Supporting Information

Constructing Porous TiO_2 Crystal by an Etching Process for Long-Life Lithium Ion Batteries

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Figure S1. Structure of SrTiO_3.

Figure S2. (a) Element mapping and the SEM of the porous crystalline TiO_2. (b) XPS of the porous crystalline TiO_2.
Figure S3. (a) Pore distribution statistics of the porous crystalline TiO$_2$ calculated from HRTEM images. (b) Pore distribution of the porous crystalline TiO$_2$ using BHJ method from nitrogen adsorption-desorption experiment.

Figure S4. Pore distribution of TiO$_2$-500.

Figure S5. XRD patterns of TiO$_2$ porous crystals annealed in different temperatures in Ar atmosphere (TiO$_2$-400, TiO$_2$-500, TiO$_2$-600, TiO$_2$-700 and TiO$_2$-800).
**Figure S6.** EPR spectra of TiO$_2$ porous crystals and TiO$_2$-400, TiO$_2$-500, TiO$_2$-600, TiO$_2$-700 and TiO$_2$-800.

**Figure S7.** Digital photographs of TiO$_2$ porous crystals and TiO$_2$-500.

**Figure S8.** O 1s spectrum of TiO$_2$ porous crystals.
Figure S9. Rate capabilities of TiO$_2$-400, 500, 600, 700 and 800 anodes at various current densities with the potential window of 0.01–3 V.

Figure S10. (a) Cyclic voltammetry of TiO$_2$-500 anode with the scan rate of 0.3 mV s$^{-1}$ with the potential of 0.01–3 V. (b) Rate charging/discharging curves of TiO$_2$-500 between 0.01 and 3 V. (c) Cyclic voltammetry of TiO$_2$-700 anode with the scan rate of 0.3 mV s$^{-1}$ with the potential of 1–3 V. (d) Rate charging/discharging curves of TiO$_2$-700 between 1 and 3 V.
Figure S11. Cyclic voltammetry of TiO$_2$-400, 600, 800 anodes with the scan rate of 0.3 mV s$^{-1}$ with the potential of 0.01–3 V.

Figure S12. Comparison of second CV curves with the potential of 0.01–3 V.
Figure S13. The detailed cycling performance of TiO$_2$-500 within 0.01–3 V at high rate of (a) 12 C, (b) 30 C and (c) 60 C.

Figure S14. The TEM and SAED of TiO$_2$-500 electrode at 60 C after 30000 cycles.
**Figure S15.** (a) Rate capability of TiO$_2$-400, 500, 600, 700 and 800 anodes at various current densities with the potential window of 1–3 V.

**Figure S16.** (a) Cyclic voltammetry of TiO$_2$-700 with the scan rate of 0.3 mV s$^{-1}$ with the potential of 1–3 V. (b) Galvanostatic charging/discharging curves of TiO$_2$-700 at 0.6 C between 1 and 3 V. (c) Cyclic voltammetry of TiO$_2$-500 with the scan rate of 0.3 mV s$^{-1}$ with the potential of 1–3 V. (d) Galvanostatic charging/discharging curves of TiO$_2$-500 at 0.6 C between 1 and 3 V.
Figure S17. (a) Cyclic voltammetry of TiO$_2$-500 anode with the scan rate from 0.1 to 20 mV s$^{-1}$ with the potential of 1–3 V. (b) The fitting of peak current (I) with scan rate ($v$) as followed: $I(v)=av^b$ in TiO$_2$-500 anode with a cut-off potential of 1 V.

Figure S18. Galvanostatic charging/discharging 1$^{\text{st}}$ and 5$^{\text{th}}$ curves of TiO$_2$-400, 500, 600, 700 and 800 anodes at 0.6 C with the potential of 0.01–3 V.
Figure S19. The comparison of galvanostatic charging/discharging curves of TiO$_2$-700 at different potential window.

Table S1. BET surface areas and the main pore size distributions of TiO$_2$ samples.

<table>
<thead>
<tr>
<th>Sample</th>
<th>BET surface area (m$^2$ g$^{-1}$)</th>
<th>Peak of pore distribution (nm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pristine TiO$_2$</td>
<td>316</td>
<td>2-3</td>
</tr>
<tr>
<td>TiO$_2$-400</td>
<td>203</td>
<td>2-4</td>
</tr>
<tr>
<td>TiO$_2$-500</td>
<td>127</td>
<td>2-4</td>
</tr>
<tr>
<td>TiO$_2$-600</td>
<td>41</td>
<td>10-20</td>
</tr>
<tr>
<td>TiO$_2$-700</td>
<td>31</td>
<td>&lt; 4</td>
</tr>
<tr>
<td>TiO$_2$-800</td>
<td>23</td>
<td>-</td>
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</table>