Supporting 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 NaBH₄ 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 NaBH₄ 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)/C₀) versus reaction time for reduction of 4-NP.)
Fig. S8 UV-vis spectra of the reduction of 4-NP by NaBH₄ 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)/C₀) versus reaction time for reduction of 4-NP.
**Fig. S9** UV-vis spectra of the reduction of 4-NP by NaBH₄ 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 NaBH₄ (d), (e), (f).
**Table S1** Comparison of pseudo-first-order rate constants for 4-NP reduction by copper nicotinate

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

**Reference:**