Electronic Supplementary Material (ESI) for RSC Advances.

Supplementary information

Nanoceria-modified platinum supported on hierarchical zeolites for selective alcohol oxidation

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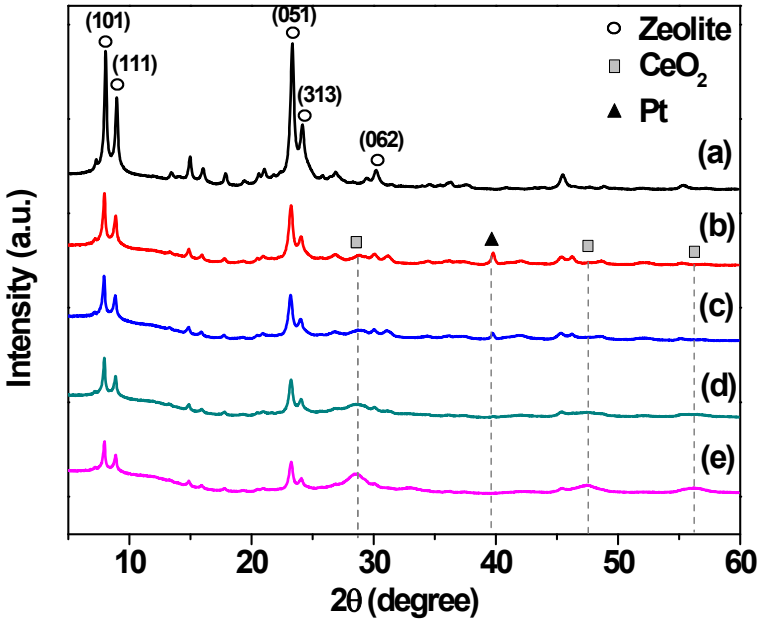

Fig. S1 XRD patterns of Pt/CeO_2 supported on hierarchical zeolites obtained using different CeO_2 loading: (a) Silicalite1-HIE; (b) $1Pt/5CeO_2$-Silicalite1-HIE; (c) $1Pt/10CeO_2$-Silicalite1-HIE; (d) $1Pt/20CeO_2$-Silicalite1-HIE; (e) $1Pt/30CeO_2$-Silicalite1-HIE.

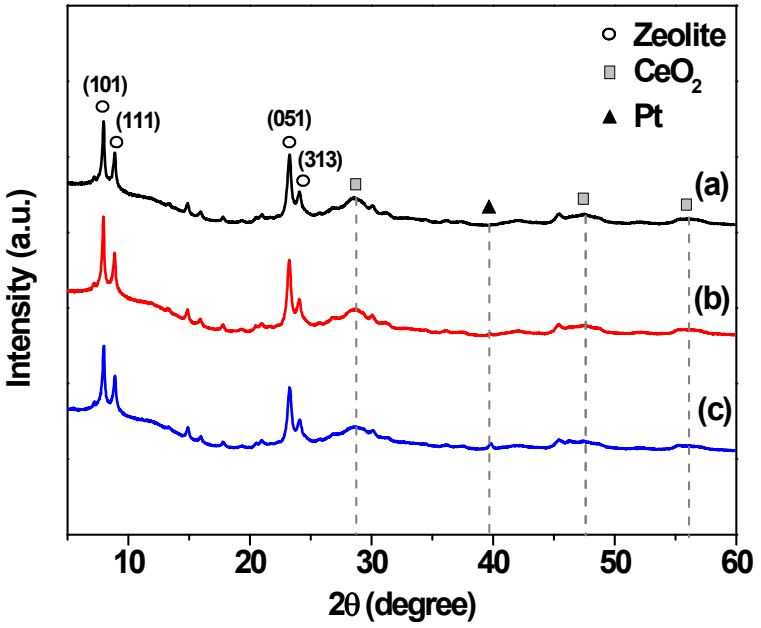

Fig. S2 XRD patterns of Pt/CeO_2 supported on hierarchical zeolites obtained using different Pt loading: (a) $0.5Pt/20CeO_2$-Silicalite1-HIE; (b) $1Pt/20CeO_2$-Silicalite1-HIE; (c) $2Pt/20CeO_2$-Silicalite1-HIE.

