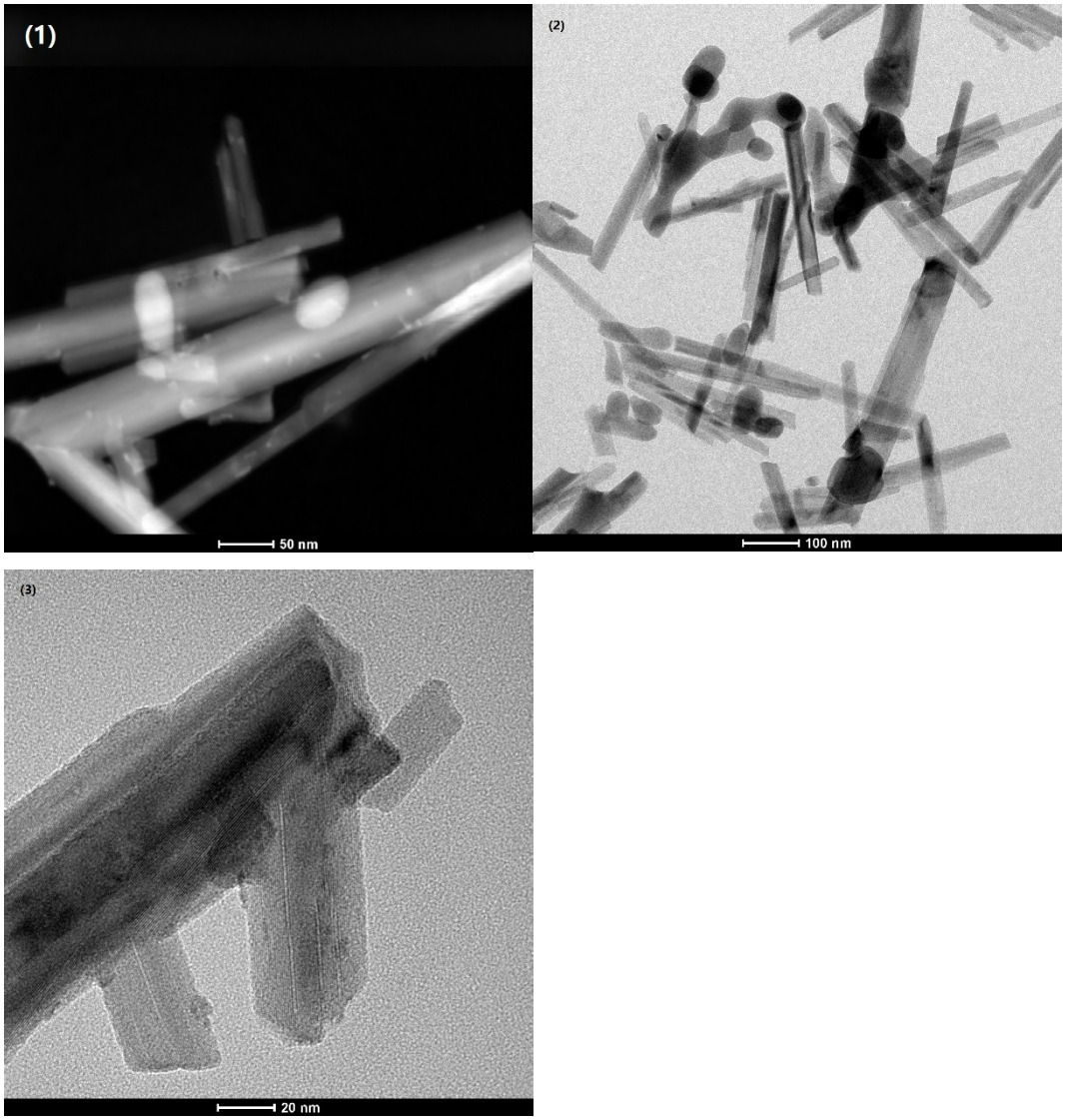


Fig. S6 (1) STEM and (2), (3) TEM