Electronic Supplementary Material (ESI) for RSC Advances.

Supplementary Information

Shape-controlled synthesis of 3D copper nicotinate hollow microstructures and their catalytic properties

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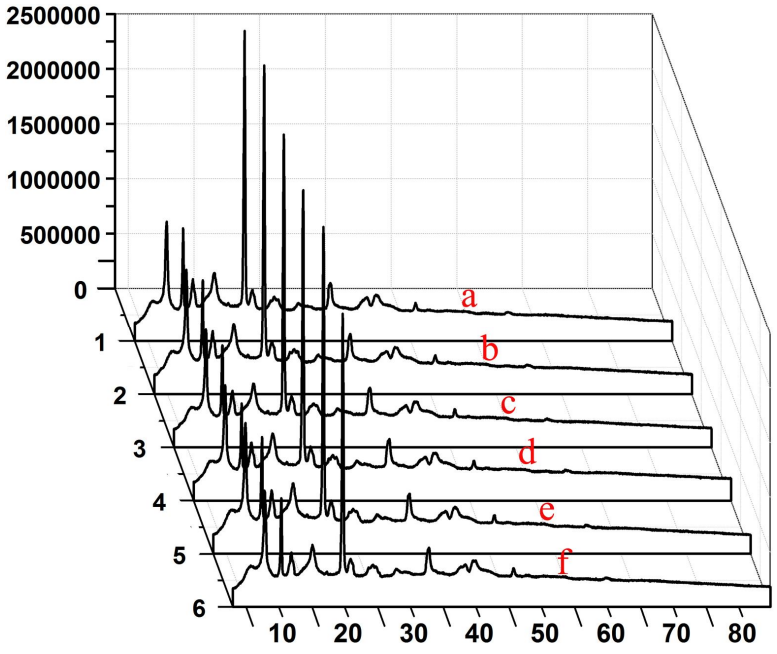

Fig. S1 XRD pattern of copper nicotinate hollow microstructures with different a. 1min, b. 5min, c. 10min, d. 20min, e. 30min, f. 40min.

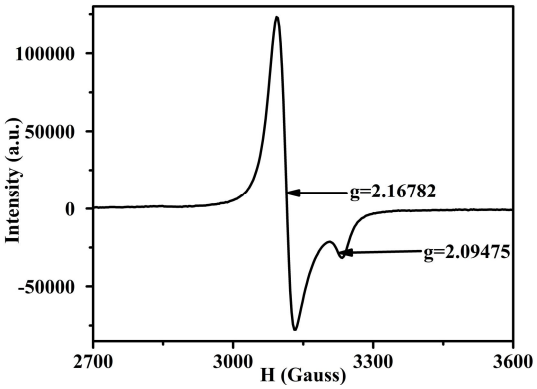

Fig. S2 EPR experimental spectra at 100 K of copper nicotinate solutions in ethanol with concentration of 0.1 M. In the experiment, a Bruker ESRA-300 spectrometer operating at 9.45 GHz (X band) at 100 K was used to take EPR data of the samples in a quartz capillary tube.

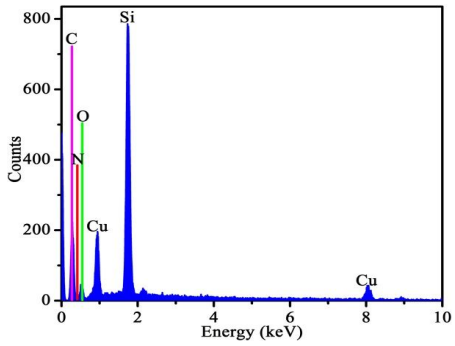

Fig. S3 EDX spectrum of Copper nicotinate hollow microstructures (0.20 M nicotinic acid).

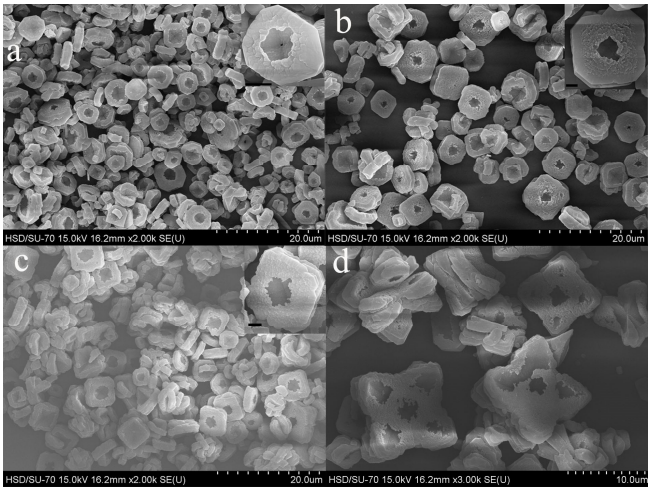

Fig. S4 Representative SEM images of copper nicotinate reaction of 30 min with various concentrations: (a) 0.10 M, (b) 0.15 M, (c) 0.20 M, (d) 0.30 M. (Inset is magnified images, scaleplate: 1 μm)

