Supplementary Information

Ternary PdNiO Nanocrystals Ornamented Porous CeO_2/Onion-like Carbon for Electrooxidation of Carbon Monoxide: Unveiling the Effect of Supports and Electrolytes

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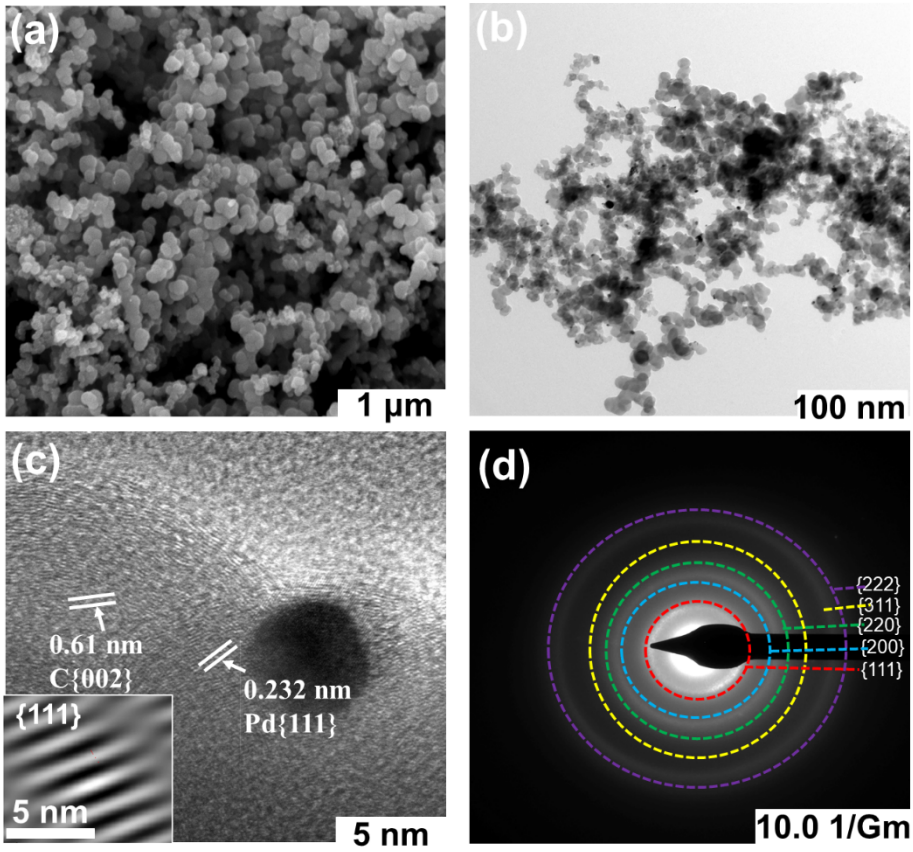

Fig. S1. (a) SEM, (b) TEM, (c) HRTEM with Fourier-transform (iii) and (d) SAED of Pd/C

