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Supporting Information

Highly Dispersed Pt Species Anchored onto NH_2-Ce-MOFs and Its Derived Mesoporous Catalyst for CO Oxidation

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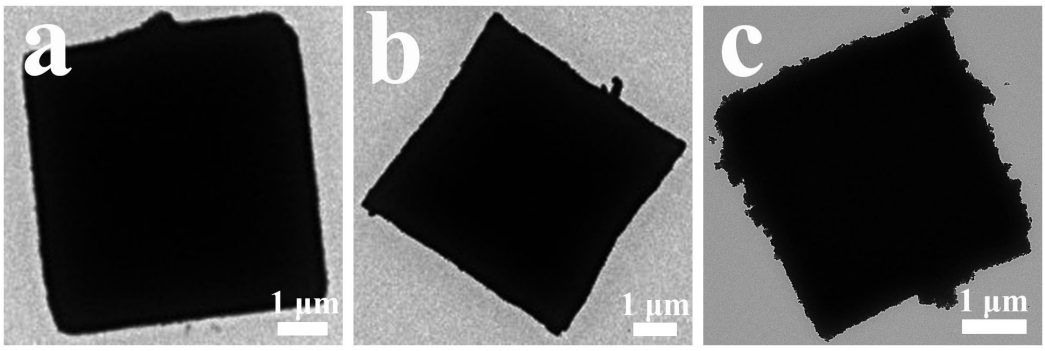

Fig. S1. TEM images of the samples: (a) NH_2-Ce-BDC; (b) N-Pt/CeO_2; and (c) IM-Pt/CeO_2.

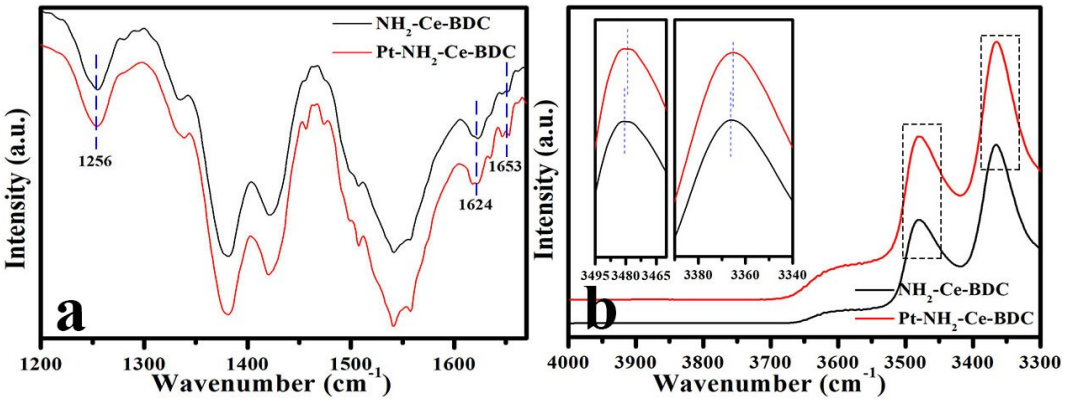

Fig. S2. (a) A partial enlarged view of Fig. 3a in the manuscript. (b) DRIFT spectra of NH_2-Ce-BDC and Pt-NH_2-Ce-BDC. The insets are enlarged picture of the corresponding part selected by rectangle. All spectra were collected after degassing under 60 mL·min^{-1} N_2 flow at 150 °C for one hour. Totally 100 scans were accumulated for single spectrum. KBr was used as background. For comparison, all spectra were scaled by setting OCO asymmetric stretching peak (1550-1580 cm^{-1}) to the same intensity.