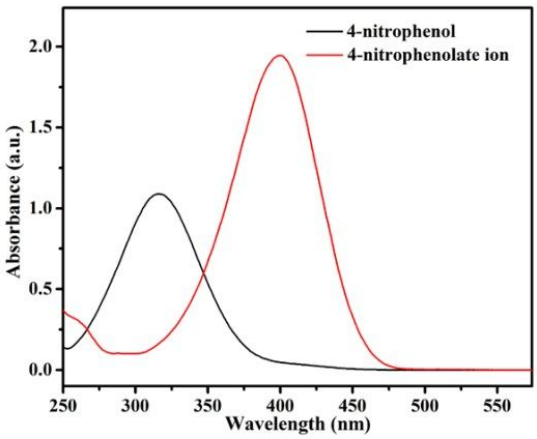

Fig. S5 The UV-vis characteristic peaks of freshly prepared 4-nitrophenol and 4-nitrophenolate ion aqueous solution at 317 and 400 nm, respectively.

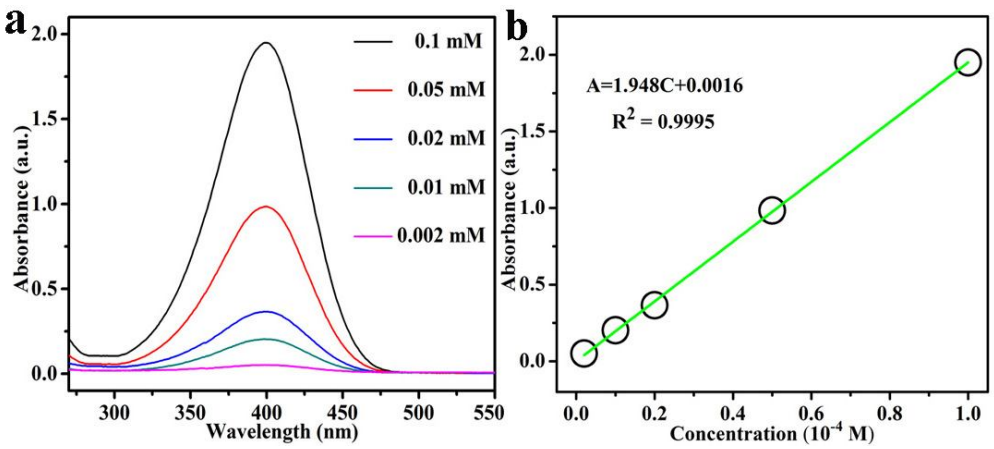

Fig. S6 (a) Absorption spectra of aqueous mixture solutions of 4-NP and $NaBH_4$ at different concentrations of 4-NP. (b) Plot of the peak absorbance against the concentration of 4-NP.

