Supporting Information

Construction of 3D carbon networks with well-dispersed SiO_\text{x} nanodomains from gelable building blocks for lithium-ion batteries

Zhitaoc Lu, Ruliang Liu, Junlong Huang, Zirun Chen, Luyi Chen, Dingcai Wu, Ruowen Fu*

Materials Science Institute, PCFM Lab and GDHPPC Lab, School of Chemistry, Sun Yat-sen University, Guangzhou 510275, P. R. China.
E-mail: cesfrw@mail.sysu.edu.cn
Fig. S1 Schematic representation of the process of introduction of Br-containing surface ATRP initiation sites for CNT.

Fig. S2 TGA curves of CNT-NH$_2$ and CNT-Br in N$_2$ flow.
Fig. S3 TEM images of CNT-g-xPTEPM.

Fig. S4 TGA curves of CNT-g-xPTEPM and xPTEPM in O$_2$ flow.

Fig. S5 High-resolution TEM image of CNT@SiO$_x$-C.
**Fig. S6** SEM images of CNT-g-xPTEPM with different polymerization time of (a) 12 h, (b) 24 h, (c) 48 h and CNT@SiO$_x$-C with different polymerization time of (d) 12 h, (e) 24 h, (f) 48 h, respectively.

**Fig. S7** TGA curves of synthesized CNT@SiO$_x$-C with different polymerization time.
**Fig. S8** Cyclic voltammograms of a half-cell composed of (a) SiO$_x$-C and (b) CNT vs. Li/Li$^+$ at a scan rate of 0.5 mV s$^{-1}$ during the first 3 cycles.

**Fig. S9** TGA curves of CNT@SiO$_x$-C and SiO$_x$-C in O$_2$ flow.
Fig. S10 SEM images of (a) xPTEPM and (b) SiOₓ-C.

Fig. S11 SEM images of CNT@SiOₓ-C electrode (a) before cycling and (b) after 50 cycles.

Fig. S12 Cycling performance of CNT@SiOₓ-C at the current of 1 A g⁻¹.
Fig. S13 Nyquist plots of CNT@SiO$_x$-C, SiO$_x$-C and CNT after different cycles in the frequency range between 100 kHz and 0.01 Hz.

Fig. S14 (a) Cycling performance and (b) rate performance of CNT@SiO$_x$-C with different polymerization time in synthesis.
## Supplementary Table 1. Electrochemical performance comparison of SiOx/C-based anode in high-energy rechargeable lithium battery reported by different research groups.

| Materials                          | Content of SiOx (%) | Current density (mA g\(^{-1}\)) | Initial discharge capacity (mAh g\(^{-1}\)) | Reversible capacity (mAh g\(^{-1}\)) | Cycling number | Capacity retention (%) | References |
|------------------------------------|---------------------|----------------------------------|---------------------------------------------|----------------------------------------|----------------|------------------------|------------|
| CNT@SiO\(_x\)-C                   | 10.0                | 0.2                              | 1307                                        | 631                                    | 150            | 48.3                   | This work  |
|                                   |                     | 0.5                              | 813                                         | 467                                    | 400            | 89                     |            |
|                                   |                     | 1                                | 805.5                                       | 509                                    | 200            | 63.2                   |            |
|                                   |                     |                                  |                                             | 258                                    | 400            | 54                     |            |
| SiO\(_x\)/C                       | 30.0                | 0.065                            | \(~780\)                                    | 645                                    | 500            | 82.7                   | 1          |
| SiO\(_x\)/C/CNTs                  | 67.8                | 1                                | \(~450\)                                    | 315.7                                  | 1000           | 70.2                   | 2          |
|                                   |                     | 0.05                             | 1267.2                                      | 826.1                                  | 100            | 65.2                   |            |
| MPSiO\(_x\)@rGO                   | 91.4                | 0.1                              | 3765                                        | 580                                    | 200            | 15.4                   | 3          |
| C/SiO\(_x\)                       | 15                  | 0.2                              | 383                                         | 290                                    | 100            | 75.7                   | 4          |
| SiO\(_x\)/C/G                     | 80.5                | 0.2                              | 601                                         | 541                                    | 600            | 90.0                   | 5          |
| SiO/G/CNTs                        | /                   | 0.23                             | 790                                         | 487                                    | 130            | 61.6                   | 6          |
| SiO\(_x\)/C                       | 61.6                | 0.1                              | \(~990\)                                    | 563                                    | 400            | 56.9                   | 7          |
|                                   |                     | 0.05                             | 1160                                        | 630                                    | 150            | 54.3                   |            |
| SiO\(_x\)-C                       | /                   | 0.1                              | \(~1210\)                                   | 674.8                                  | 100            | 55.8                   | 8          |
|                                   |                     | 0.5                              | \(~1060\)                                   | 485                                    | 100            | 45.8                   |            |
| MWCNT@Si/SiO\(_x\)@C              | 55                  | 0.4                              | 1011                                        | 450                                    | 500            | 44.5                   | 9          |
| SiO\(_x\)/C-2                     | 98.8                | 0.1                              | 1296.3                                      | 843.5                                  | 200            | 65.1                   | 10         |
| SiO\(_x\)/C                       | 68.6                | 0.1                              | 2223.6                                      | 800                                    | 50             | 36.0                   | 11         |
| SiO\(_x\)/C nanorods              | /                   | 0.1                              | 1324                                        | 720                                    | 350            | 54.4                   | 12         |
| S-1300                             | 73.8                | 0.1                              | \(~960\)                                    | 810                                    | 100            | 84.4                   | 13         |
| SiO\(_x\)/C                       | /                   | 0.1                              | \(~1380\)                                   | 780                                    | 350            | 56.5                   | 14         |
| SiO\(_x\)                         | 100                 | 0.5                              | \(~850\)                                    | \(~640\)                               | 50             | 75.3                   | 15         |
|                                   |                     | 0.2                              | \(~1150\)                                   | \(~700\)                               | 50             | 60.9                   |            |
|                                   |                     | 0.1                              | \(~1290\)                                   | \(~855\)                               | 50             | 66.3                   |            |
| SiO\(_x\)/SiO\(_y\) Bilayer      | 100                 | 0.5                              | \(~2300\)                                   | \(~570\)                               | 150            | \(~24.8\)               | 16         |
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