

Enhancement mechanism of Sn on the catalytic performance of Cu/KIT-6 during catalytic combustion of chlorobenzene

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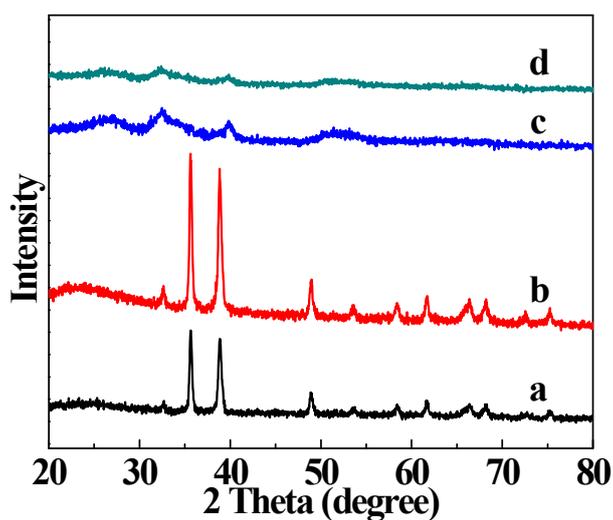


Fig. S1 Wide-angle XRD patterns of different catalysts: (a) CK-fresh; (b) CK-used; (c) SCK0.1-fresh; (d) SCK0.1-used.

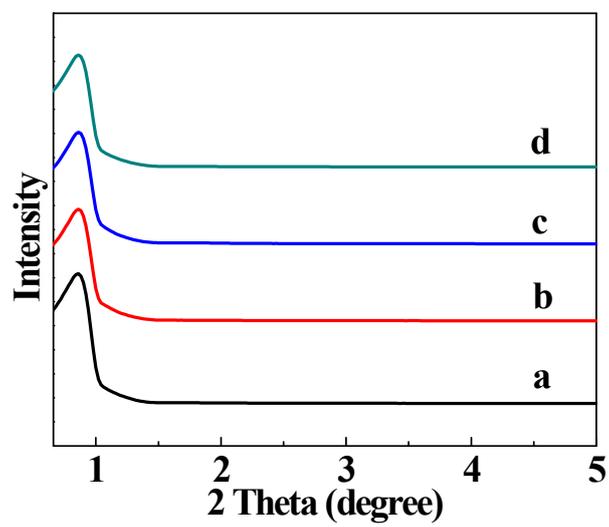


Fig. S2 Low-angle XRD patterns of different catalysts: (a) KIT-6; (b) SCK0.05; (c) SCK0.1; (d) SCK0.2.

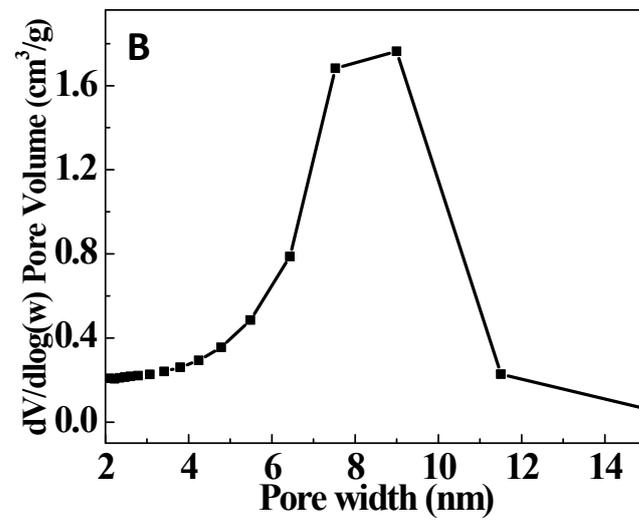
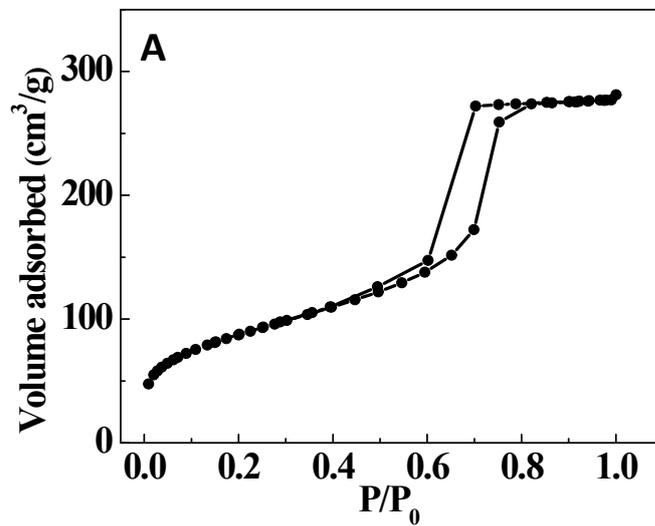


Fig. S3 (A) Nitrogen adsorption–desorption isotherms and (B) the corresponding pore size distribution curves of the SCK0.1.