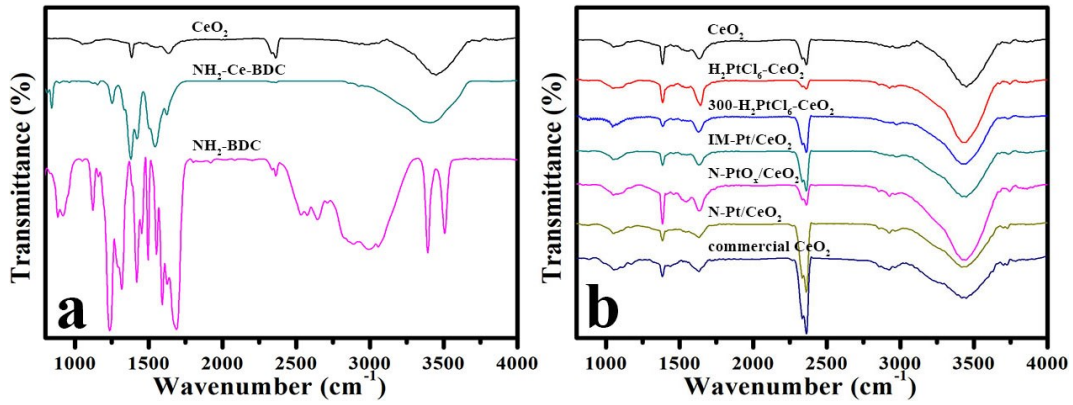

Fig. S3. FT-IR characterization of (a) the CeO_2 prepared from NH_2-Ce-BDC, NH_2-Ce-BDC and NH_2-BDC; and (b) the CeO_2, H_2PtCl_6-CeO_2, 300-H_2PtCl_6-CeO_2, IM-Pt/CeO_2, N-PtO_x/CeO_2, N-Pt/CeO_2 and commercial CeO_2, respectively. (The H_2PtCl_6-CeO_2 sample is the sample of CeO_2 impregnated with Pt. The 300-H_2PtCl_6-CeO_2 sample is the sample of H_2PtCl_6-CeO_2 after calcination at 300 ^oC. The N-PtO_x/CeO_2 sample is the sample of N-Pt/CeO_2 without reduction.)

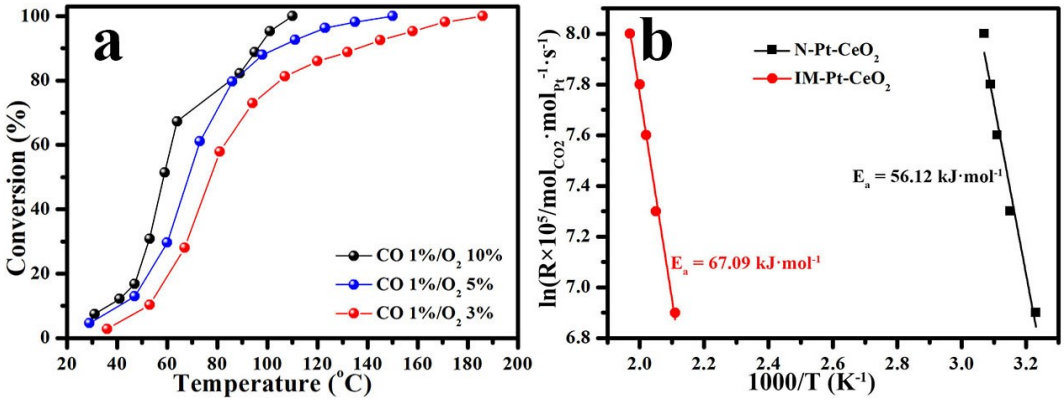

Fig. S4. (a) The catalytic performance of N-Pt/CeO_2 catalyst for CO oxidation under different O_2 concentrations. (b) Arrhenius plots for N-Pt/CeO_2 and IM-Pt/CeO_2 samples of CO reaction rates under CO conversion between 10 and 30%. Conversions of CO to CO_2 were calculated from the data (X_{CO}) from the online infrared gas analyzer for CO according to $X_{CO} = (1 - A_{CO} / A_{CO*}) \times 100$ (%), where A_{CO*} and A_{CO} are the data of CO before and after the reaction, respectively. The reaction rate (R, (mol of CO)·(mol of Pt)$^{-1}$·s^{-1}) was calculated as follows: $R = X_{CO} \times F_{CO} / M_{Pt}$. F_{CO} (mol·s^{-1}) is the flow rate of CO in reactant gas, and M_{Pt} is the amount of Pt (mol) in the used catalyst (50 mg).