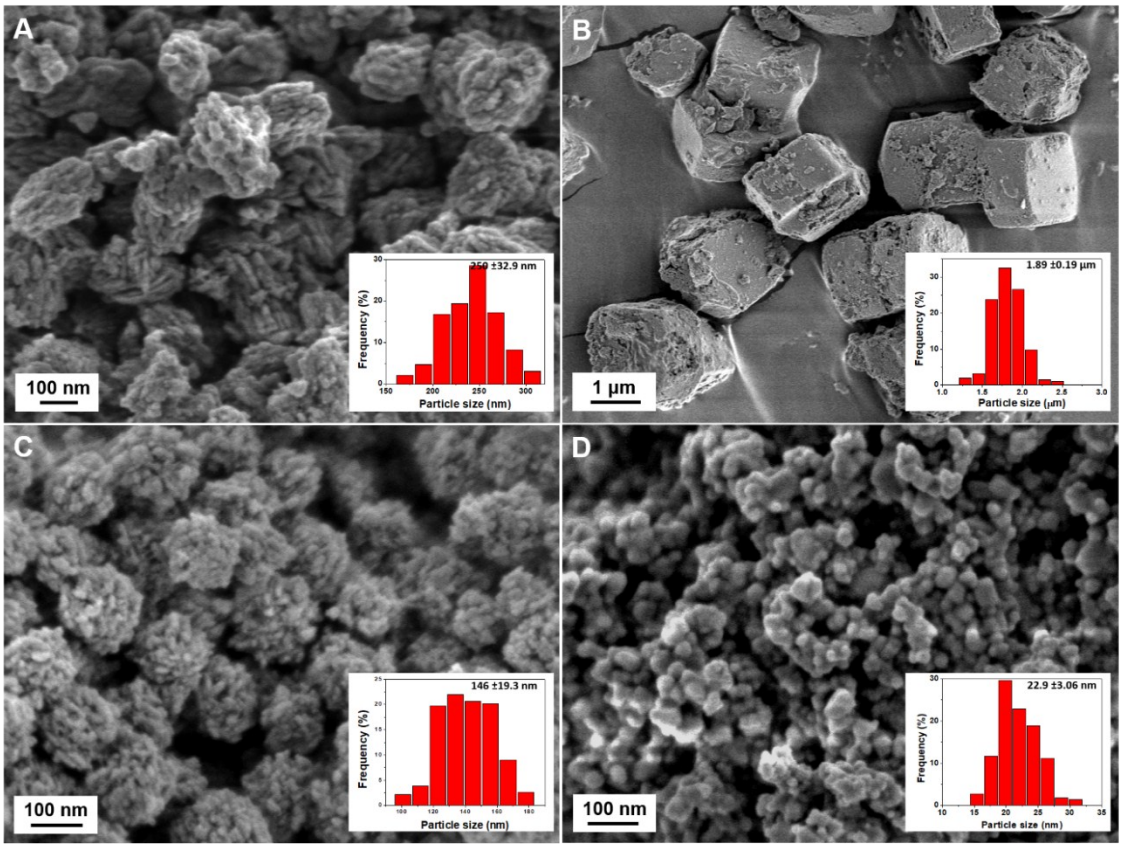

Fig. S3 SEM images of (A) 1Pt/20CeO_2-Silicalite1-HIE; (B) 1Pt/20CeO_2-Silicalite1-CON; (C) 1Pt/20CeO_2-ZSM5-HIE; (D) 1Pt/CeO_2.