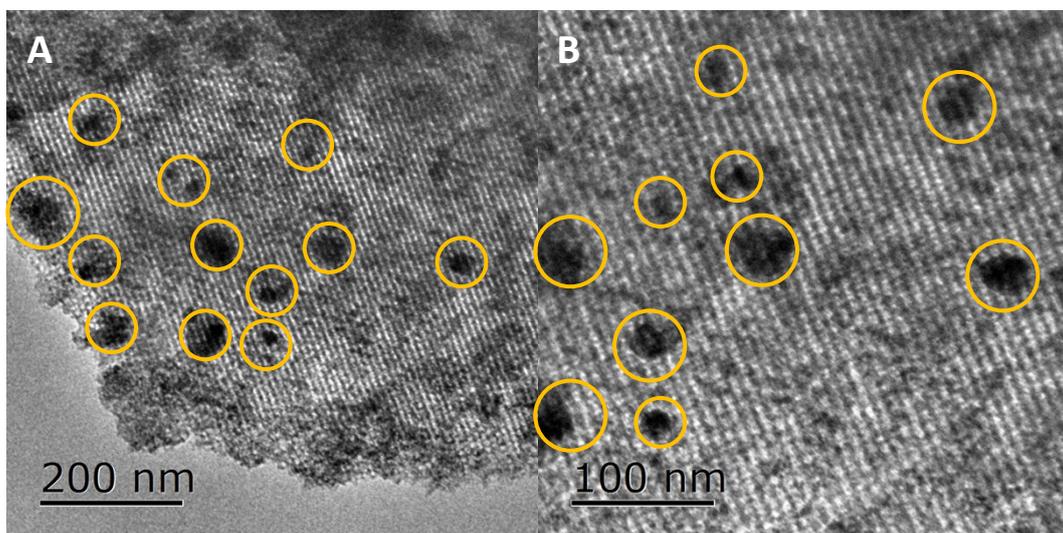


Fig. S4 TEM images of (A) CK and (B) SCK0.1 catalysts.
(Metal oxide nanoparticles were marked in yellow circles)

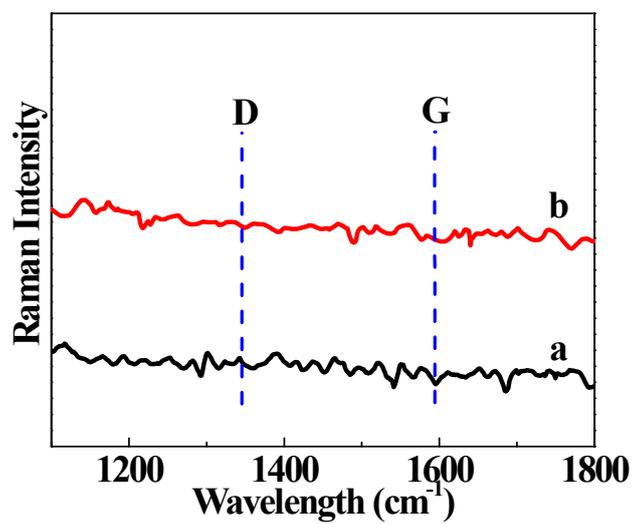


Fig. S5 Raman spectra of (a) fresh SCK0.1 and (b) used SCK0.1.