images of Pd/OMS-2-600

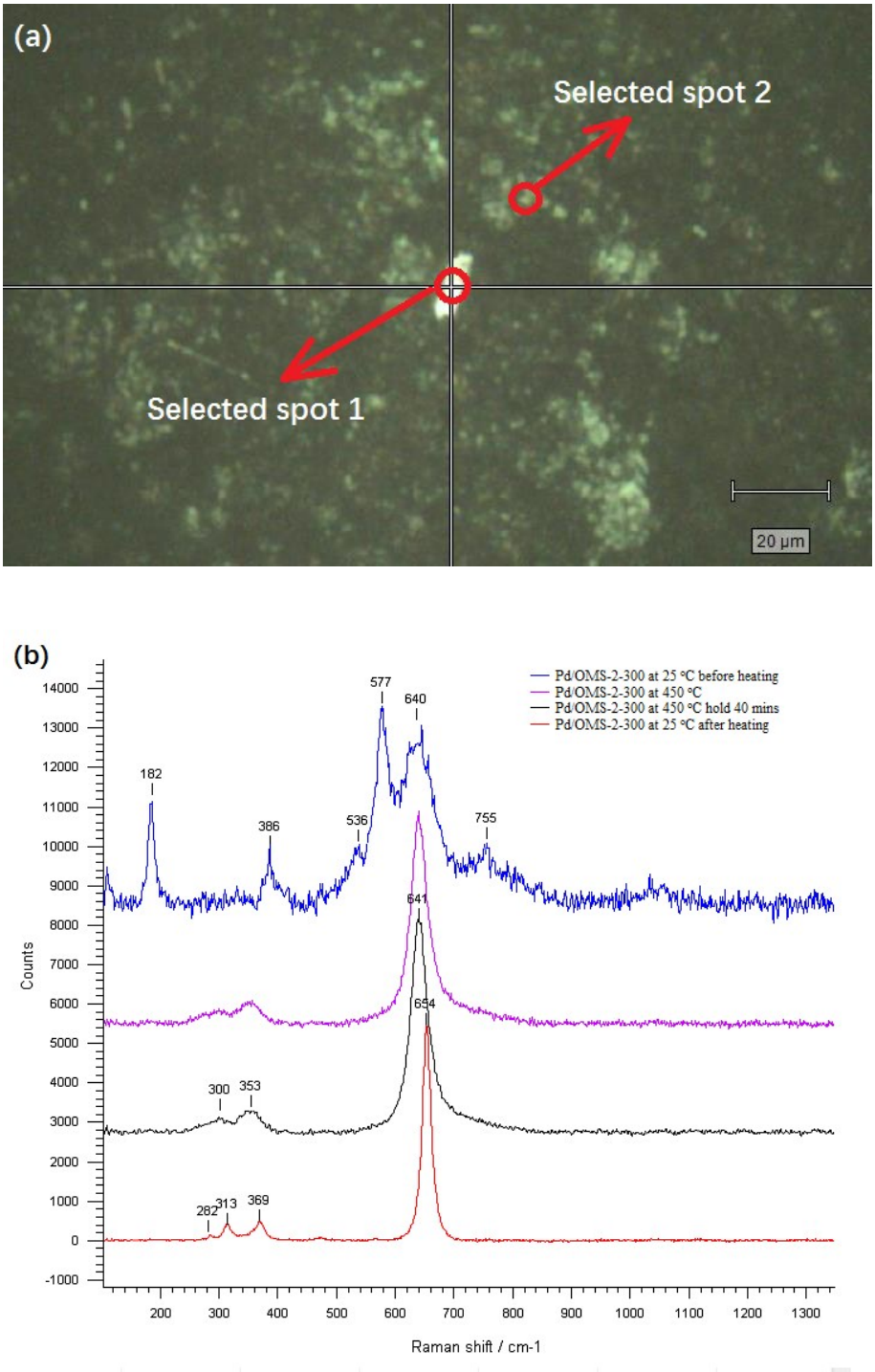
