

The effect of copper species in copper-ceria catalysts: structure evolution and enhanced performance in CO oxidation

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Table S1 Primary particle size of P1-P6 calculated by Scherrer equation.

samples	primary particle size (nm)
P1	6.2
P2	5.3
P3	5.7
P4	5.8
P5	4.6
P6	5.5

Table S2 N₂ adsorption-desorption characterization and the compositional data of the as prepared carbon spheres and precursors of P₁ and P₄ samples

samples	Nominal ratio	S _{BET}	D _{BJH}	V _{BJH}
	Cu/Ce+Cu, % _{mol}	m ² g ⁻¹	nm	cm ³ g ⁻¹
carbon spheres	-----	13.68	4.2	0.022
precursors of P ₁	0	18.79	3.4	0.039
precursors of P ₄	2.5	22.41	3.8	0.045

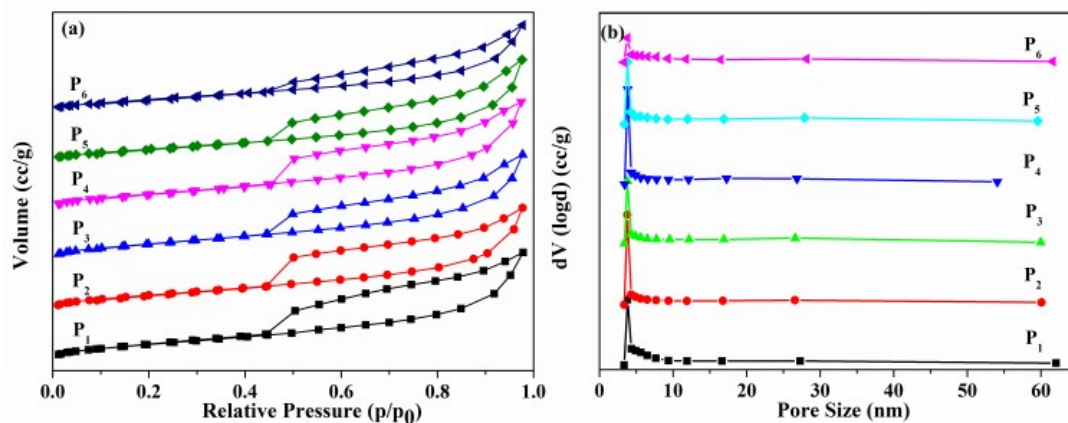


Fig. S1 N₂ adsorption-desorption isotherms of the pure and Cu²⁺ doped CeO₂ (a) and the corresponding BJH pore size distribution curves (b)

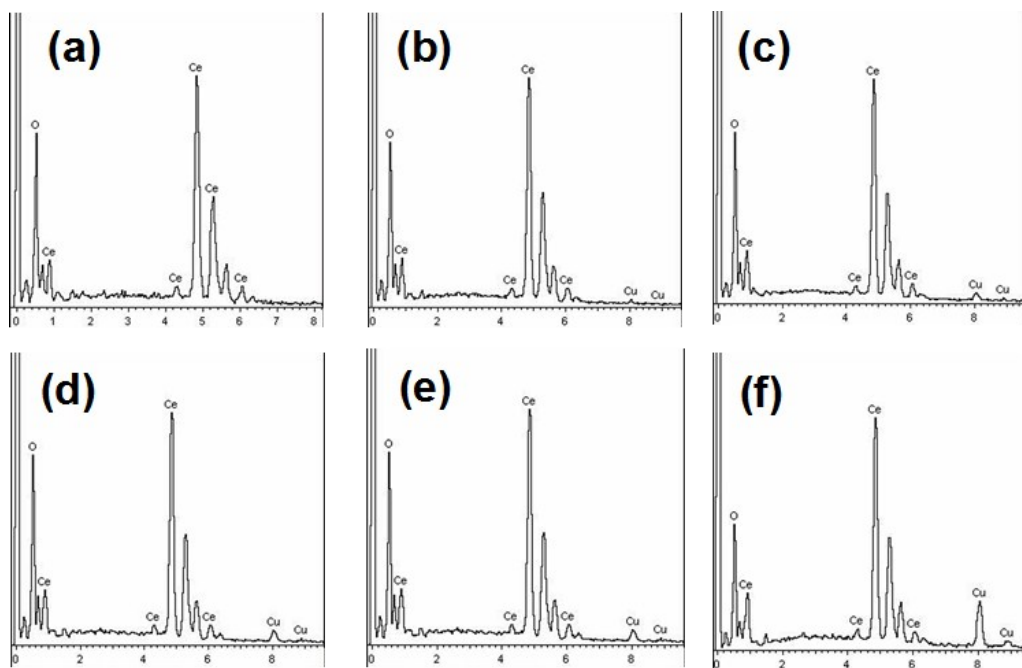


Fig. S2 EDS results of the pure and Cu^{2+} doped CeO_2 : (a) P₁, (b) P₂, (c) P₃, (d) P₄, (e) P₅ and (f) P₆.