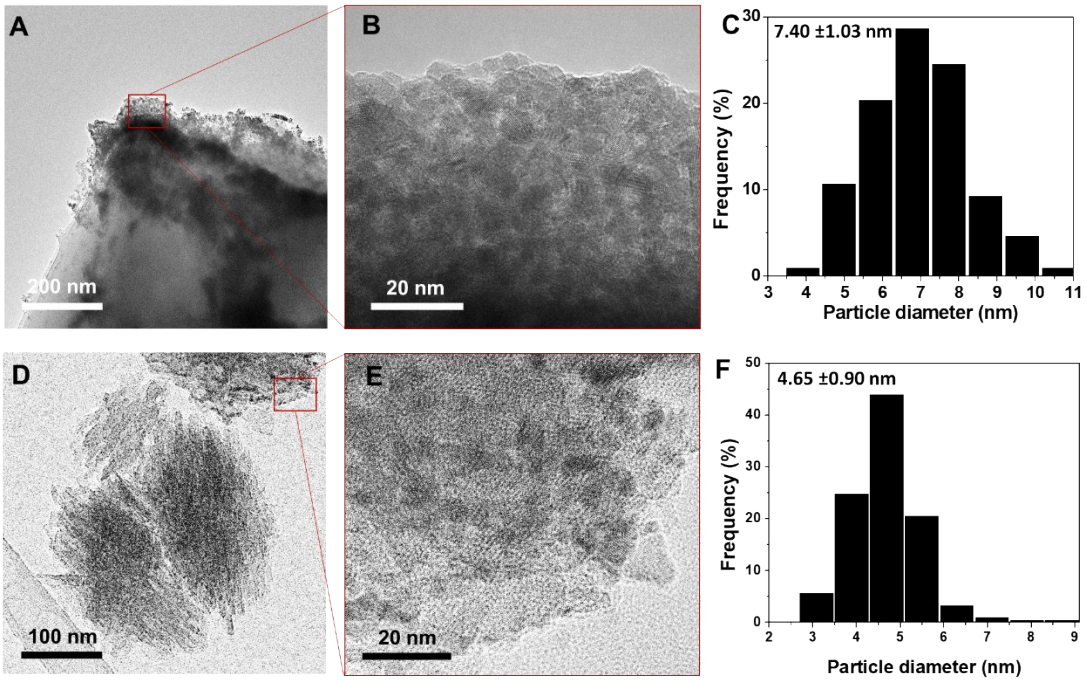

Fig. S4 TEM images and the particle size distribution of (A-C) 1Pt/20CeO_2-Silicalite1-CON; (D-F) 1Pt/20CeO_2-Silicalite1-HIE.

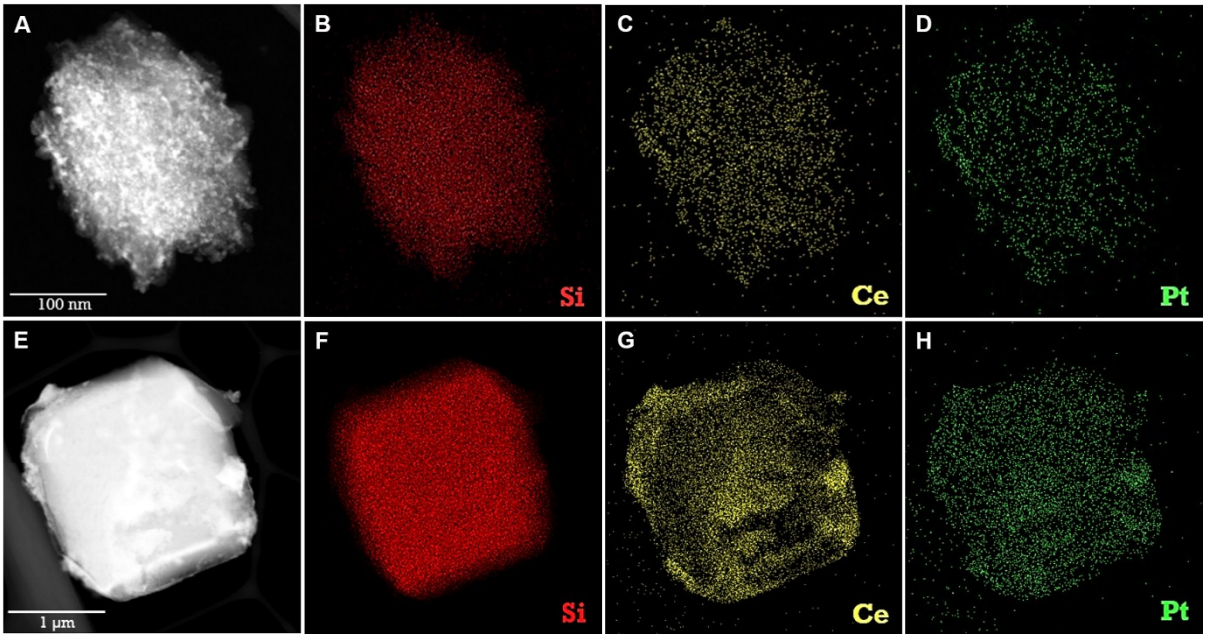

Fig. S5 TEM-EDX images of (A-D) 1Pt/20CeO_2-Silicalite1-HIE; (E-H) 1Pt/20CeO_2-Silicalite1-CON.