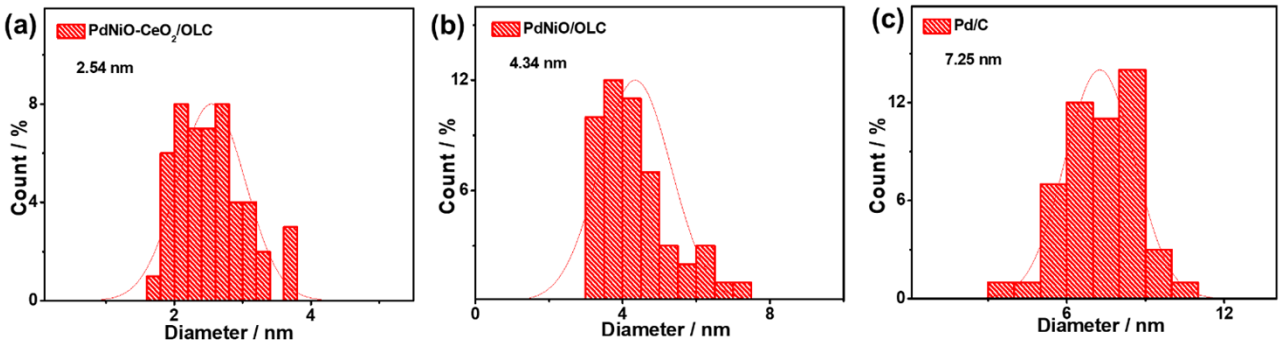

Fig. S2. Nanoparticles sizes distribution (a) PdNiO-CeO_2/OLC and (b) PdNiO/OLC and (c) Pd/C

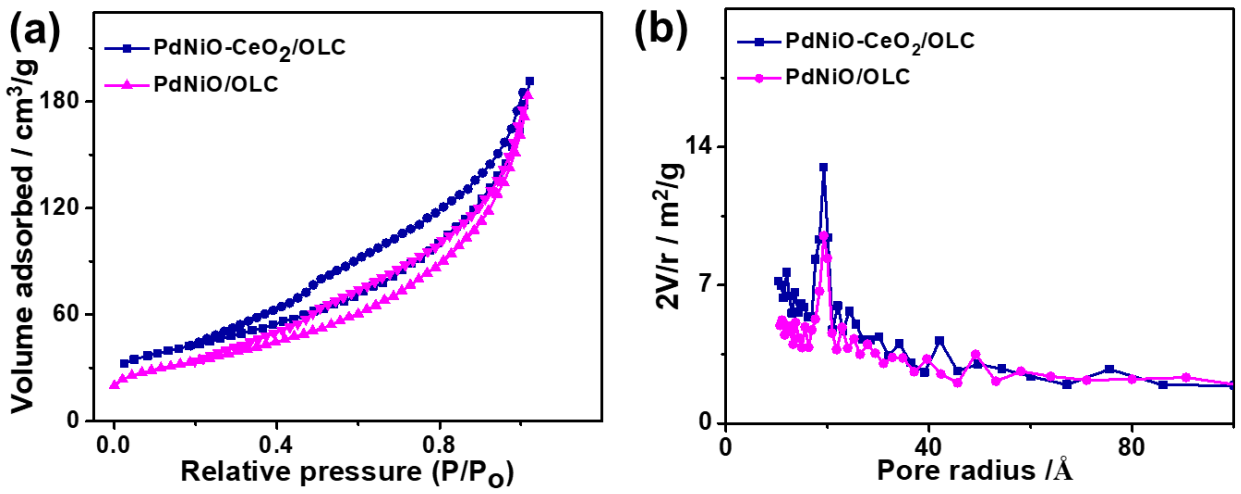

Fig. S3. BET analysis (a) adsorption-desorption isotherm and (b) pore area distribution of ternary PdNiO-CeO_2/OLC and PdNiO/OLC.

Table S1: EIS data for the PdNiO-CeO_2/OLC, PdNiO/OLC, PdNiO-CeO_2 and Pd/C in CO-saturated- KOH (0.1 M).

	R_s (Ω)	R_{ct} (Ω)	CPE (μS.s^a)	n
PdNiO-CeO_2/OLC	0.98 ± 0.12	45.52 ± 1.76	232.78 ± 0.29	0.74
PdNiO/OLC	0.98 ± 0.18	60.74 ± 1.58	227.64 ± 2.63	0.85
Pd/C	1.34 ± 0.06	71.34 ± 0.34	96.99 ± 1.04	0.76
PdNiO-CeO_2	1.45 ± 0.38	75.52 ± 1.76	88.94 ± 0.47	0.84