Table. S3 AES-ICP data of P₂-P₆

samples	Cu/Cu+Ce
	% _{mol}
P ₂	3.22
P ₃	8.30
P ₄	14.07
P ₅	21.77
P ₆	31.80

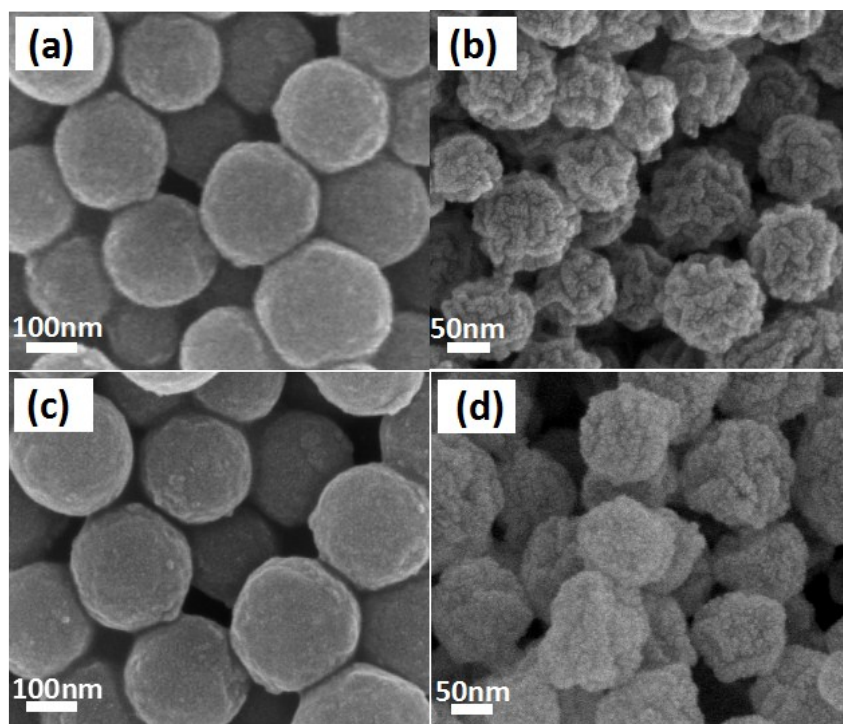


Fig. S3 The SEM images of precursors of P_1 samples (a), P_1 (b), precursors of P_4 samples (c) and P_4 (d)

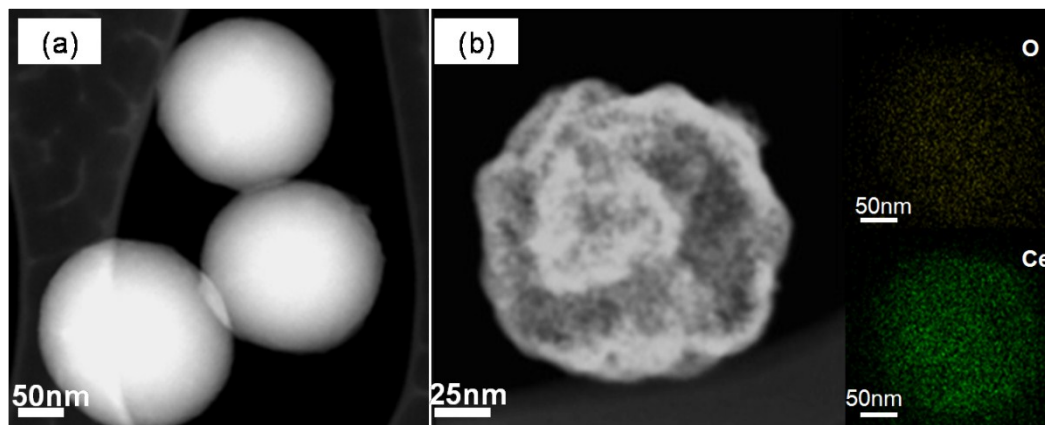


Fig. S4 The STEM images of precursors of P_1 samples (a) and P_1 (b); EDS-mapping image of an individual nanosphere, which is marked in Fig. D (b).

