Supporting Information

Nitrogen-doped Mesoporous Hollow Carbon Nanoflowers as High Performance Anode Materials of Lithium Ion Batteries

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Synthesis of nitrogen-doped hollow carbon nanorods (N-HCNRs)

Firstly, β-FeOOH nanorods were prepared according to our previous work.[1] Briefly, the aqueous solution of 1.1250 g $FeCl_3 \cdot 6H_2O$ and 1.20 g urea dissolved in 20 mL water was heated to 90-95℃ to make Fe^{3+} hydrolyze for 8h. Then the yellow product was separated from the mother liquor with an ultra-speed centrifuge and rinsed with distilled water repeatedly in order to eliminate the remaining chloride ions on the surfaces, and finally dried in a vacuum oven at temperature of 45℃. Secondly, the β-FeOOH nanorods (0.045 g) was mixed with dopamine (15 mg) in Tris-buffer (50

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mL,10 mM; pH 8.5) for 24 h at 50 °C. The resultant product was separated and collected, followed by washing with deionized water and ethanol for 3 times, respectively. Then, the obtained β-FeOOH@PDA composites was dried at 60 °C for 24 h. Thirdly, the β-FeOOH@PDA composites were heated in a quartz tube under Ar atmosphere at 400°C for 2 h with a heating rate of 1 °C min^{-1}, which was followed by further treatment at 500°C for 2 h with a heating rate of 5 °C min^{-1}. The powder is Fe_3O_4@C-N nanorods composites. Lastly, the black product was treated with 2M HCl to remove the Fe_3O_4 core. The non-magnetic black precipitation was washed with distilled water until the pH was about 7. The final product was dried overnight at 60 °C for 24 h. Nitrogen-doped hollow carbon nanorods (N-HCNRs) were obtained.

Synthesis of hollow carbon nanoflowers (HCNFs)

The urchin-like α-FeOOH (0.05 g) was mixed with glucose (0.5 g) in 30 mL deionized water. The mixture was transformed into a Teflon-lined stainless-steel autoclave with 50 mL capacity. Then, the autoclave was placed in an oven and kept at 200℃ for 12 h. The resultant product was separated and collected, followed by washing with deionized water and ethanol for 3 times, respectively. Then, the obtained powder was dried at 60 °C overnight. The above intermediate products were heated in a quartz tube under Ar atmosphere at 400°C for 2h with a heating rate of 1°C min^{-1}, which was followed by further treatment at 500°C for 2h with a heating rate of 5°C min^{-1}. The urchin-like Fe_3O_4@C composites were obtained. Finally, the black product was treated with 2M HCl to remove the Fe_3O_4 core. The non-magnetic black precipitation was washed with distilled water until the pH was about 7. The final product was dried overnight at 60 °C for 24 h. Hollow carbon nanoflowers (HCNFs) were obtained.

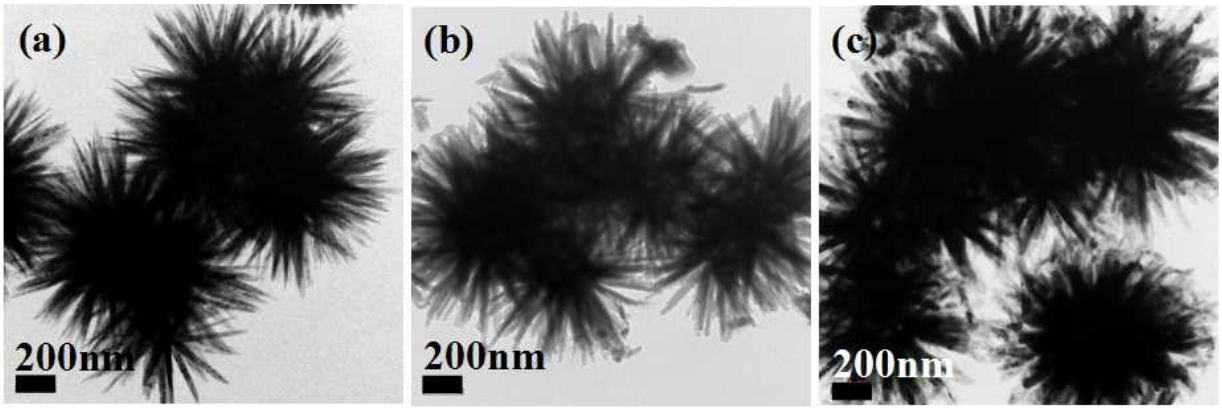

Fig. S1. TEM images of (a) urchin-like α-FeOOH, (b) urchin-like α-FeOOH@PAD, (c) nitrogen-doped carbon encapsulation urchin-like Fe_3O_4.