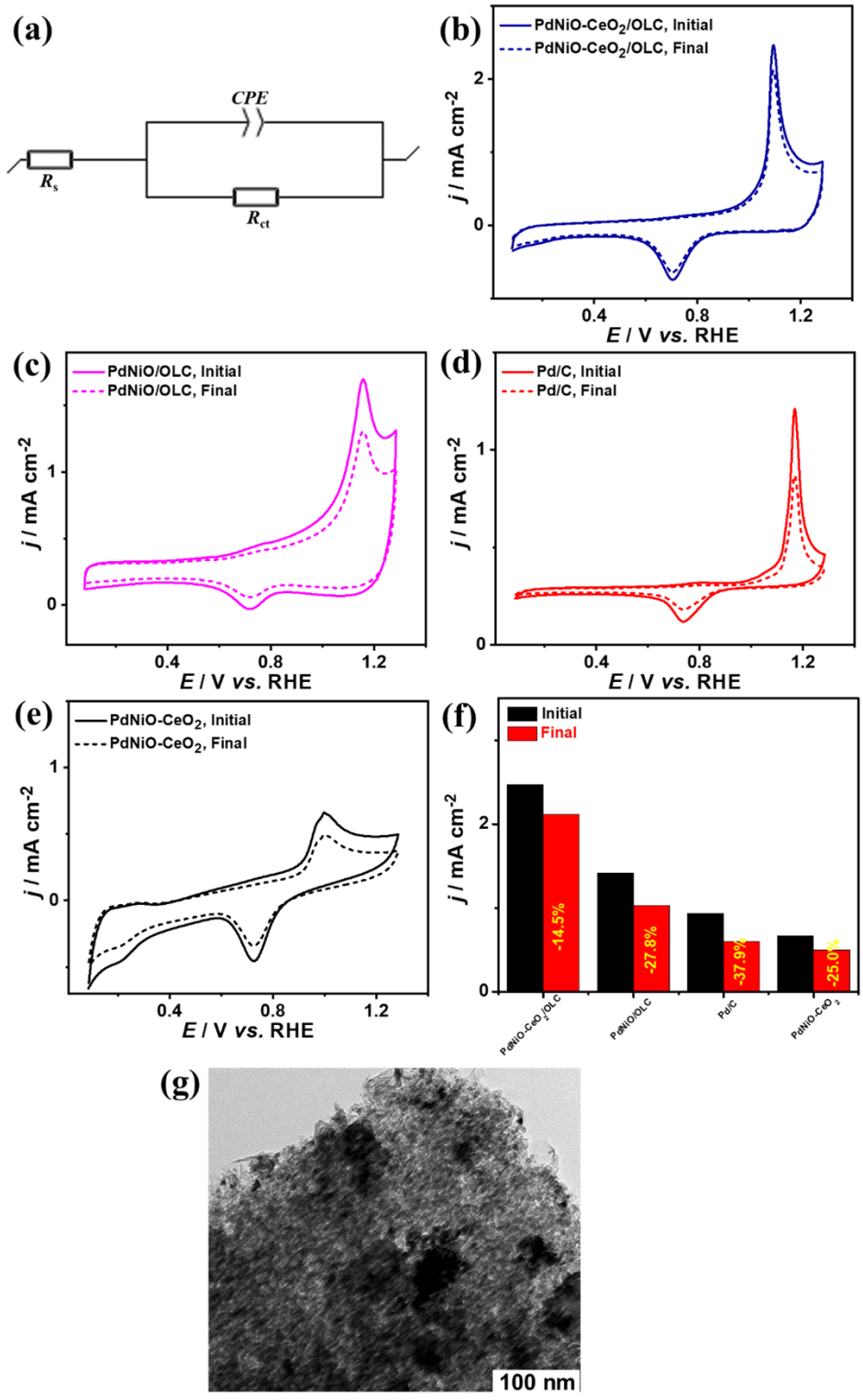

Fig. S4. (a) Voigt electrical equivalent circuit (EEC) model, (b-e) Accelerated stability test (AST), (f) percentage loss of Pd-based nanocatalysts and (g) TEM micrograph after AST of PdNiO-CeO_2/OLC in CO-saturated-$HClO_4$ (0.1 M).