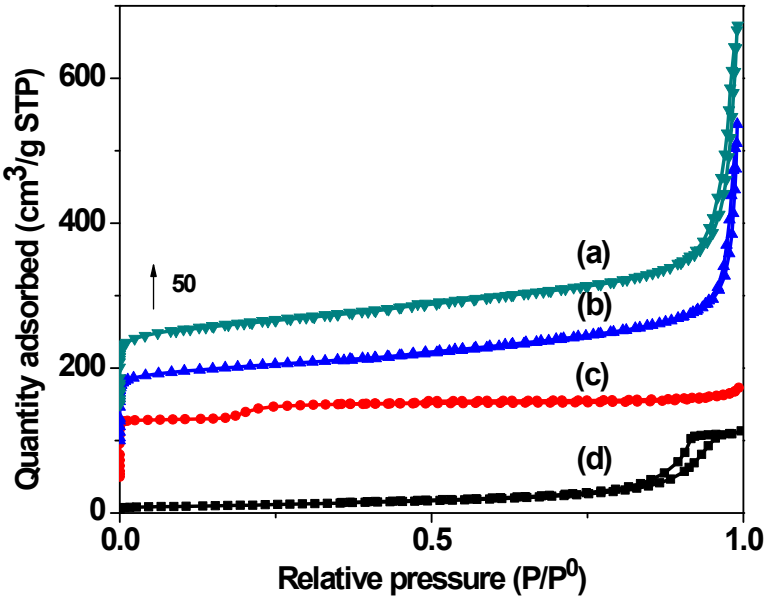

Fig. S6 N_2 adsorption/desorption isotherms of (a) 1Pt/20CeO_2-ZSM5-HIE; (b) 1Pt/20CeO_2-Silicalite1-HIE; (c) 1Pt/20CeO_2-Silicalite1-CON; (d) 1Pt/CeO_2.

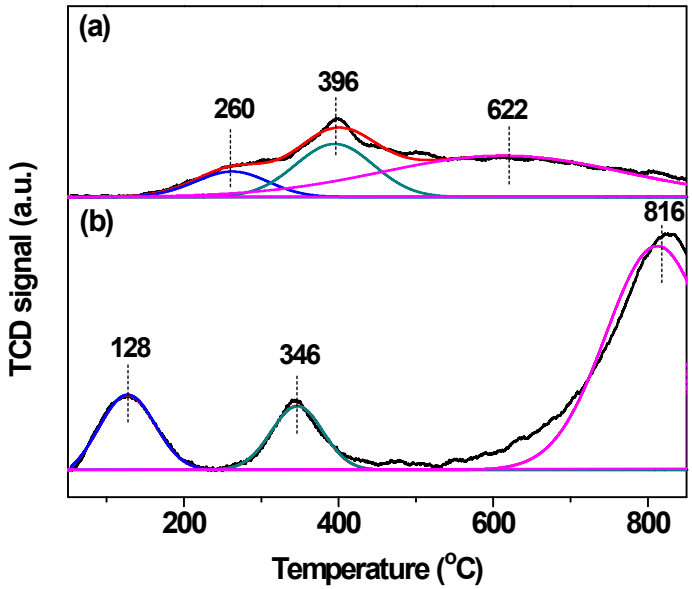

Fig. S7 H_2-Temperature programmed reduction (H_2-TPR) profiles of (a) 1Pt/20CeO_2-ZSM5-HIE and (b) 1Pt/CeO_2.