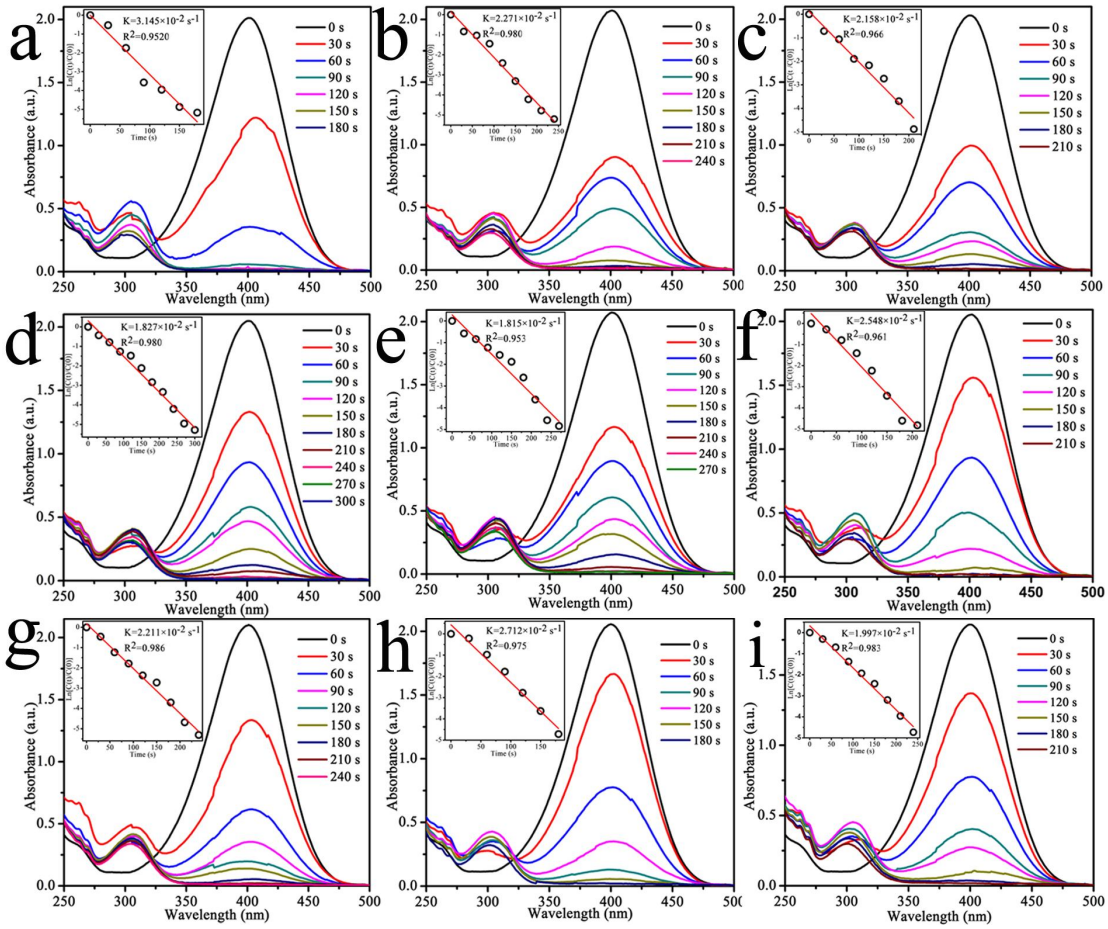

Fig. S7 UV−vis absorption spectra of reduction of 4-NP by $NaBH_4$ under the catalysis of copper nicotinate (0.20 M) with different reaction time (a) 1 min, (b) 3 min, (c) 5 min, (d) 8 min, (e) 10 min, (f) 15 min, (g) 20 min, (h) 40 min, (i) 70 min. (insets: the corresponding $\ln(C_{(t)}/C_{(0)})$ versus reaction time for reduction of 4-NP.)