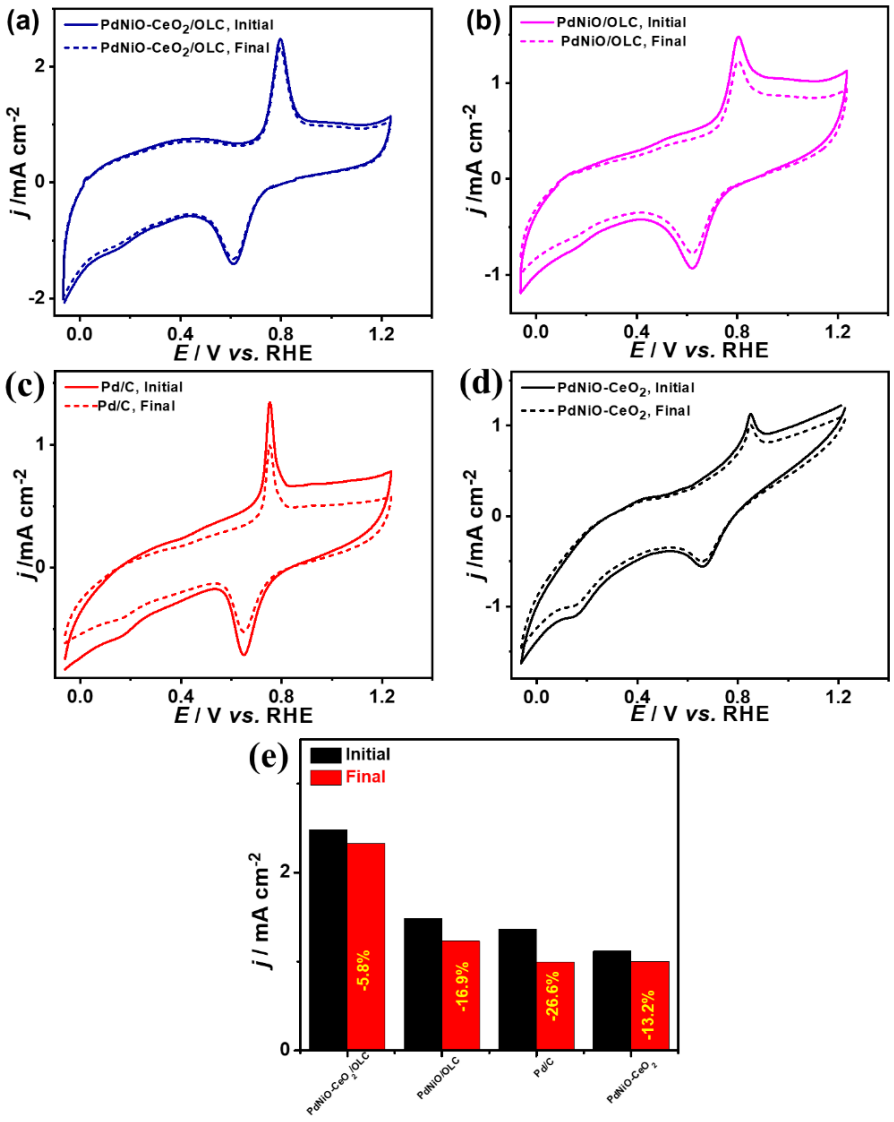

Fig. S5. (a-d) AST and (e) percentage loss after AST analysis of PdNiO-CeO_2/OLC, PdNiO/OLC, PdNiO-CeO_2 and Pd/C in CO-saturated- KOH (0.1 M).

Table S2: EIS data for the PdNiO-CeO_2/OLC, PdNiO/OLC, PdNiO-CeO_2 and Pd/C in CO-saturated-$NaHCO_3$ (0.1 M).

