Electronic Supplementary Material (ESI) for Materials Chemistry Frontiers.

Supporting Information

Pt-embedded-CeO_2 hollow spheres for enhancing CO oxidation performance

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Table S1. Composition characterizations of Pt/CeO_2 HS composites, CeO_2 NS and supported Pt/CeO_2 NS reference catalysts.

samples	ICP-OES	XPS		
	Pt content / (wt %)	Ce(III) / (%)	O_{ad} / (%)	Pt(0) / (%)
Pt/CeO_2 HS	1.6	41.7	41.2	50.2
CeO_2 NS	–	34.7	32.7	–
Pt/CeO_2 NS	1.7	34.3	39.6	10.3

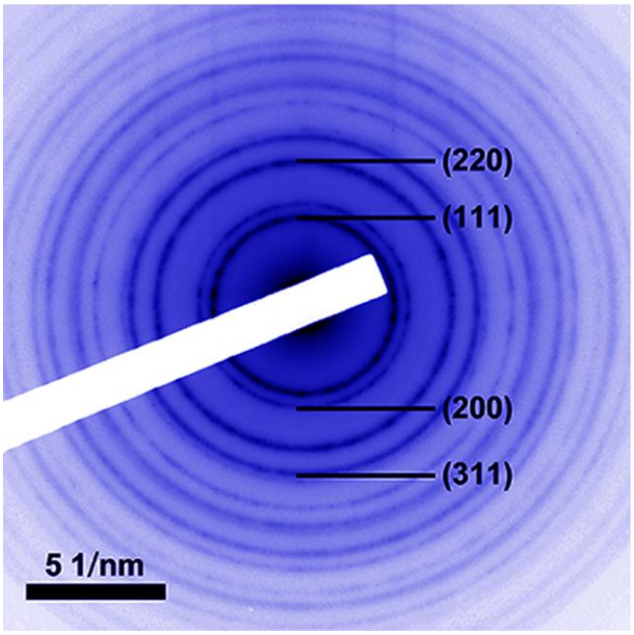

Fig. S1. The corresponding SAED image of Pt/CeO_2 HS composites.

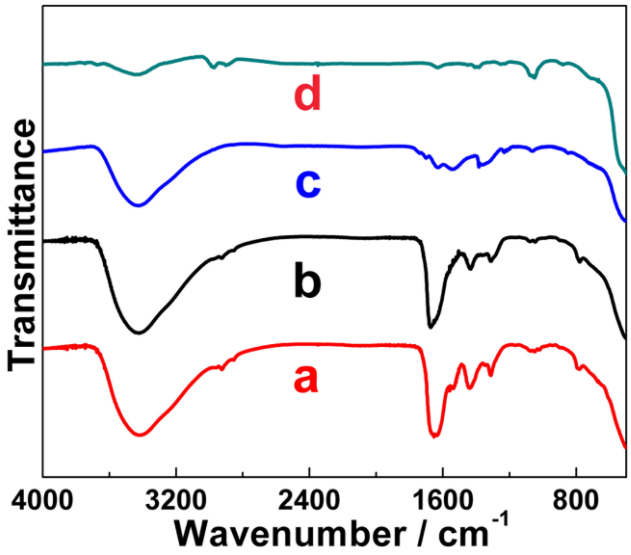

Fig. S2. FT-IR spectra of (a) CeO_2 NS before calcination; (b) as-synthesized Pt/CeO_2 HS composites before calcination; (c) calcined Pt/CeO_2 HS composites; (d) bulk CeO_2 powders.

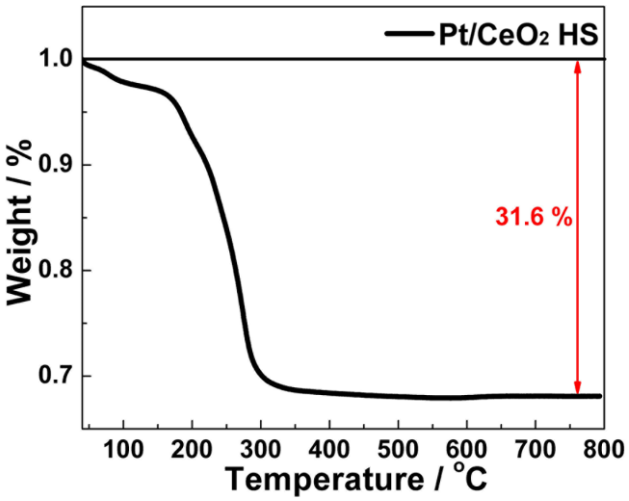

Fig. S3. Thermogravimetric curves for Pt/CeO_2 HS composites under air atmosphere, at a flow rate of 100 mL min^{-1}.

