**Fe3O4-Embedded and N-Doped Hierarchically Porous Carbon Nanospheres as High-Performance Lithium Ion Battery anodes**

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**Figure S1.** TEM images of the monodispersed, 6 nm sized Fe3O4 nanoparticles.



**Figure S2.** SEM images of Fe3O4@N-HPCNs



**Figure S3.** TEM images of N-HPCNs at different magnifications



**Figure S4.** N2 adsorption/desorption isotherms of Fe3O4@N-HPCNs and N-HPCNs



**Figure S5.** The EDS spectra of various elements for Fe3O4@N-HPCNs before (a) and after (b) the etching process.

**Table S1.** The BET surface areas, pore volumes and pore size distributions of Fe3O4@N-HPCNs and N-HPCNs.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Samples** | **Specific surface area (m2 g-1)** | **t-Plot micropore area**  **(m2 g-1)** | **Pore volume**  **(cm3 g-1)** | **Pore size (nm)** |
| **Fe3O4@N-HPCNs** | 688.6 | 134.7 | 0.92 | 2.7&15.8 |
| **N-HPCNs** | 814.2 | 158.3 | 1.13 | 2.9&16.1 |



**Figure S6**. CV curves of the Fe3O4 anode.



**Figure S7**. CV curves of the N-HPCNs anode.



**Figure S8.** Cycling performance of Fe3O4@N-HPCNs 0.5 A g-1.



**Figure S9.** Cycling performances of N-HPCNs and Fe3O4 at 1 A g-1.

**Table S2.** Impedance Parameter Values Obtained by the Fitting of the Nyquist Plots in Figure 7b.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Samples** | **Re (Ω)** | **Rct (Ω)** | **CPE (μF)** | **Zw (Ω)** |
| **Before cycling** | 1.676 | 90.34 | 14.93 | 30.45 |
| **20th cycle** | 6.863 | 178.83 | 86.64 | 67.09 |
| **100th cycle** | 2.918 | 98.53 | 227 | 11.51 |



**Figure S10.** TEM image of the Fe3O4@N-HPCNs anode after 250 cycles.

**Table S3.** Comparison of the performances and Fe3O4 contents of various Fe3O4-based materials for LIBs reported in the literatures.

|  |  |  |  |
| --- | --- | --- | --- |
| **Fe3O4-based materials** | **Capacity (mAh g-1) at different current density** | **Fe3O4 content**  **(wt%)** | **Ref.** |
| **Fe3O4@ N-HPCNs** | ~1240 (100 cycles) at 0.1 A g-1  ~581 (400 cycles) at 1 A g-1 | ~20.12 | This work |
| **Hollow N-doped Fe3O4/Carbon Nanocages** | ~700 (100 cycles) at 0.2 A g-1 | ~70.13 | [1] |
| **Fe3O4@C Nanoparticles** | ~800 (100 cycles) at 0.1 A g-1  ~530 (350 cycles) at 1 A g-1 | ~89.1 | [2] |
| **Fe3O4@C yolk-shelled Nanocubes** | ~1100 (50 cycles) at 0.1 A g-1 | ~92.48 | [3] |
| **G- Fe3O4-GNRs** | ~787 (55 cycles) at 0.1 A g-1 | ~60 | [4] |
| **Sandwich-Structured Graphene- Fe3O4@C** | ~1200 (150 cycles) at 0.1 A g-1 | ~73.5 | [5] |
| **3D Fe3O4/macroporous Graphene** | ~712 (180 cycles) at 0.1 A g-1 | ~56.8 | [6] |
| **Fe3O4/N-doped Carbon/Nitrogen-doped Graphene** | ~905 (100 cycles) at 0.2 A g-1 | ~58.3 | [7] |
| **Fe3O4@C Nanoparticles** | ~1290(200 cycles) at 0.1 A g-1  ~520 (200 cycles) at 1 A g-1 | ~30 | [8] |
| **Fe3O4@PPy Nanocages** | ~950 (100 cycles) at 0.2 A g-1 | ~88.7 | [9] |
| **Fe3O4-Fe @ Bamboo-like Carbon Nanotubes** | ~764 (100 cycles) at 0.3 A g-1 | ~34 | [10] |
| **Fe3O4/C Composite** | ~1300 (100 cycles) at 0.1 A g-1 | ~67 | [11] |

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