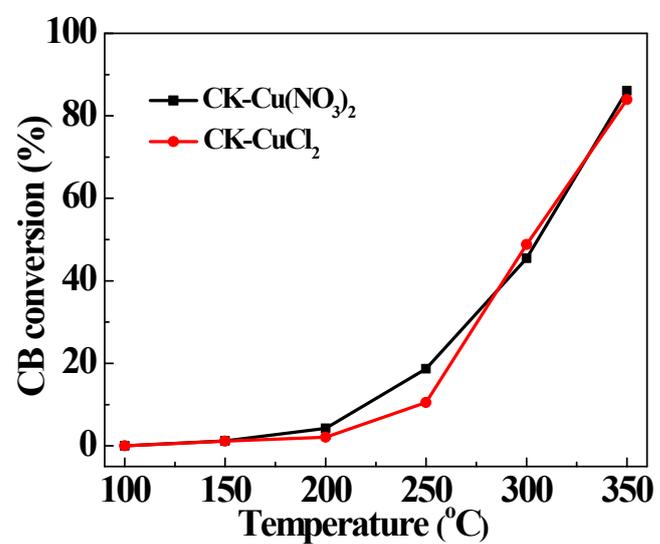


Fig. S6 The light-off curves for CB catalytic combustion over CK catalyst prepared with Cu(NO₃)₂ and CuCl₂. CB concentration: 1000 ppm; GHSV: 15000 h⁻¹; catalyst amount: 200 mg.

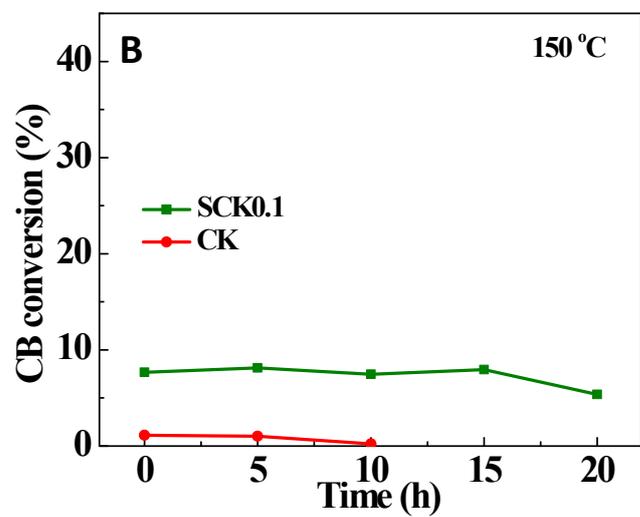
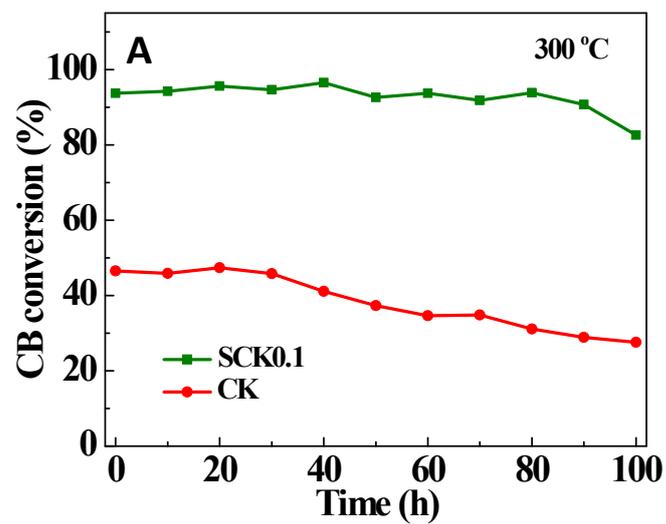


Fig. S7 The stability of CB over SCK0.1 and CK catalysts at (A) 300 °C and (B) 150 °C. CB concentration: 1000 ppm; GHSV: 15000 h⁻¹; catalyst amount: 200 mg.

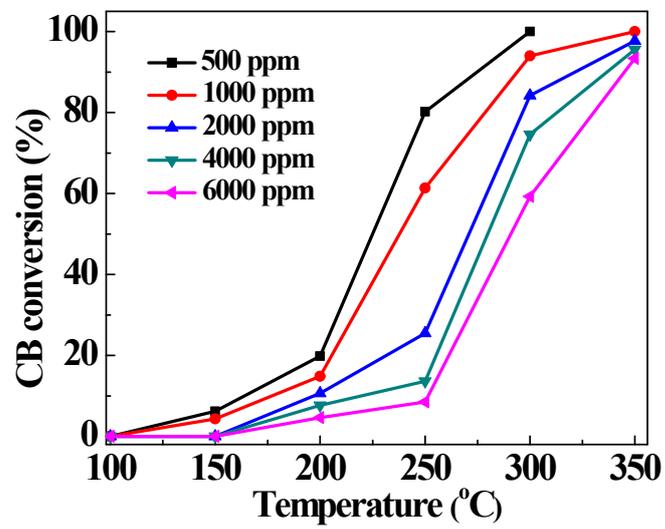


Fig. S8 The light-off curves for CB catalytic combustion over SCK0.1 under different inlet concentration.