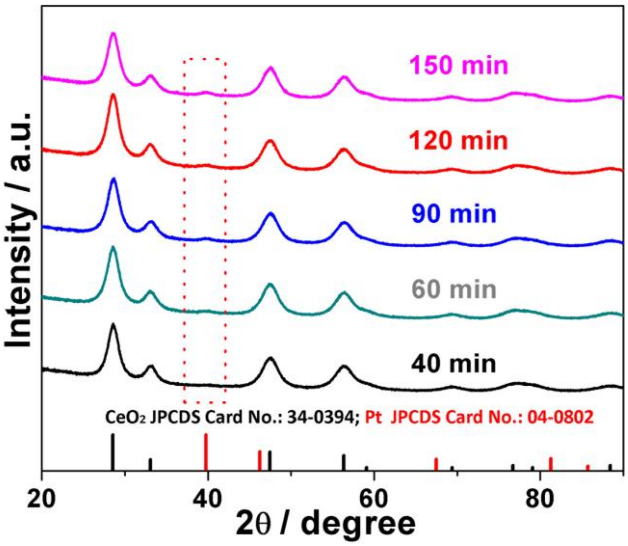

Fig. S4. XRD patterns of as-synthesized Pt/CeO_2 HS composites obtained at different growth stages from 40 min to 150 min during solvothermal reaction process.

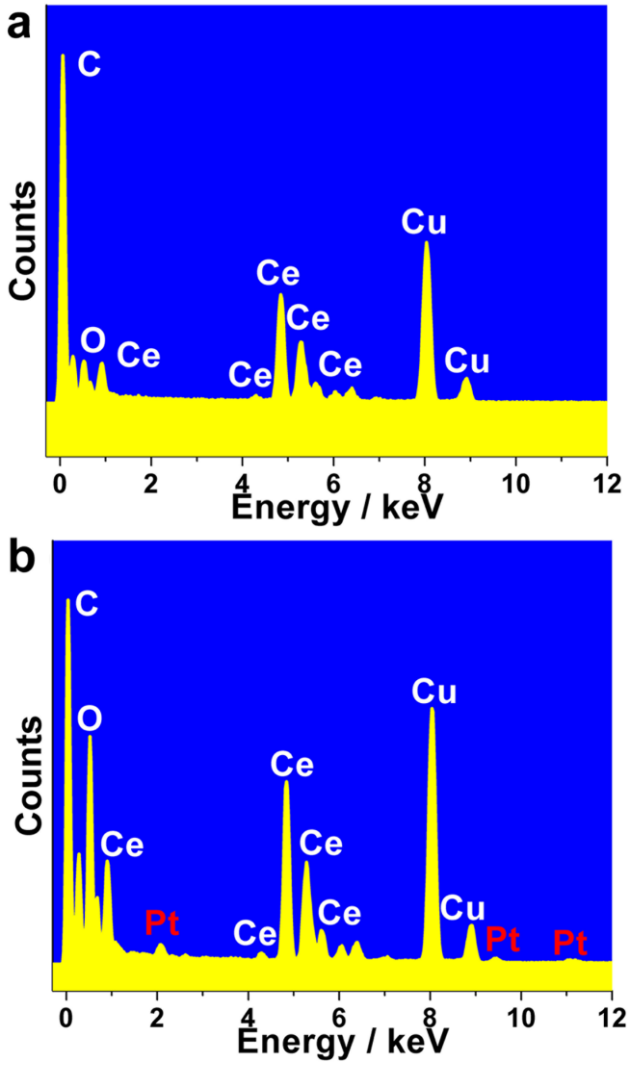

Fig. S5. EDS spectra of as-obtained Pt/CeO_2 HS composites synthesized at different growth stages: (a) 40 min; (b) 120 min.