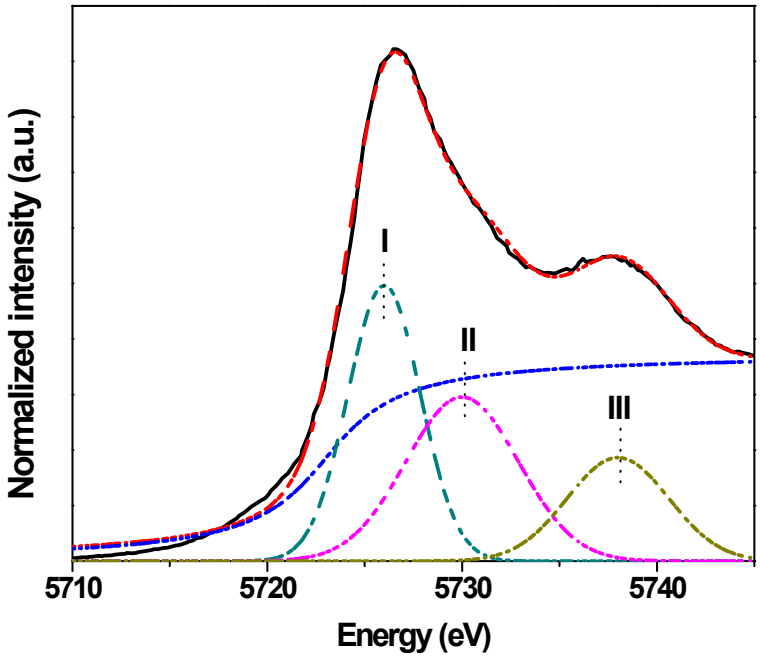

Fig. S8 Fitting curves of XANES spectra of the Ce L_3 edge for 1Pt/20CeO_2-ZSM5-HIE.

Table S1 Textural properties

Catalyst	Si/Al ratio[a]	Pt dispersion[b] (%)	Particle size[b] (nm)	S_{BET}[c] (m^2g^{-1})	S_{ext}[d] (m^2g^{-1})	S_{micro}[e] (m^2g^{-1})	V_{total}[f] (cm^3g^{-1})	V_{micro}[g] (cm^3g^{-1})	V_{ext}[h] (cm^3g^{-1})
1Pt/20CeO_2-ZSM5-HIE	110.2	37.89	2.99	404.86	225.48	179.38	0.80	0.003	0.80
1Pt/20CeO_2-Silicalite1-HIE	∞	29.57	3.83	375.69	164.35	211.34	0.66	0.03	0.63
1Pt/20CeO_2-Silicalite1-CON	∞	17.65	6.41	331.45	13.98	317.47	0.19	0.15	0.04
1Pt/CeO_2	-	-	1.74	38.58	6.03	32.55	0.17	0.16	0.02

[a] Si/Al determined by wavelength dispersive x-ray fluorescence.
[b] Pt dispersion and average particle size were determined by H_2-pulse method.
[c] S_{BET}: Specific surface area (m^2g^{-1}) determined by BET method.
[d] S_{ext}: External surface area (m^2g^{-1}).
[e] S_{micro}: micropore surface area (m^2g^{-1}), determined by t-plot method.
[f] V_{total}: total pore volume (cm^3g^{-1}) obtained at P/P_0=0.90.
[g] V_{micro}: micropore volume (cm^3g^{-1}), determined by t-plot method.
[h] V_{ext}: external pore volume (cm^3g^{-1}), $V_{ext}=V_{total}-V_{micro}$.

Table S2 Quantitative analysis of Ce oxidation obtained from XANES for fresh and spent catalysts[1, 2].

Catalysts	I^I	I^{II}	I^{III}	$\%Ce^{3+}$
1Pt/20CeO_2-ZSM5-HIE-Fresh	5.79	5.353	3.044	65.5
1Pt/20CeO_2-ZSM5-HIE-Spent	7.904	4.132	3.197	71.2
1Pt/20CeO_2-Silicalite1-HIE-Fresh	5.166	6.156	3.175	61.9
1Pt/20CeO_2-Silicalite1-HIE-Spent	5.451	5.66	3.309	62.2
1Pt/20CeO_2-Silicalite1-CON-Fresh	0.69	5.853	7.714	8.2
1Pt/20CeO_2-Silicalite1-CON-Spent	0.225	4.132	4.458	4.8
1Pt/CeO_2-Fresh	1.642	5.651	9.683	14.5
1Pt/CeO_2-Spent	1.426	1.898	5.815	19.7

* Fittings of the experimental XANES spectra of the Ce L_3 edge of the synthesized samples.
** The estimation of Ce^{3+} concentration in the sample is calculated as follows:
$\%Ce^{3+} = I^I/(I^I+I^{II}+I^{III})$, where I^I, I^{II} and I^{III} are the intensities of the different peaks.

References

1. N. Qiu, J. Zhang, Z. Wu, T. Hu and P. Liu, *Crystal Growth & Design*, 2011, **12**, 629-634.
2. S. Phokha, S. Pinitsoontorn and S. Maensiri, *Nano-Micro Letters*, 2013, **5**, 223-233.