α-Fe$_2$O$_3$ submicron spheres with hollow and macroporous structures as high-performance anode materials for lithium ion batteries

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Figure S1. SEM images of (a and b) LPS and (c and d) semi-IPN PS microspheres at low and high magnification.
Figure S2. SEM images at low and high magnification of semi-IPN PS microspheres prepared by sulfonation with different reaction time: (a and b) 24h; (c and d) 30h and (e and f) 36h. All sulfonation temperature was fixed at 50°C.
Figure S3. SEM and cross-sectional images of Fe metal precursor/SPS composite microspheres using SPS microspheres prepared by sulfonation with different reaction time: (a and b) 24h; (c and d) 30h and (e and f) 36h.
Figure S4. TGA curves of SPS microspheres prepared by sulfonation with different reaction time: (black line) 24h, (red line) 30h and (blue line) 36h.
Figure S5. The pore size distribution by BJH method of the (a) hollow and (b) macroporous $\alpha$-Fe$_3$O$_3$ submicron spheres and their (insets) the nitrogen sorption isotherms by BET method.
Figure S6. Particle size distribution of (black line) hollow, (red line) hollow with thick shell and (blue line) macroporous α-Fe₂O₃ submicron spheres measured by Zetasizer nano ZS of Malvern instruments.
Figure S7. EDX profiles of heat-treated $\alpha$-Fe$_2$O$_3$ submicron spheres using SPS microspheres prepared by sulfonation with reaction time for 36 h.
Figure S8. Cross-sectional images of two types of composite electrodes containing (a, c and e) hollow and (b, d and f) macroporous $\alpha$-Fe$_2$O$_3$ submicron spheres (a and b) before cycling and (c and d) lithiated- and (e and f) de-lithiated electrodes at 10$^{th}$ cycle.
Figure S9. XRD patterns of (a and c) lithiated and (b and d) macroporous $\alpha$-Fe$_2$O$_3$ submicron spheres at 10$^{th}$ cycle.