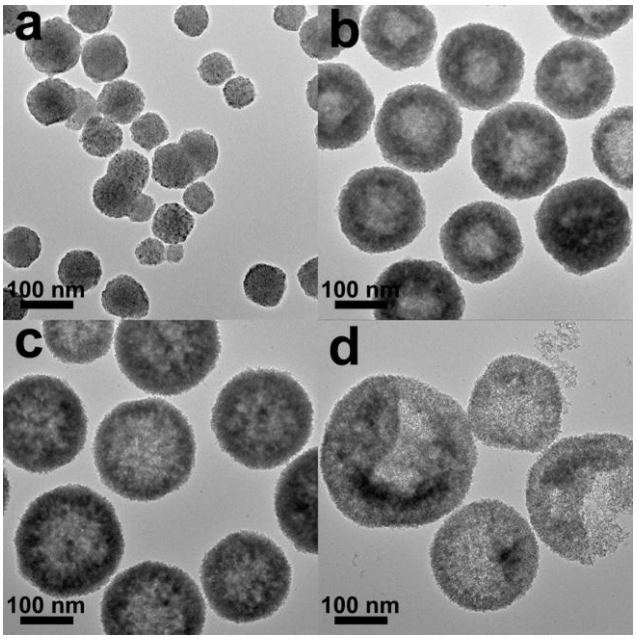

Fig. S6. TEM images of as-prepared Pt/CeO_2 HS composites obtained at different dosages of the acetic acid: (a) 0 ml; (b) 1.0 ml; (c) 1.5 ml; (d) 3.0 ml. Scale bar: 100 nm.

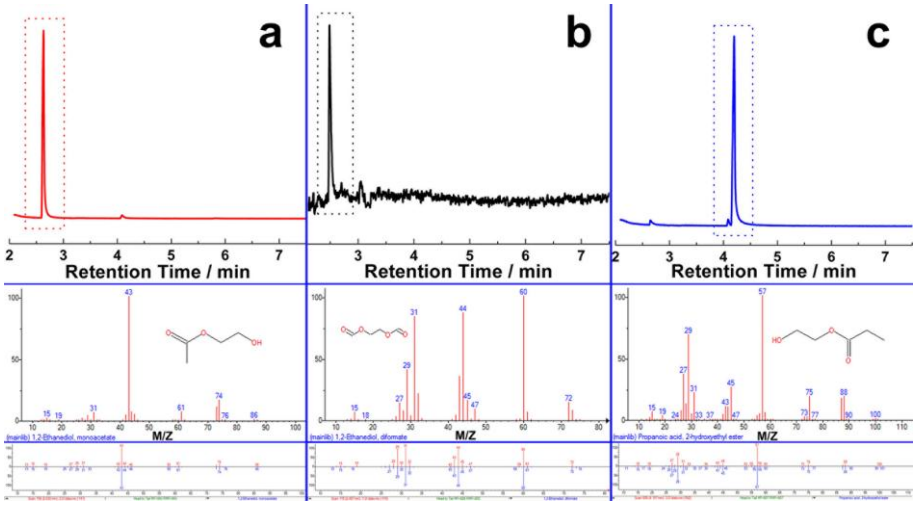

Fig. S7. GC-MS results of the different reaction media analytes: (a) 1,2 Ethanediol, monoacetate; (a) 1,2 Ethanediol, diformate; (c) Propanoic acid, 2-hydroxyethyl ester;

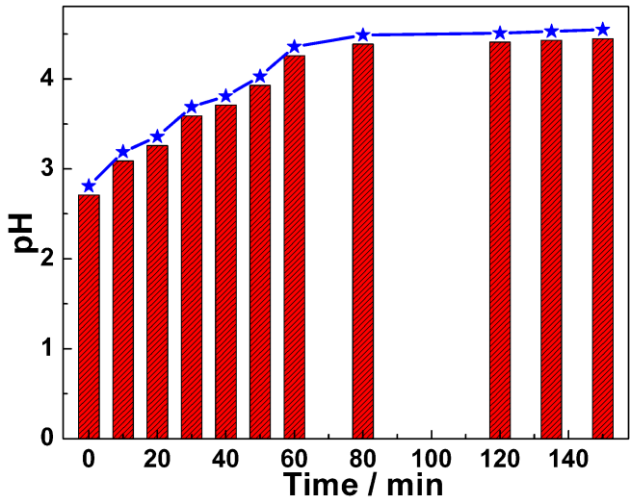

Fig. S8. The measured pH value of as-synthesized Pt/CeO_2 HS composites prepared at different growth stages from 0 min to 150 min during solvothermal reaction process.

