Supporting Information for

Dopamine as the coating agent and carbon precursor for the fabrication of N-doped carbon coated Fe_3O_4 composites as superior lithium ion anodes

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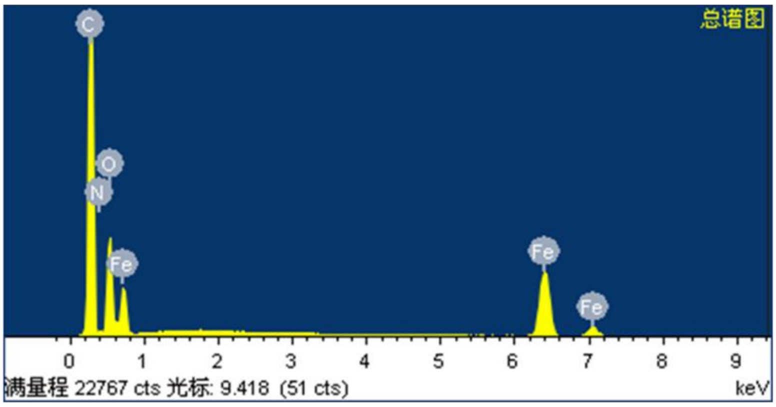

Fig. S1 EDX spectrum of the Fe_3O_4@NC-1.

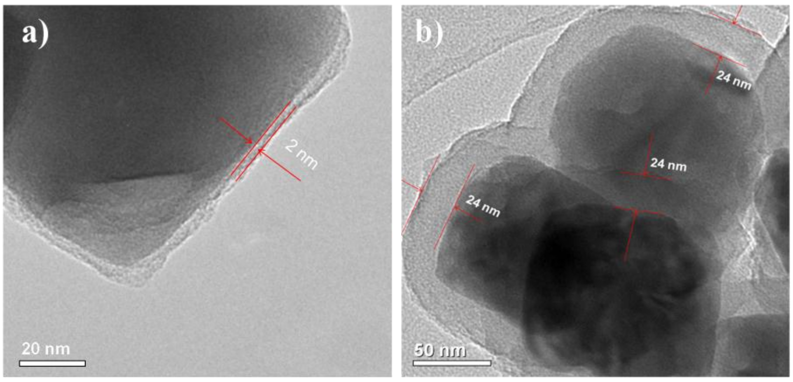

Fig. S2 TEM image of a) Fe_3O_4@NC-2, b) Fe_3O_4@NC-3.

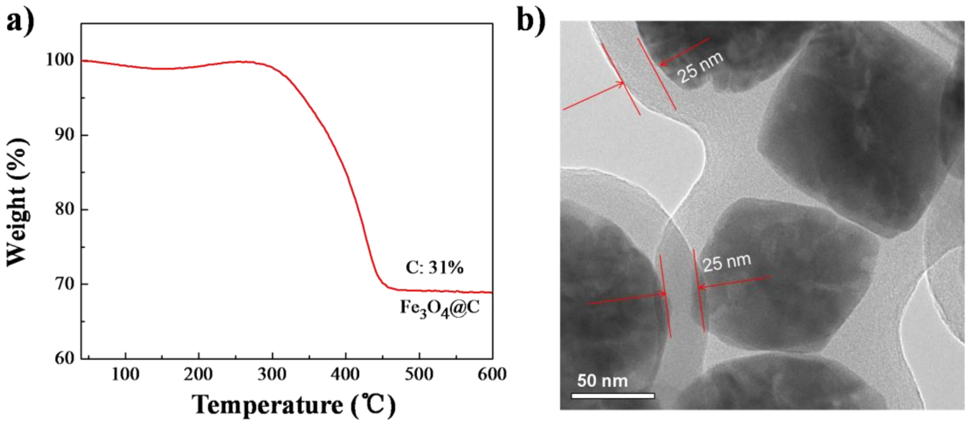

Fig. S3 a) TG curve of Fe_3O_4@C composite, and b) TEM image of Fe_3O_4@C.