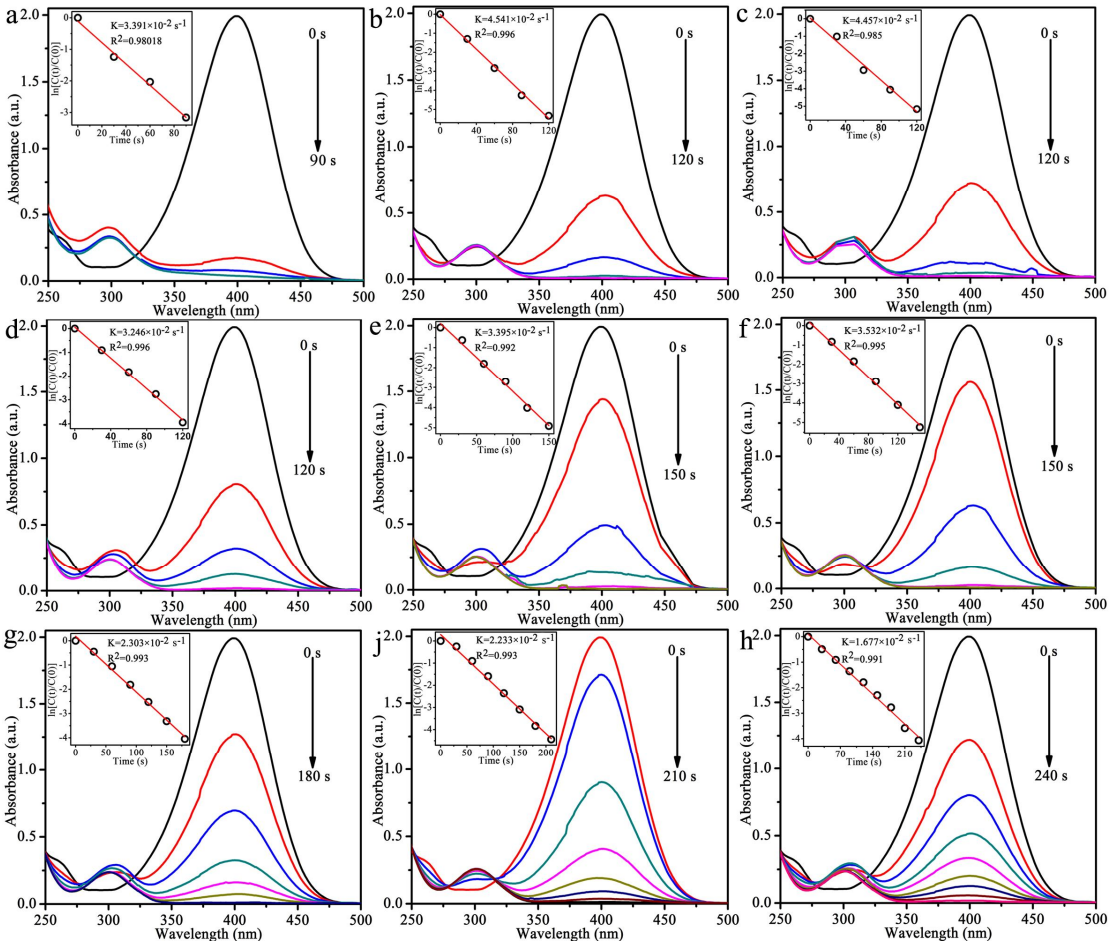

Fig. S8 UV-vis spectra of the reduction of 4-NP by $NaBH_4$ in the presence of copper nicotinate recorded for the 2nd (a), 3rd (b), 4th (c), 5th (d), 6th (e), 7th (f), 8th (g), 9th (j), 10th (h), insets: the corresponding $\ln(C_{(t)}/C_{(0)})$ versus reaction time for reduction of 4-NP.