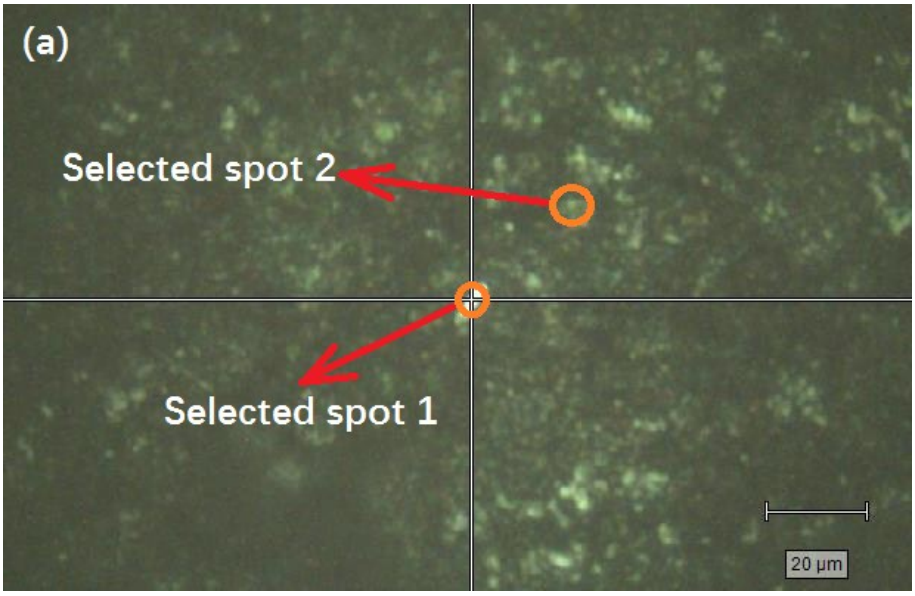
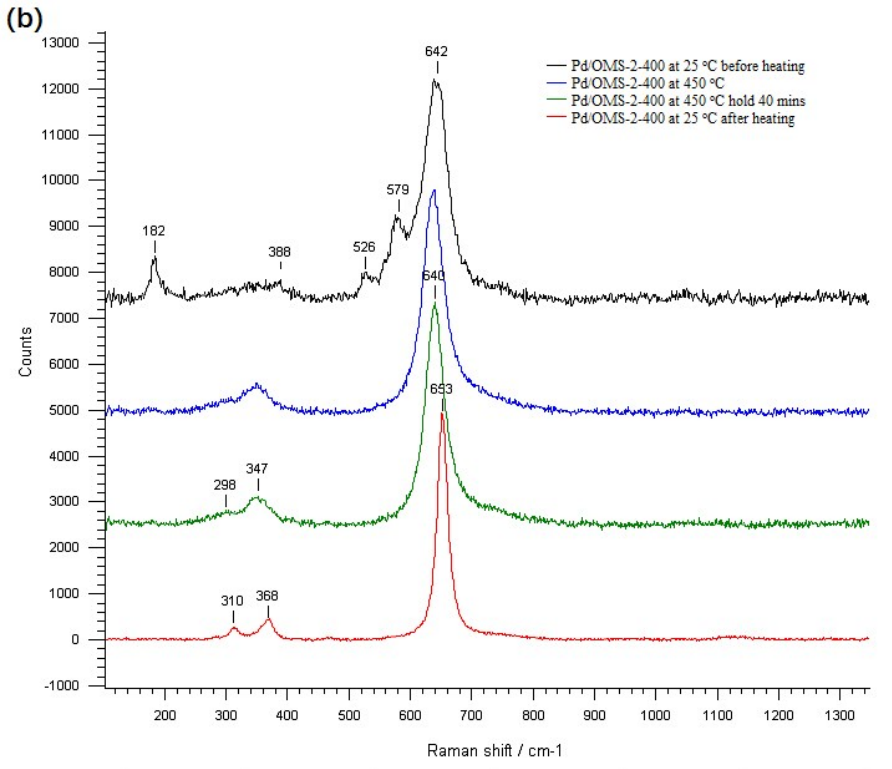