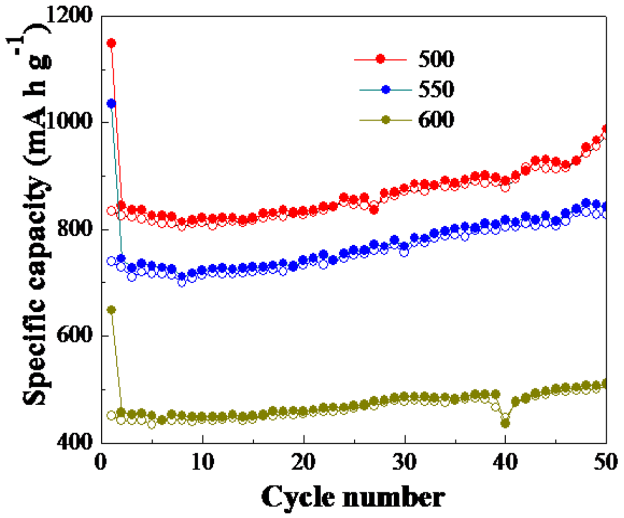

Fig. S4 Discharge capacity versus cycle number plots of Fe_3O_4@NC composites carbonized at different temperature at a current density of 500 mA g^{-1}.

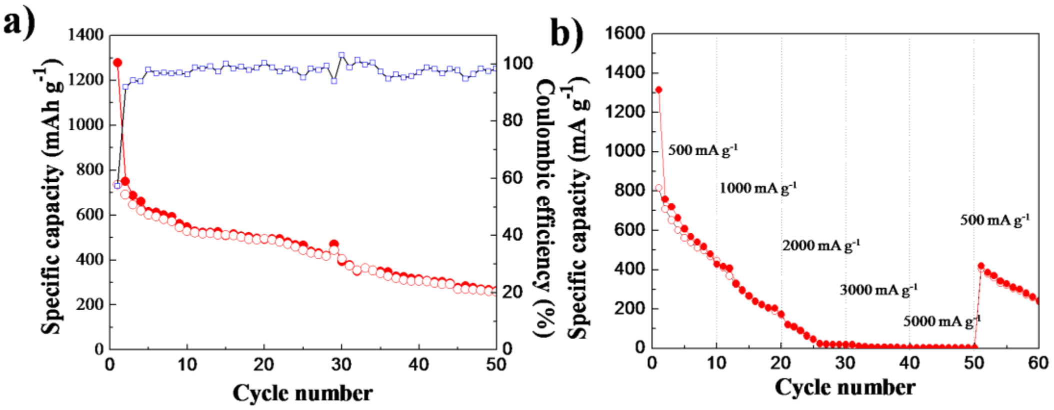

Fig. S5 a) Discharge capacity versus cycle number plots of pure Fe_3O_4 nanoparticles measured at a current density of 500 mA g^{-1}, b) The rate capability of pure Fe_3O_4 nanoparticles at different current densities.

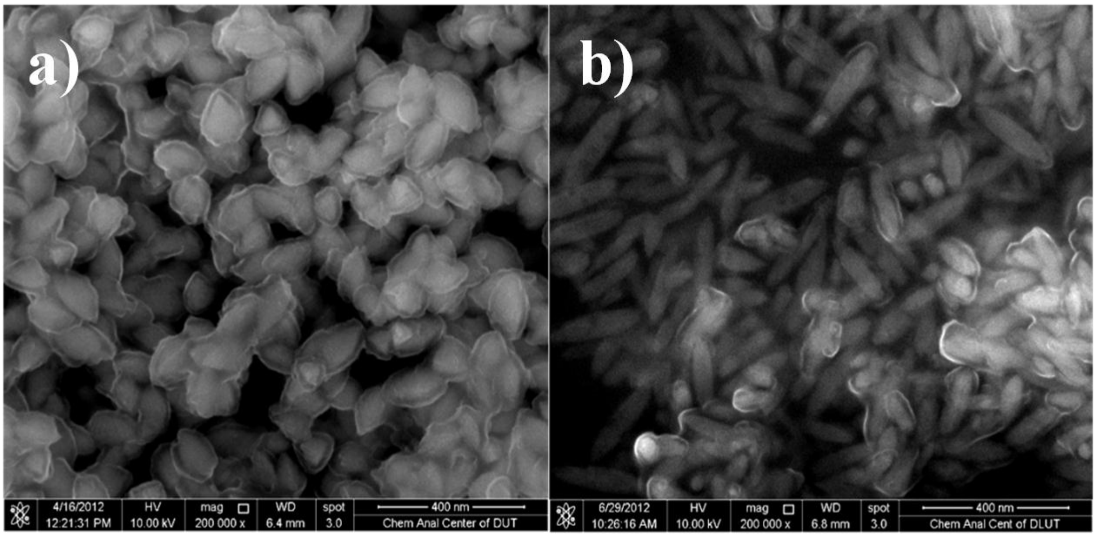

Fig. S6 SEM images of a) polydopamine coated spindle shaped-Fe_2O_3, b) rod shaped-β-FeOOH.