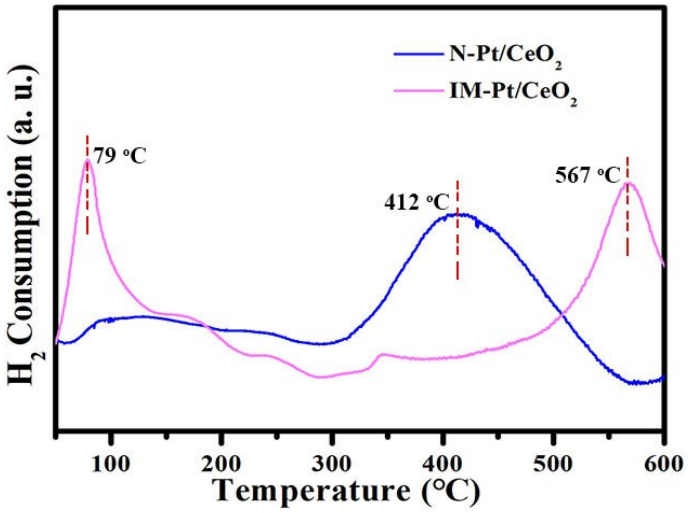

Fig. S5. Hydrogen temperature-programmed reduction (H_2-TPR) profiles of N-Pt/CeO_2 and IM-Pt/CeO_2 samples. H_2-TPR experiment was carried out with a thermal conductivity detector on 100 mg sample in a gas mixture (80% (molar) argon and 20% (molar) hydrogen, gas flow rate of 30 mL•min^{-1}), using a temperature ramp rate of 10 ^{o}C•min^{-1}.

As shown in Fig. S5, the peak at 79 ^{o}C in IM-Pt/CeO_2 catalyst is indexed to regenerative Pt oxide species,[S1] while there is almost no reduction peaks in N-Pt/CeO_2 before 300 ^{o}C. The re-oxidized phenomenon is due to the small sized Pt (<3.5 nm) in IM-Pt/CeO_2, although which is larger than that of N-Pt/CeO_2. Compared with IM-Pt/CeO_2, there is a strong interaction between Pt and CeO_2 in N-Pt/CeO_2, and the resultant formation of Pt-O-Ce strong bond (refer to Raman spectra) is possibly responsible for making Pt^{2+} species difficult to be reduced.

Table S1. Comparison of this work with reported work.

Catalyst	WHSV ($mL \cdot g^{-1} \cdot h^{-1}$)	Pt loading (wt%)	T_{100} (°C)	Rates ($mol_{CO} \cdot mol_{Pt}^{-1} \cdot s^{-1}$)	Activation energy (E_a) ($kJ \cdot mol^{-1}$)	Reference
N-Pt/CeO_2	60000	1.33	110	0.0936 (100 °C)	56.1	This study
S-Pt/CeO_2	72000	0.256	~140	<0.09 (100 °C)	Not stated	[S2]
R-Pt/CeO_2	72000	0.257	~150	~0.05 (100 °C)	Not stated	[S2]
C-Pt/CeO_2	72000	0.255	~150	~0.05 (100 °C)	Not stated	[S2]
Pt/CeO_2 IWI	-	1.00	~250	0.0033 (110 °C)	68.0 ± 1.6	[S3]
Pt/CeO_2 ODH-N	-	1.06	~250	0.0060 (110 °C)	56.7 ± 0.4	[S3]
Pt/CeO_2 Gly-N	-	1.14	~200	0.0250 (110 °C)	58.8 ± 1.0	[S3]
Pt/CeO_2 Rod	-	-	-	Not stated	101.7	[S4]
Pt/CeO_2 Octahedra	-	-	-	Not stated	145.2	[S4]
Pt/CeO_2-Fecralloy foam	17000	-	>270	Not stated	~116	[S5]
Pt/CeO_2	80000	~1.60	>155	Not stated	Not stated	[S6]
Pt/CeO_2	-	0.98	~260	Not stated	59.0 ± 1.0	[S7]
Pt/CeO_2	-	2.00	>270	Not stated	Not stated	[S8]
Pt/CeO_2 Rod	-	5.00	160	0.0135 (80 °C)	34.0 ± 2.0	[S9]
Pt/CeO_2 Cube	-	5.00	180	0.0118 (80 °C)	46.0 ± 2.0	[S9]
Pt/CeO_2 Octahedra	-	5.00	190	0.0031 (80 °C)	63.0 ± 4.0	[S9]

Reference

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