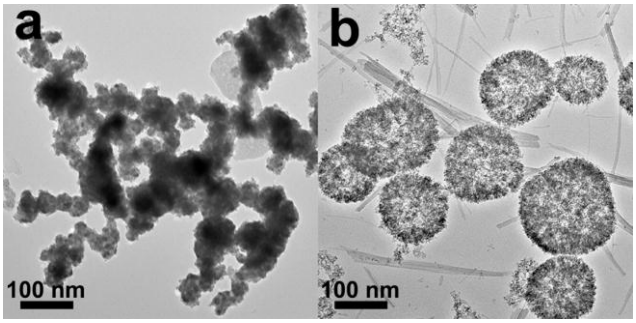

Fig. S9. TEM images of as-prepared Pt/CeO_2 HS composites obtained at different kinds of carboxylic acid: (a) formic acid, scale bar; (b) propionic acid. Scale bar: 100 nm.

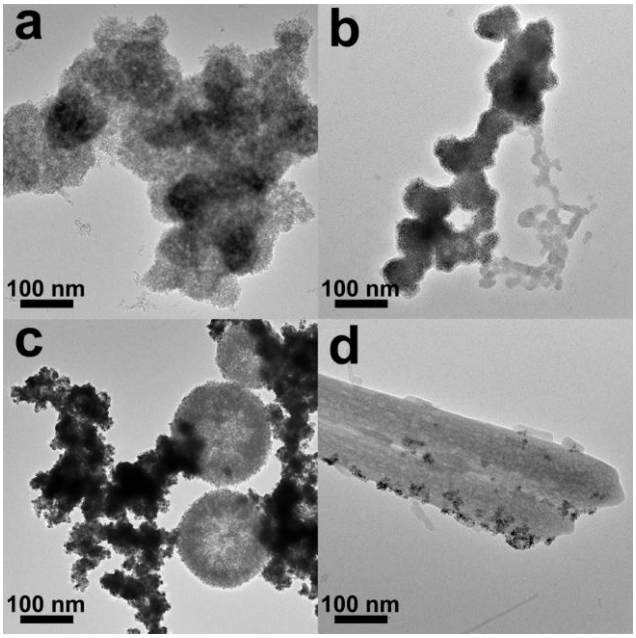

Fig. S10. TEM images of as-prepared products synthesized under the same condition for Pt/CeO_2 HS composites, except the use of (a) polyethylene glycol, (b) glycerol, (c) water, and (d) DMF to replace glycol, respectively. Scale bar: 100 nm.

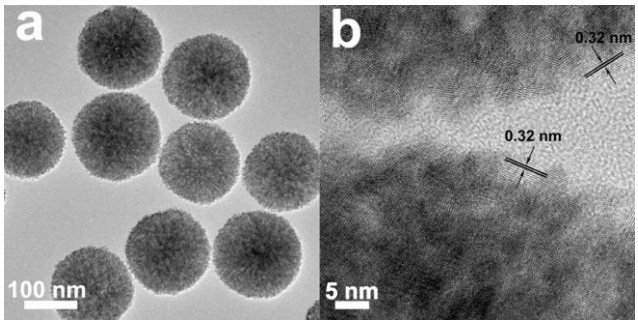

Fig. S11. TEM images of as-prepared CeO_2 NS synthesized under the same condition as for Pt/CeO_2 HS composites, except the exclusion of K_2PtCl_4: (a) low resolution TEM image with a scale bar of 100 nm. (b) High resolution TEM (HRTEM) image with a scale bar of 5 nm.