	R_s (Ω)	R_{ct} (Ω)	CPE (μS.s$^{(1-a)}$	n
PdNiO-CeO_2/OLC	2.03 ± 0.27	68.98 ± 1.46	47.76 ± 0.80	0.83
PdNiO/OLC	2.61 ± 0.61	93.40 ± 2.06	40.71 ± 1.61	0.86
Pd/C	2.44 ± 0.85	253.17 ± 6.60	37.74 ± 0.26	0.88
PdNiO-CeO_2	2.53 ± 0.74	105.63 ± 3.88	25.78 ± 0.26	0.85

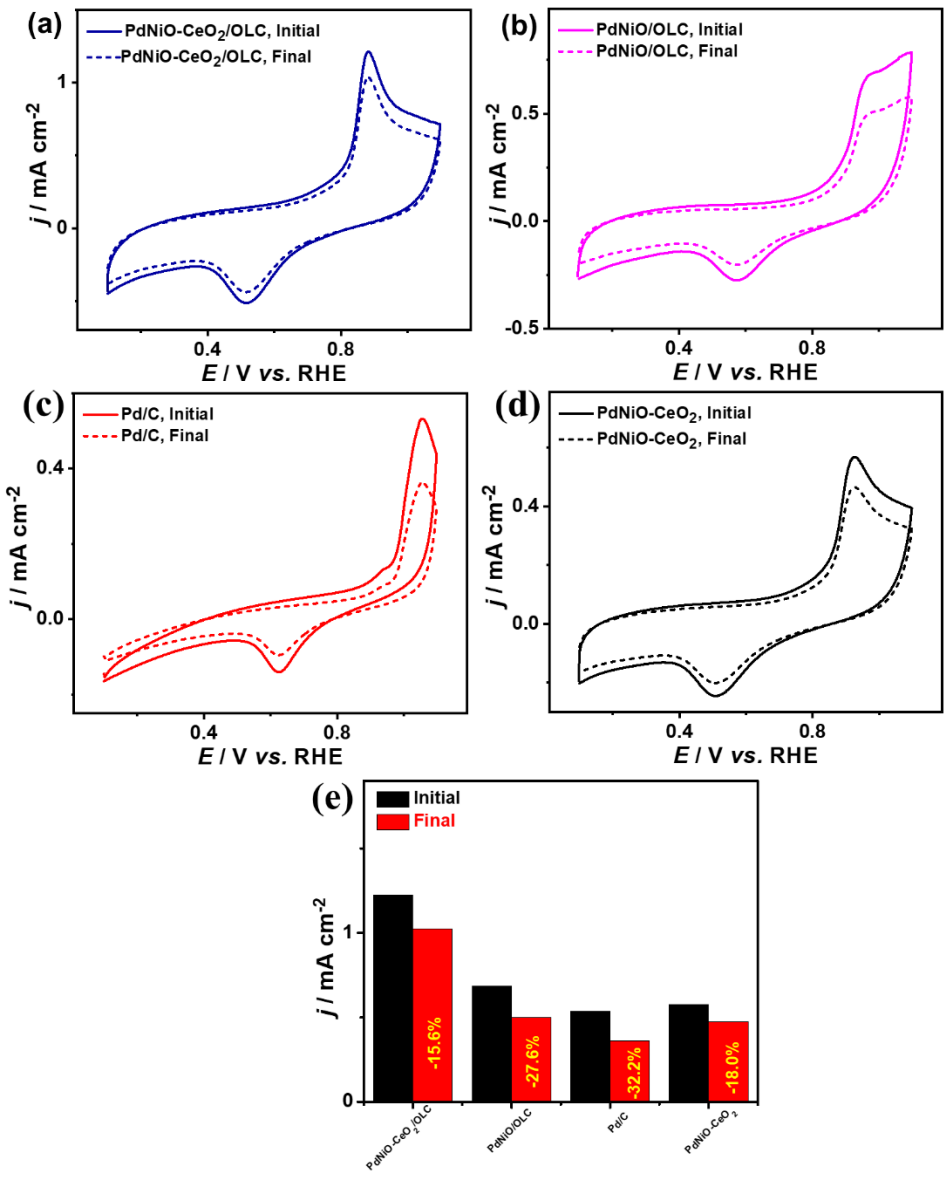

Fig. S6. (a-d) AST and (e) percentage degradation after AST analysis of PdNiO-CeO_2/OLC, PdNiO/OLC, PdNiO-CeO_2 and Pd/C in CO-saturated-$NaHCO_3$ (0.1 M).