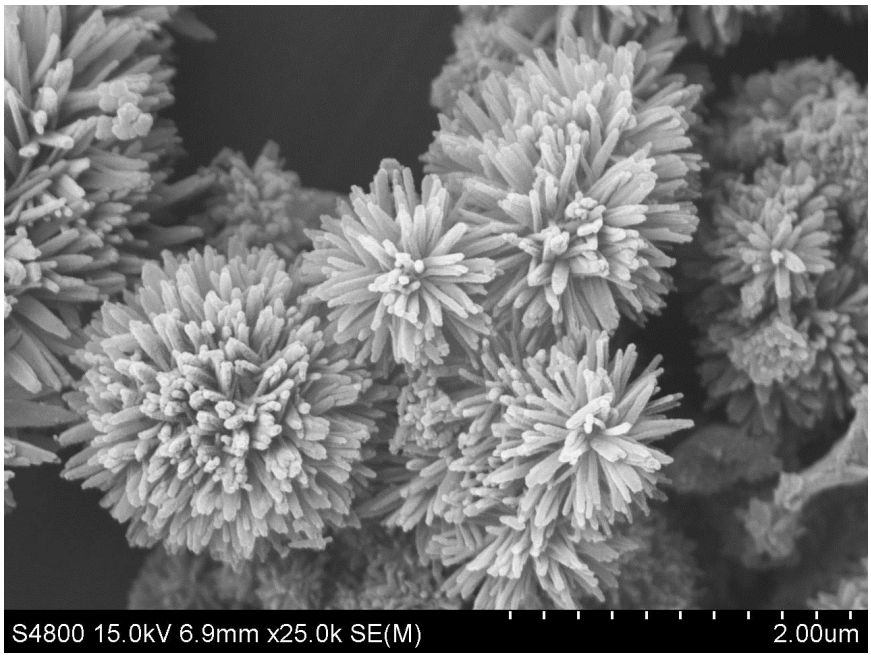

Fig. S2. SEM image of nitrogen-doped hollow carbon nanoflowers (N-HCNFs).