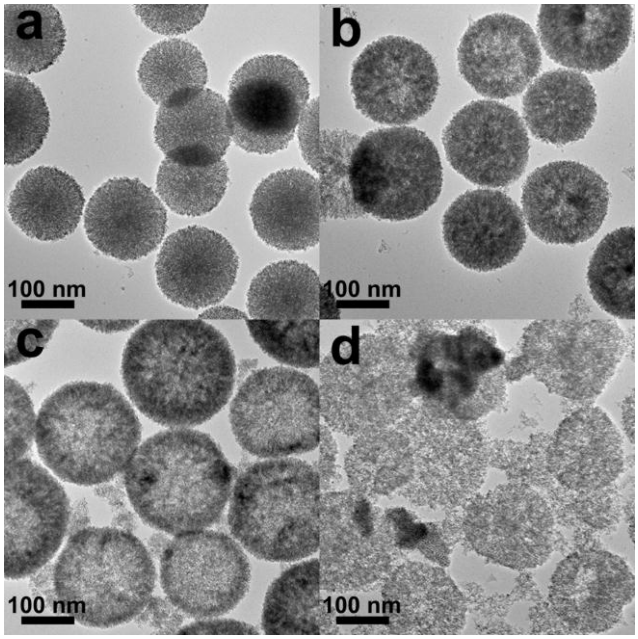

Fig. S12. TEM images of as-prepared products obtained at different contents of the K_2PtCl_4 in the raw materials: (a) 0.5 wt%; (b) 1.0 wt%; (c) 2.0 wt%; (d) 3.0 wt%. Scale bar: 100 nm.

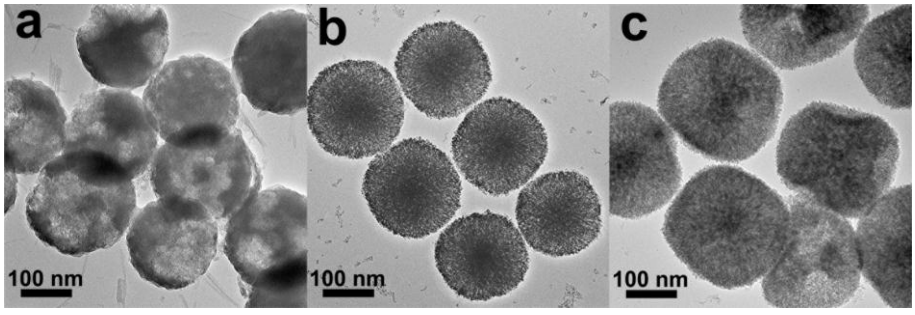

Fig. S13. TEM images of the as-prepared products obtained with the other kinds of noble metal precursors: (a) $RhCl_3$; (b) H_2PdCl_4; (c) $HAuCl_4$. Scale bar: 100 nm.

Table S2. Comparison of the catalytic activities of Pt/CeO_2 HS composites for CO Oxidation with other reported noble metal/CeO_2 catalysts.

Catalyst	T_{100} / °C	Ref
Pt/CeO_2 HS	155	this work
Pt/CeO_2 NS reference catalysts	186	this work
CeO_2 NS	290	this work
Pt-Cu NPs	158	7
$Au@CeO_2$	155	15
Pt/ceria cubes	160	65
$Pt/La\text{-}Al_2O_3$	250	66
hollow $Pd–CeO_2$	160	67