Table S3. CO oxidation electrocatalysis on PdNiO-CeO_2/OLC, PdNiO/OLC, and PdNiO-CeO_2 with literature. Dendrimer-encapsulated nanoparticles (DEN), ordered mesoporous carbon (CMK-3-R8), polyhedron with smooth surfaces (PSS), $^{\$}$mA

Electrocatalysts	Medium / Scan rate (mV/s) / Reference electrode	Maximum Current (mA/cm^2) / Voltage (V)	Refs.
Pt(110)–Ru	0.5 M H_2SO_4 / 100 / RHE	$^{\$}$0.025 / 0.50	[1]
Pt-NbOx	0.5 M H_2SO_4 / 20 / RHE	0.500 / 0.75	[1]
Well-ordered Pt(111)	0.1 M NaOH / 50 / RHE	0.500 / 0.80	[2]
PtRu (1:1)	0.1 M $HClO_4$ / 50 / Ag/AgCl	0.120 / 0.25	[3]
Pt/SnO_x	1 M $HClO_4$ / 20 / RHE	0.870 / 0.70	[4]
Pt(FAM)	0.1 M H_2SO_4 / 50 / RHE	0.320 / 0.72	[5]
Pt DEN	0.1 M $HClO_4$ / 50 / Hg/Hg_2SO_4	0.200 / 0.30	[6]
Polycrystalline Pd	0.5 M H_2SO_4 / 20 / RHE	0.175 / 0.90	[7]
PdAg/C	0.5 KOH/ 20 / RHE	0.944 / 0.60	[8]
PtPd nanodendrites	1.0 M KOH / 50 / Ag/AgCl	5.100 / -0.15	[9]
60 wt. % Pt/C	0.5 H_2SO_4 / 10 / SHE	0.200 / 0.64	[10]
PtRu@h-BN/C	0.1 M H_2SO_4 / 20 / RHE	1.250 / 0.60	[11]
PtNi multicubes	1 M KOH / 50 / RHE	0.580 / 0.65	[12]
Pt PSS	0.5 M H_2SO_4 / 50 / RHE	0.300 / 0.80	[13]
PtPd(50%) nanodendrites	0.5 M H_2SO_4 / 20 / SCE	~3.000 / ~0.60	[14]
Pd/CMK-3-R8-1500-10	0.5 M H_2SO_4 / 20 / RHE	~ 0.145 / ~ 0.90	[15]
Pd-Pd(4:1)/C	1.0 M KOH / 50 / Hg/HgO	~ 0.175 / ~ -0.10	[16]
Pd/$Ti_3C_2T_x$	0.1 M $HClO_4$ / 50 / Ag/AgCl	0.318 / ~0.90	[17]
Pd/Ni-MOF/PC	0.1 M NaHCO3/ 50 / RHE	1.220 / 0.83	[18]
Pd/ZIF-67/C	0.1 M NaHCO3/ 50 / RHE	1.497 / 0.85	[19]
PdAu/C	0.5 H_2SO_4/ 20 / Ag/AgCl	0.567 / ~ 0.90	[20]
PdNiO-CeO_2	0.1 $HClO_4$ / 50 / RHE	0.667 / 0.99	Our work
	0.1 KOH / 50 / RHE	1.120 / 0.857	
	0.1 $NaHCO_3$ / 50 / RHE	0.574 / 0.923	
PdNiO/OLC	0.1 $HClO_4$ / 50 / RHE	1.440 / 1.16	
	0.1 KOH / 50 / RHE	1.330 / 0.81	Our work
	0.1 $NaHCO_3$ / 50 / RHE	0.692 / 0.96	
PdNiO-CeO_2/OLC	0.1 M $HClO_4$ / 50 / RHE	2.500 / 1.10	Our work
	0.1 M KOH / 50 / RHE	2.486 / 0.79	
	0.1 M $NaHCO_3$ / 50 / RHE	1.231 / 0.88	

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