Fig. S7 (a) Optical microscope image and selected spots of Pd/OMS-2-300 catalyst, (b) in-situ Raman spectroscopy of the selected spot 1 over Pd/OMS-2-300 catalyst. (c) in-situ Raman spectroscopy of the selected spot 2 over Pd/OMS-2-300 catalyst


(a)
Selected spot 2
Selected spot 1
20 μm


(b)
Pd/OMS-2-400 at 25 °C before heating
Pd/OMS-2-400 at 450 °C
Pd/OMS-2-400 at 450 °C hold 40 mins
Pd/OMS-2-400 at 25 °C after heating
642
579
526
388
182
640
653
347
298
310
368
Counts
Raman shift / cm-1

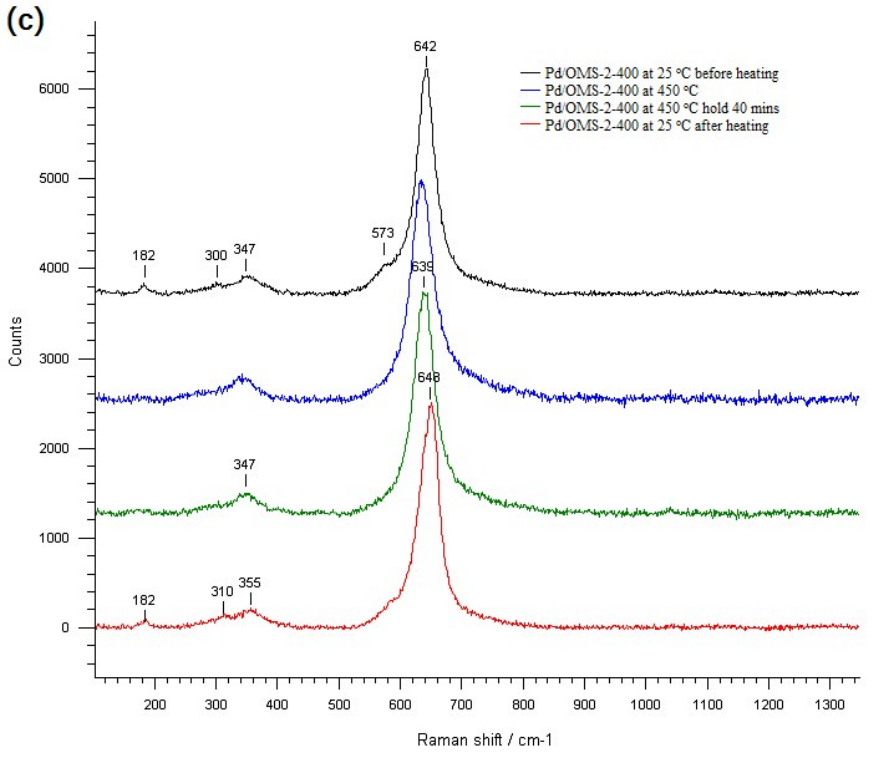
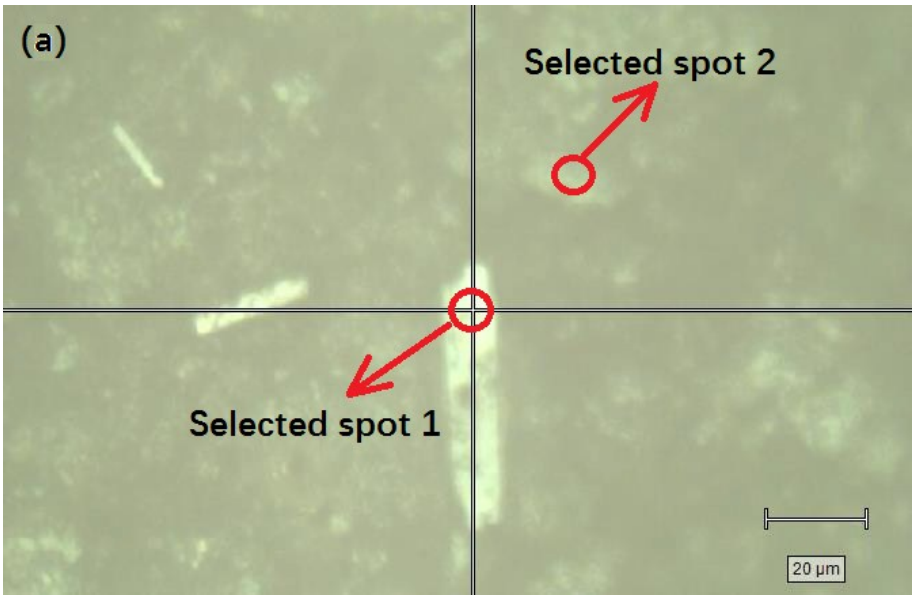