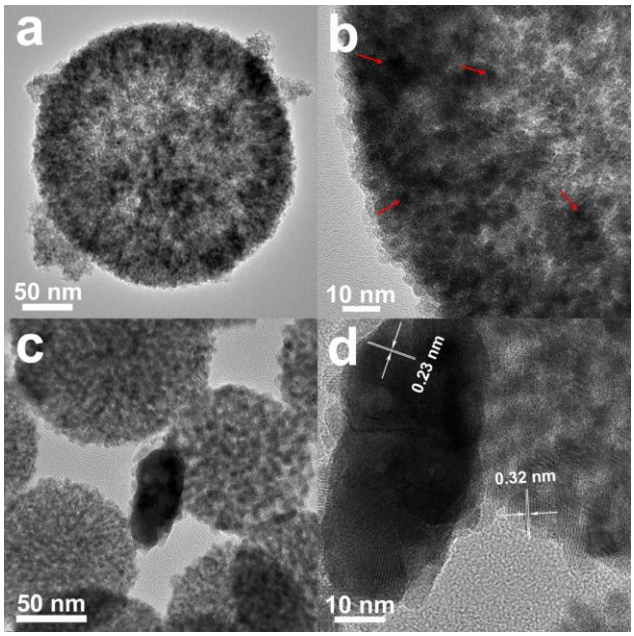

Fig. S14. (a-b) TEM images of the Pt/CeO_2 HS nanocomposite catalysts after the long-term stability test; (c-d) TEM images of the Pt/CeO_2 NS reference catalysts after the first cycle of CO oxidation reaction.

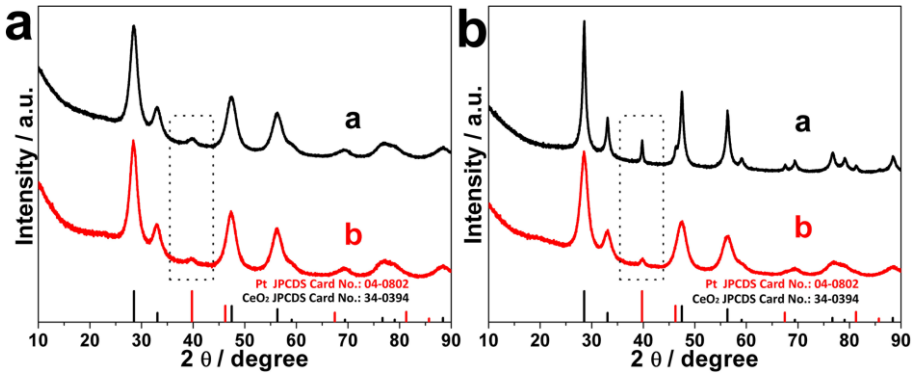

Fig. S15. (a) XRD patterns of Pt/CeO_2 HS composites: a) after the long-term stability test, b) before the long-term stability test; (b) XRD patterns of Pt/CeO_2 NS reference catalysts: a) after the first cycle of CO oxidation reaction, b) before the first cycle of CO oxidation reaction.

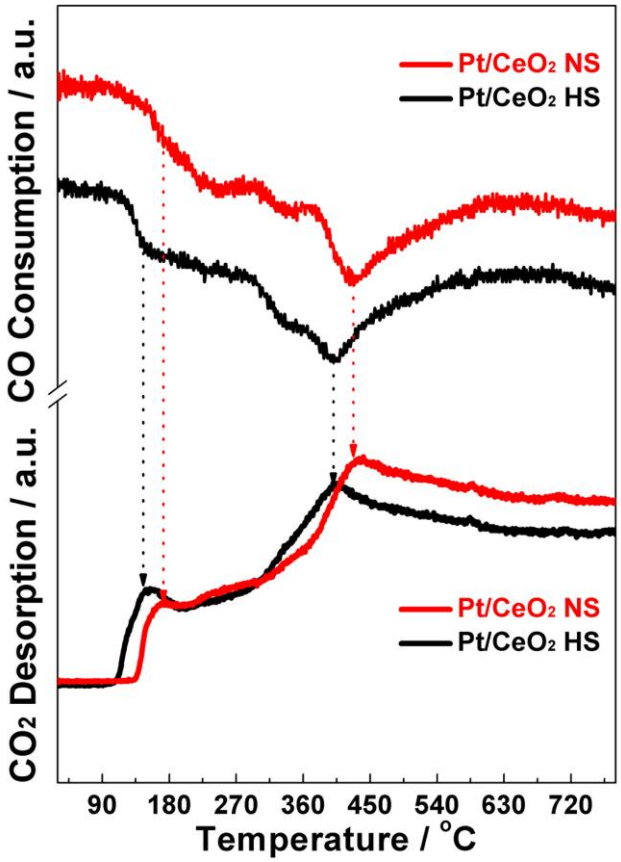

Fig. S16. CO-TPR profiles of Pt/CeO_2 HS composites and Pt/CeO_2 NS reference catalysts.