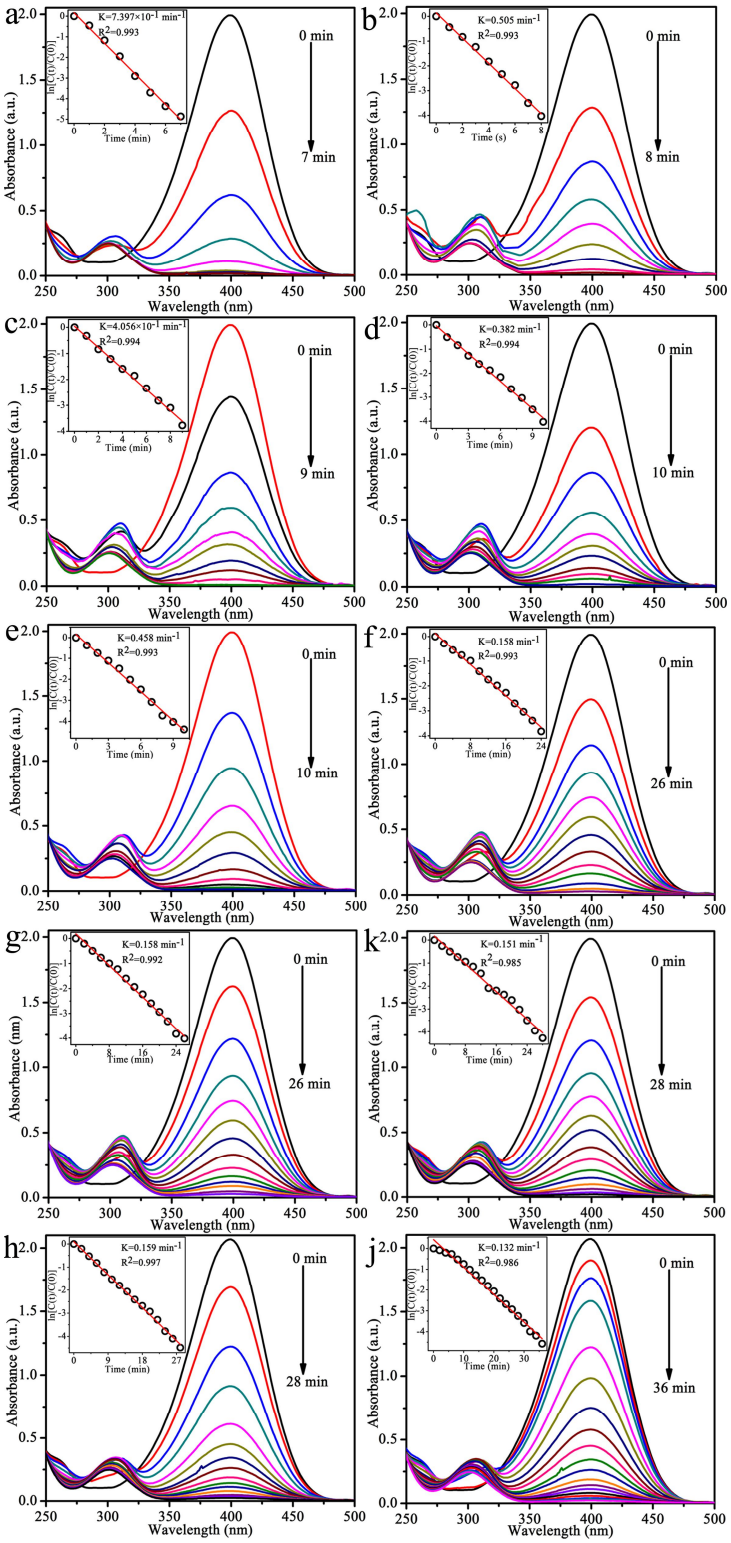

Fig. S9 UV-vis spectra of the reduction of 4-NP by $NaBH_4$ in the presence of copper nicotinate recorded for the 11th (a), 12th (b), 13th (c), 14th (d), 15th (e), 16th (f), 17th (g), 18th (k), 19th (h), 20th (j), insets: the corresponding ln(C(t)/C(0)) versus reaction time for reduction of 4-NP.

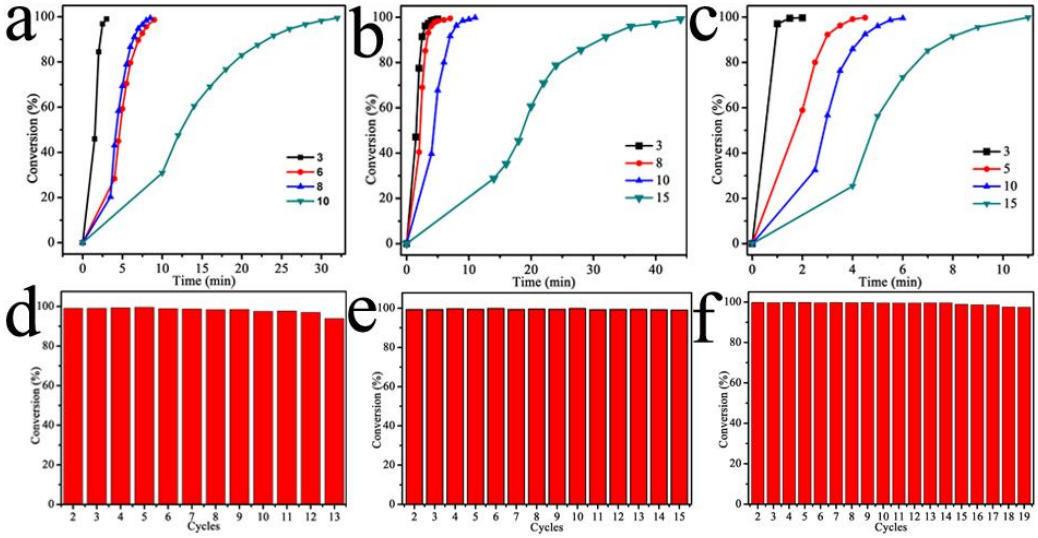

Fig. S10 Conversion (%) of 4-NP with the change of time by copper nicotinate as catalyst with various concentrations nicotinic acid (a) 0.10 M, (b) 0.15 M, (c) 0.30 M. The reusability of copper nicotinate as a catalyst for the reduction of 4-NP with $NaBH_4$ (d), (e), (f).

Table S1 Comparison of pseudo-first-order rate constants for 4-NP reduction by copper nicotinate

Catalyst	Type	Initial concentration of the 4-NP	Final amount of catalyst	Rate constant	References
copper nicotinate	hollow microstructures	1.09×10^{-4} M	0.00916 mg/mL	2.999×10^{-2} s^{-1}	This work
Cu nanoparticles	nanoparticles	0.6×10^{-4} M	0.25 mg/mL	0.159×10^{-2} s^{-1}	1
CuO nanostructures	Flowerlike	1.0×10^{-4} M	0.01 mg/mL	1.06×10^{-2} s^{-1}	2
PANI/Ag	composites	0.93×10^{-4} M	0.333 mg/mL	2.56×10^{-2} s^{-1}	3
Fe_3O_4–@C@ Ag	Supported	0.099×10^{-4} M	0.00495 mg/mL	0.372×10^{-2} s^{-1}	4

Reference:

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(2) Wei. Che, Y. H. Ni, Y. X. Zhang and Y. Ma, *Journal of Physics and Chemistry of Solids, **2015**, 77*, 1-7.

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