Fig. S8 (a) Optical microscope image and selected spots of Pd/OMS-2-400 catalyst, (b) in-situ Raman spectroscopy of the selected spot 1 over Pd/OMS-2-400 catalyst. (c) in-situ Raman spectroscopy of the selected spot 2 over Pd/OMS-2-400 catalyst



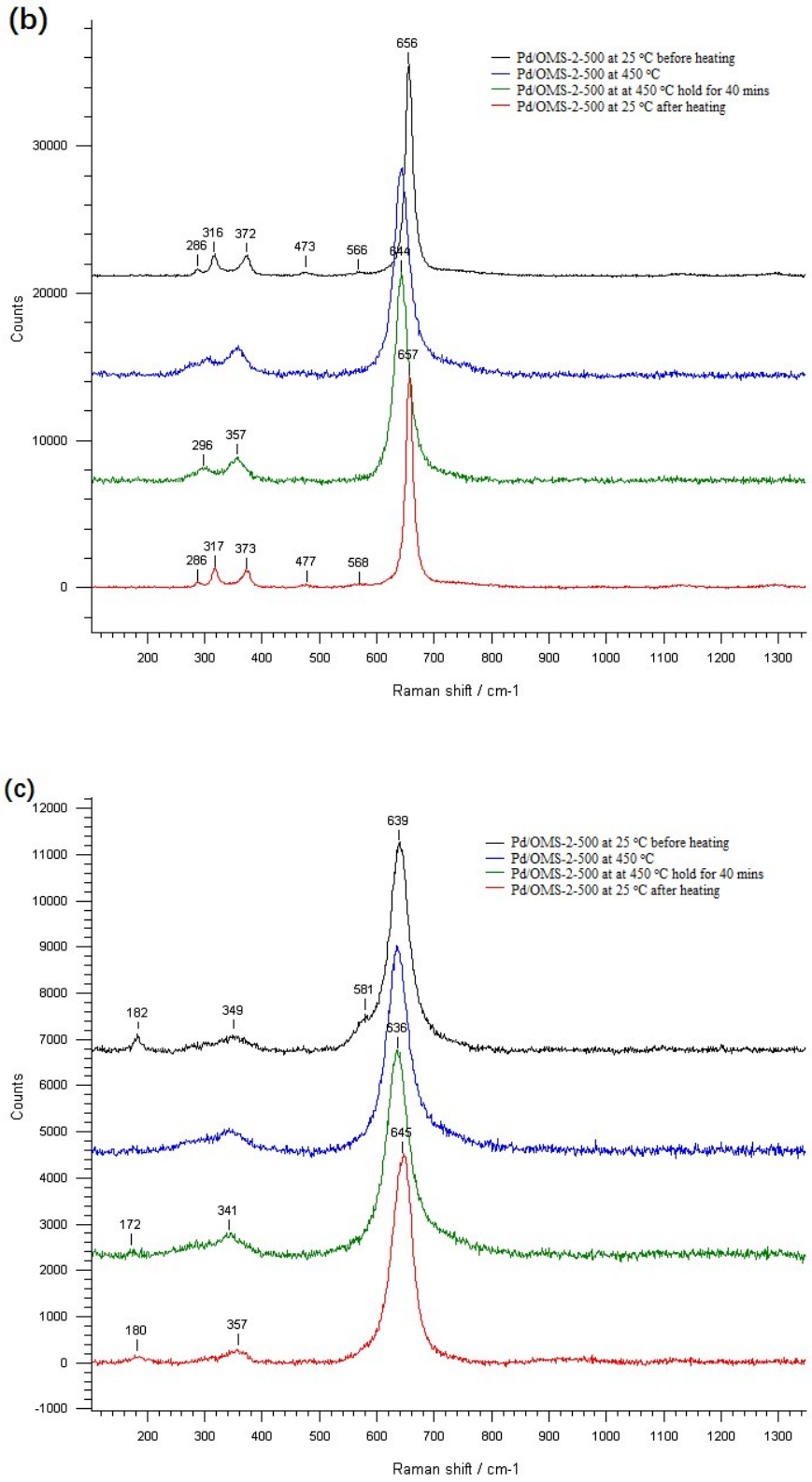
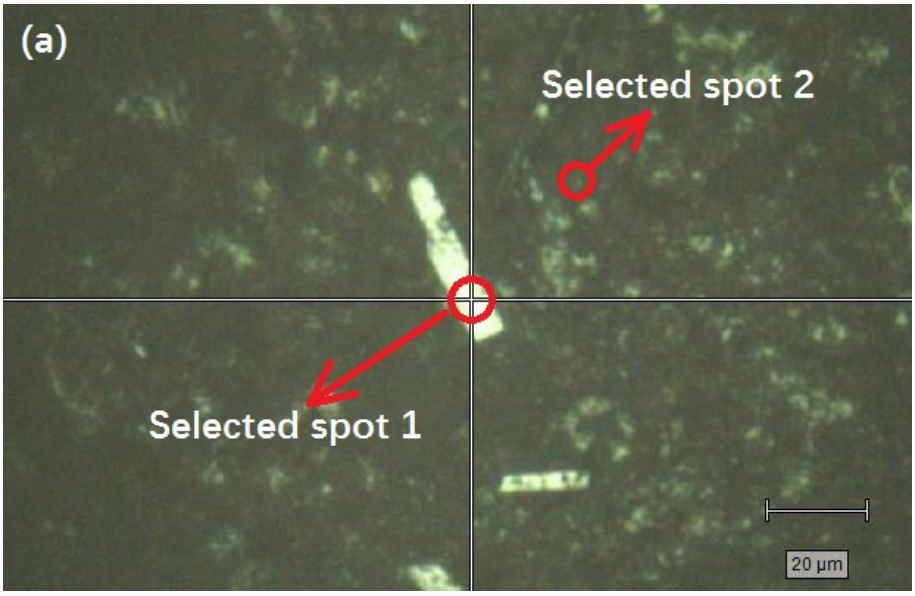
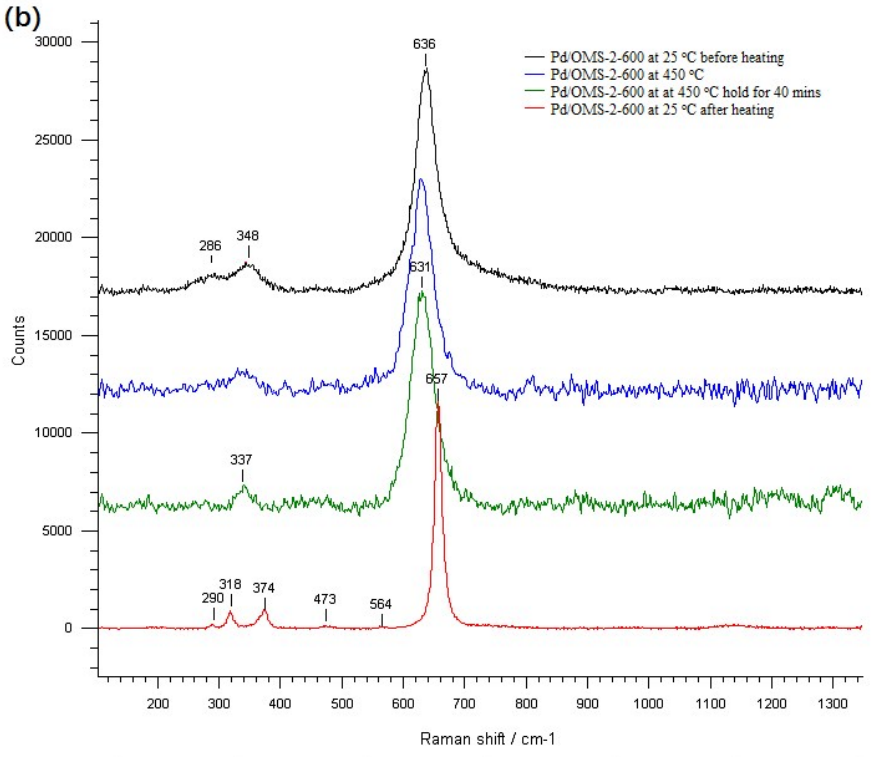