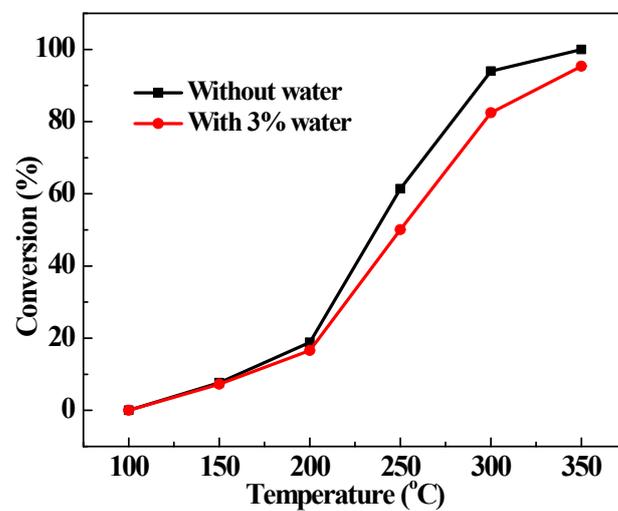


Fig. S9 Conversion of CB over SCK0.1 under dry and water (3%, v/v) air conditions. CB concentration: 1000 ppm; GHSV: 15000 h⁻¹; catalyst amount: 200 mg.

Table S1 BET surface area, average pore size and pore volume of different catalysts.

Sample	BET surface area ($\text{m}^2 \cdot \text{g}^{-1}$)	Average pore size (nm)	Pore volume ($\text{cm}^3 \cdot \text{g}^{-1}$)
KIT-6	612	5.64	0.85
CK	388	5.18	0.59
SK	389	5.6	0.46
SCK0.05-fresh	356	5.33	0.55
SCK0.1-fresh	317	5.16	0.44
SCK0.15-fresh	311	4.81	0.42
SCK0.2-fresh	304	4.43	0.4
CK-used	377	5.54	0.52
SCK0.1-used	294	5.14	0.42

Table S2 Physicochemical properties of various catalysts.

Catalysts	Cu ^a (%)		Sn ^b (%)		Sn/Cu ^c	O _{ads} /(O _{latt} + O _{ads} + O _{wat}) ^d (%)	Cl ^e (%)
	Cu ²⁺	Cu ⁺	Sn ⁴⁺	Sn ²⁺			
CK fresh	53.4	46.6	/	/	/	47.8	/
CK used	40.8	59.2	/	/	/	45.4	0.96
SCK0.1 fresh	62.9	37.1	97.9	2.1	0.23	49.6	3.27
SCK0.1 used	60.2	49.8	91.7	8.3	0.37	46.8	3.33

^a Obtained from the deconvolution results of Auger L3VV kinetic energy spectra of samples.

^b Obtained from the deconvolution results of XPS spectra of samples.

^c The surface Sn/Cu molar ratio estimated by XPS analysis.

^d Percentage of the surface oxygen species, $O_{ads} = O_{ads}/(O_{ads} + O_{latt} + O_{wat}) \times 100\%$.

^e Surface Cl content obtained from the deconvolution results of XPS spectra.

Table S3 Catalytic activity of different catalysts for CB combustion.

Catalyst	T10 (°C)	T50 (°C)	T90 (°C)
CK	238	306	/
SK	306	/	/
SCK0.05	198	264	298
SCK0.1	161	237	294
SCK0.15	207	267	321
SCK0.2	212	272	335

Table S4 Amounts of the surface Cu²⁺ cations and performance of the catalysts.

Catalysts	r ^a ($\times 10^{-3}$ $\mu\text{mol} \cdot \text{m}^{-2} \cdot \text{min}^{-1}$)	E _a ^b (KJ/mol)
CK	2.4	58.20
SCK0.05	6.3	42.40
SCK0.1	13.2	35.42
SCK0.15	4.4	44.23
SCK0.2	3.1	56.87
SK	0.5	61.27

^a The r (reaction rate) calculated based on the mole of CB transformed per minute and per square meter from CB conversion at 200 °C under the reaction condition described in Fig. 4A.

^b E_a calculated based on the result showed in Fig. 4B.