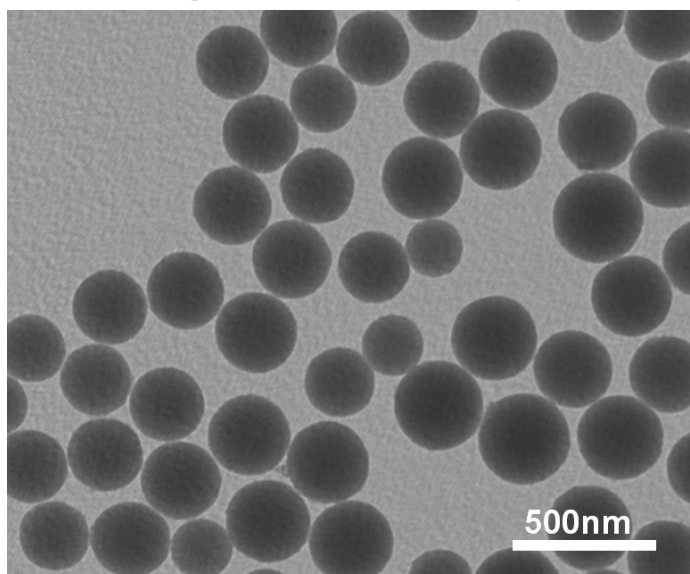


Fig. S5 The TEM images of the carbon nanospheres

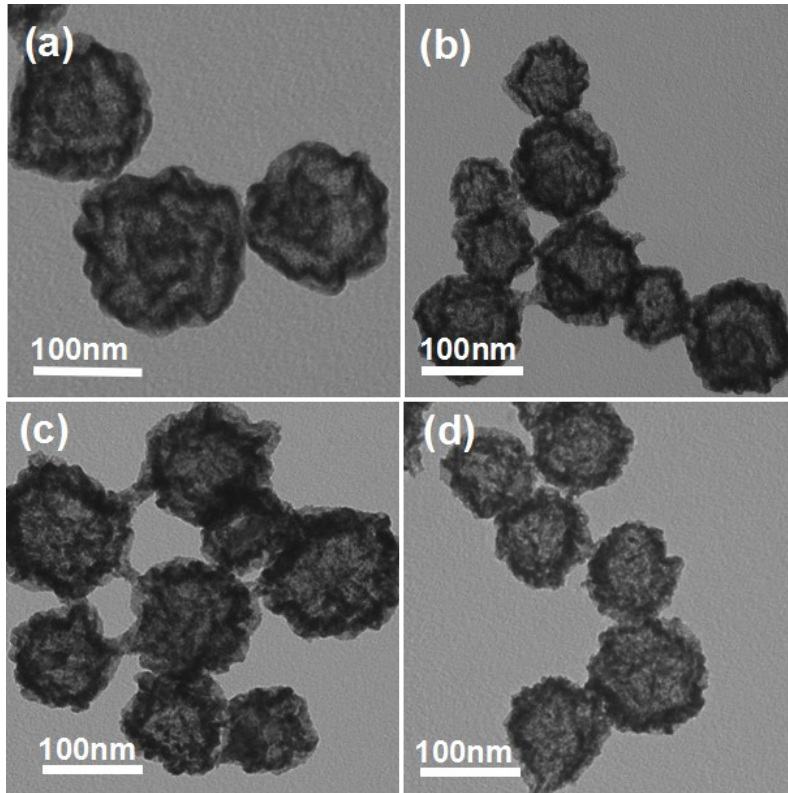


Fig. S6 The TEM images of the Cu²⁺ doped CeO₂ (a-d): P2,P3, P5 and P6.