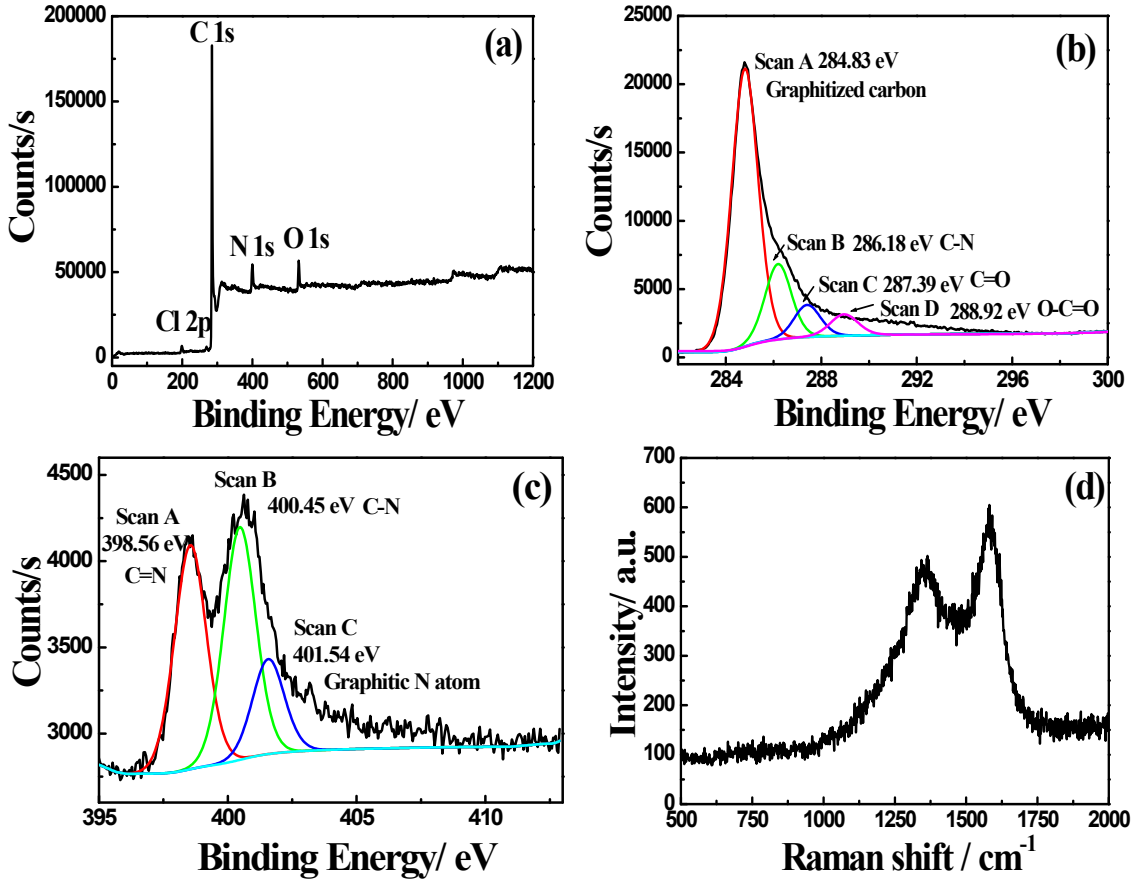

Fig. S3. XPS spectra of nitrogen-doped hollow carbon nanorods (N-HCNRs): (a) survey, high-resolution XPS spectra of (b) C 1s, (c) N 1s. (d) Raman spectrum of nitrogen-doped hollow carbon nanorods (N-HCNRs).

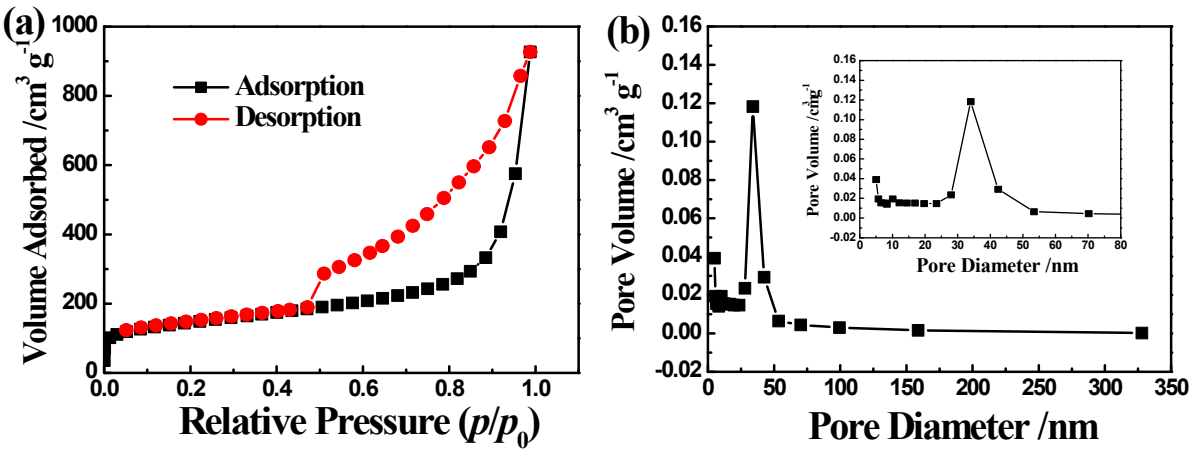

Fig. S4. (a) N_2 adsorption–desorption isotherm of nitrogen-doped hollow carbon nanorods (N-HCNRs) and (b) the corresponding pore size distribution.

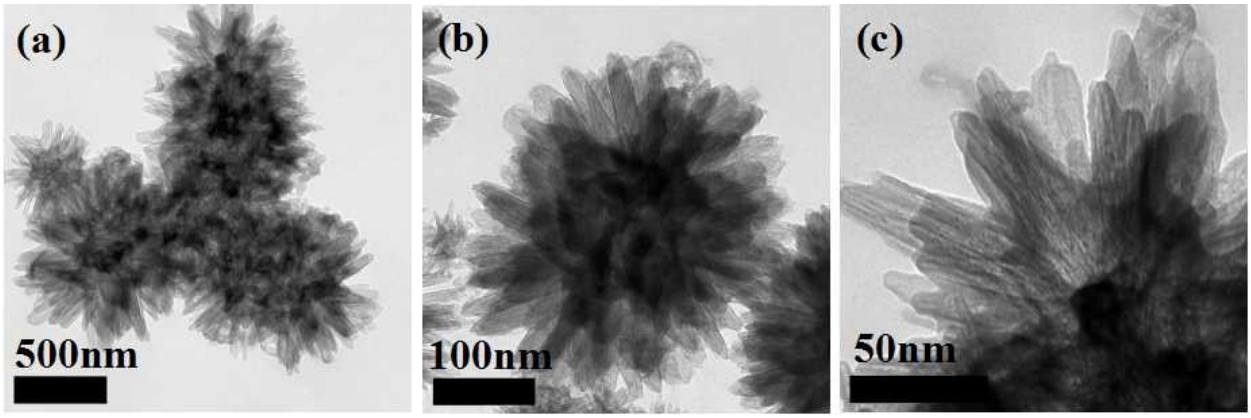

Fig. S5. TEM images of hollow carbon nanoflowers (HCNFs) using glucose as carbon source.

Reference:

1 M. Chen, J. Jiang, X. Zhou and G. Diao, *J. Nanosci. Nanotechnol.*, 2008, **8**, 3942–3948.