The calculating process of carbon yield of dopamine:

$$C\,\% = \frac{M_{Fe3O4@NC\text{-}1} - M_{Fe3O4@NC\text{-}1} \times (1-0.16)}{M_{Fe2O3@polydopamine} - \dfrac{M_{Fe3O4@NC\text{-}1} \times (1-0.16)}{0.9667}} \times 100\,\%$$

where $M_{Fe3O4@NC\text{-}1}$=the mass of Fe_3O_4@NC-1 after pyrolysis; $M_{Fe2O3@polydopamine}$ = the mass of Fe_2O_3@polydopamine before pyrolysis; 0.16 is the carbon content of Fe_3O_4@NC-1; 0.9667 is the mass variation rate from Fe_3O_4 to Fe_2O_3.

In the synthesis process of Fe_3O_4@NC-1, 0.242g Fe_2O_3@polydopamine was loaded in the quartz tube and the resulting Fe_3O_4@NC-1 is 0.222 g.

$$C\,\% = \frac{0.222 - 0.222 \times (1-0.16)}{0.242 - \dfrac{0.222 \times (1-0.16)}{0.9667}} = 72.36\,\%$$

So via this equation, we can find that the carbon yield of dopamine is about 72.36%.

Table. S1 A comparison of the electrochemical performance of carbon coated Fe_3O_4 anodes from literature.

Type of material	Reversible capacity /mA h g^{-1}	Initial efficiency	0.5C-Rate / mA h g^{-1}	1C-Rate / mA h g^{-1}	2 C-Rate / mA h g^{-1}	5C-Rate / mA h g^{-1}	Reference
Fe_3O_4@NC	976(500 mA g^{-1})	69.3 %	803	595	396	80	This study
Fe_3O_4@CF	784 (100 mA g^{-1})	70.1%	570	140	140	-	[1]
Fe3O4–C	600 (400 mA g-1)	80%	580	510	380	190	[2]
Fe_3O_4@C	600 (100 mA g^{-1})	54%	430	340	270	170	[3]
C@Fe_3O_4 nanotube array	500 (25 mA g^{-1})	62.5%	270	237.5	–	–	[4]
N–C–Fe_3O_4	848 (100 mA g^{-1})	79.5%	665	485	360	–	[5]
Fe_3O_4/carbon-600	610 (201 mA g^{-1})	70%	532	459	380	199	[6]
Fe_3O_4@C	837(180 mA g^{-1})	–	778	642	500	330	[7]
Fe_3O_4/C beads	700 (100 mA g^{-1})	75.68%	573	–	–	–	[8]

(Note, in this table 1C=1000 mA g^{-1})

Reference

[1] T. Yoon, C. Chae, Y. K. Sun, X. Zhao, H. H. Kungc and J. K. Lee, *J. Mater. Chem.*, 2011, **21**, 17325.
[2] W. M. Zhang, X. L. Wu, J. S. Hu, Y. G. Guo and L. J. Wan, *Adv. Funct. Mater.*, 2008, **18**, 3941.
[3] Z. M. Cui, L. Y. Jiang, W. G. Song and Y. G. Guo, *Chem. Mater.*, 2009, **21**, 1162.
[4] K. Y. Xie, Z. G. Lu, H. T. Huang, W. Lu, Y. Q. Lai, J. Li, L. M. Zhou and Y. X. Liu, *J. Mater. Chem.*, 2012, **22**, 5560.
[5] Y. Ma, C. Zhang, G. Ji and J. Y. Lee, *J. Mater. Chem.*, 2012, **22**, 7845.
[6] S. L. Jin, H. G. Deng, D. H. Long, X. J. Liu, L. Zhan, X. Y. Liang, W. M. Qiao and L. C. Ling, *Journal of Power Sources* 2011, **196**, 3887.
[7] J. Liu, Y. C. Zhou, F. Liu, C. P. Liu, J. B. Wang, Y. Pan and D. F. Xue, *RSC Adv.*, 2012, **2**, 2262.
[8] Y. Chen, H. Xia, L. Lu and J. M. Xue, *J. Mater. Chem.*, 2012, **22**, 5006.