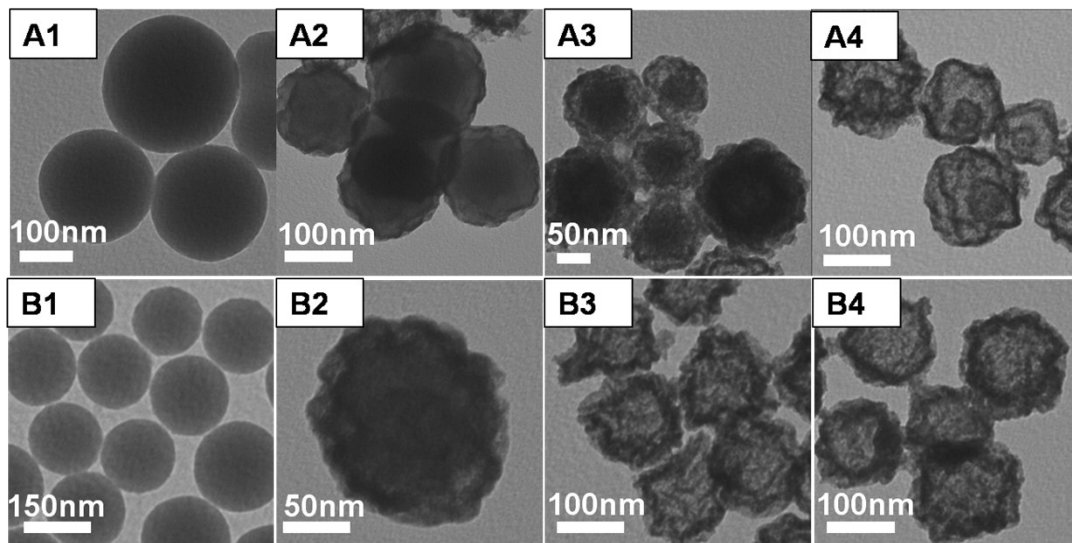


Fig. S7 TEM images of P1 (A1-A4) and P5 (B1-B4) with a series of calcination temperature and time. (A1: 280 °C, 10 min; A2: 300 °C, 10 min; A3: 320 °C, 10 min; A4: 320 °C, 50 min; B1 260 °C, 10 min; B2: 280 °C, 10 min; B3: 280 °C, 50 min; B4: 320 °C, 10 min)

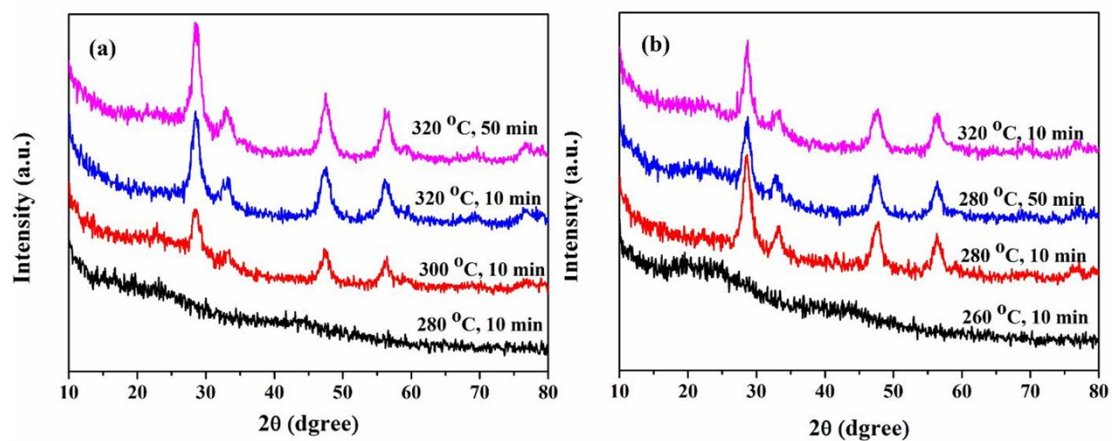


Fig. S8 The XRD patterns of P1 (a) and P5 (b) with a series of calcination temperature and time

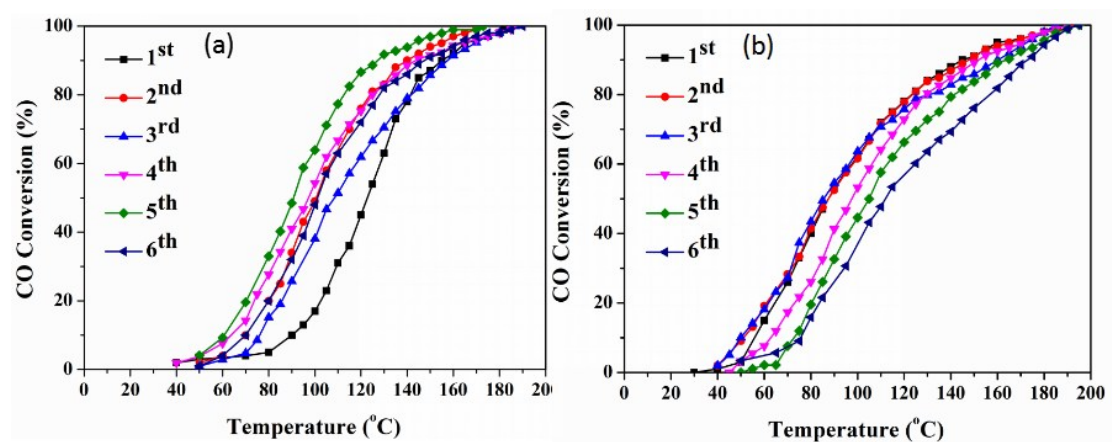


Fig S9 Catalytic performance of P₅ (a) and P₆ (b) in different runs