Fig. S9 (a) Optical microscope image and selected spots of Pd/OMS-2-500 catalyst, (b) in-situ Raman spectroscopy of the selected spot 1 over Pd/OMS-2-500 catalyst. (c) in-situ Raman spectroscopy of the selected spot 2 over Pd/OMS-2-500 catalyst


(a)
Selected spot 2
Selected spot 1
20 μm


(b)
Pd/OMS-2-600 at 25 °C before heating
Pd/OMS-2-600 at 450 °C
Pd/OMS-2-600 at at 450 °C hold for 40 mins
Pd/OMS-2-600 at 25 °C after heating
636
631
657
348
286
337
318
290
374
473
564
Counts
Raman shift / cm-1

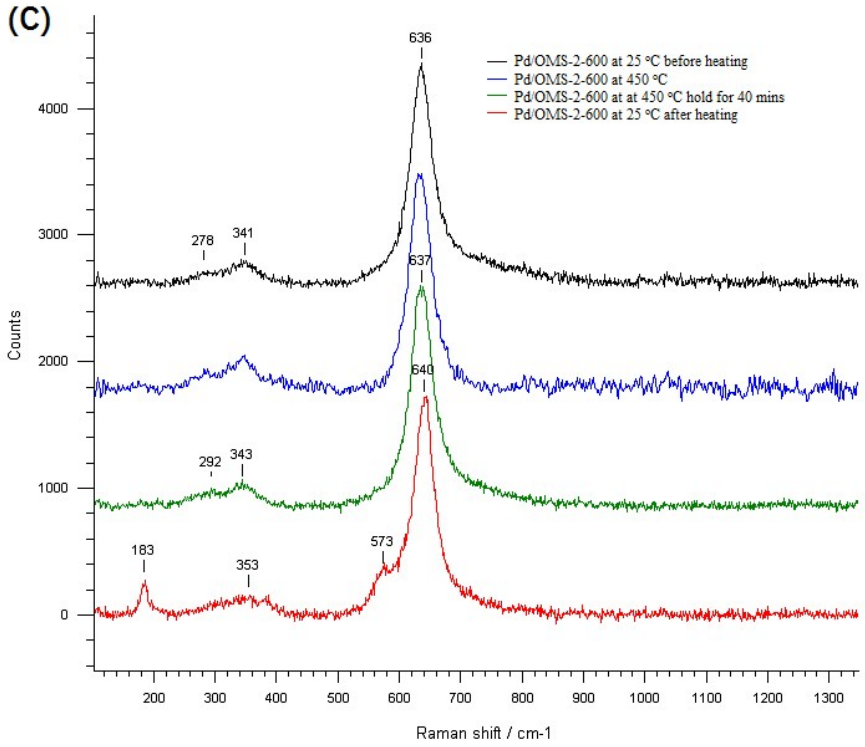


Fig. S10 (a) Optical microscope image and selected spots of Pd/OMS-2-600 catalyst, (b) in-situ Raman spectroscopy of the selected spot 1 over Pd/OMS-2-600 catalyst. (c) in-situ Raman spectroscopy of the selected spot 2 over Pd/OMS-2-600 catalyst

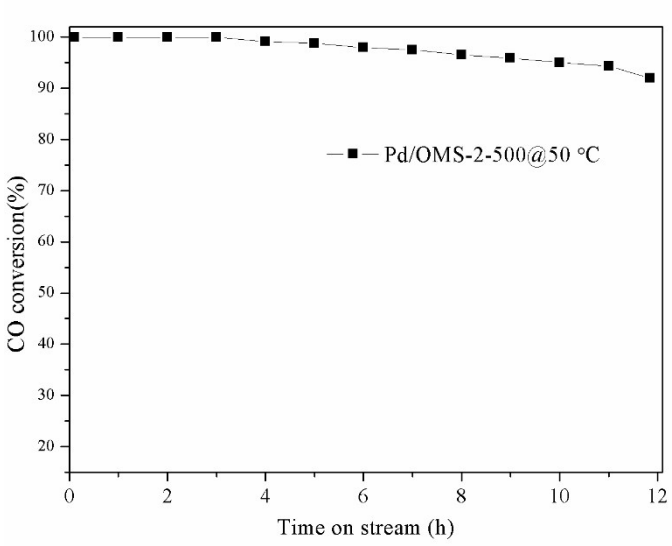


Fig. S11 Stability test of the Pd/OMS-2-500 catalyst under 50 °C (Reaction conditions: 200mg of the sample, 1.0 vol % CO, 10.5 vol% O_2, N_2 balanced, 50ml/min of total flow rate).

Table S1 Catalytic oxidation of CO over manganese oxides and manganese oxides supported noble-metal catalysts

Catalysts	GHSV ($ml \bullet g^{-1} \bullet h^{-1}$)	T_{50} (ºC)	T_{90} (ºC)	T_{99} (ºC)	E_a (kJ/mol)	Noble metal content (*wt* %)	Ref.
MnO_x	21428	---	---	27	17	0	[1]
MnO_x	7500	---	200	225	28.7	0	[2]
α-Mn_2O_3	36000	---	---	220	---	0	[3]
K-OMS-2	12000	---	---	125	12.6	0	[4]
β-MnO_2	40000	---	126	---	---	0	[5]
Ag/β-MnO_2			80			15	
Ag-OMS-2	9000	---	---	90	---	Not mentioned	[6]
Au/α-MnO_2	80000	-84	---	---	28.3	1.5	[7]
Au/β-MnO_2		-85	---	---	36.5	0.64	
Au/α-MnO_2	150000	-21	---	270	19	2.9	[8]
Pd/OMS-2	60000	25	55	70	---	0.5	[9]
Pd/OMS-2	15000	---	---	35	18.2	1	[10]
Pd/OMS-2	15000	---	＜20	35	12.8	1	This work
Pd/MnO_x-CeO_2	40000	---	---	＜50	---	1	[11]

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