Supporting Information

Unraveling the effect of carbon morphology evolution in hard carbons on sodium storage performance

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**Supporting Information**

**Fig. S1** SEM and TEM images of CHC-T, (a, e) CHC-700, (b, f) CHC-1100, (c, g) CHC-1300 and (d, h) CHC-1500.
Fig. S2 Interlayer distance of CHC-T, (a) CHC-700, (b) CHC-1100, (c) CHC-1300 and (d) CHC-1500.
Fig. S3 The proportion of highly disordered domains, pseudo-graphitic domains and graphite-like domains for CHC-T.

Fig. S4 (a) N$_2$ adsorption–desorption isotherms, (b) pore size distribution curves.

Fig. S5 High-resolution C 1s, O 1s and N 1s XPS spectra of (a-c) CHC-700 and (d-f) CHC-1100.
**Supporting Information**

**Fig. S6** Electron configurations for pyridinic N, pyrrolic N, and graphitic N.

**Fig. S7** Rate performance images of (a) CHC-700, (b) CHC-1100, (c) CHC-1300 and (d) CHC-1500.

**Fig. S8** Electrochemical performance images of (a) CHC-900, (b) CHC-1200 and (c) CHC-1400.
Fig. S9 Comparison of rate capability between CHC-1300 and ever reported carbon anode materials in literatures.

Fig. S10 CV curves at different scan rates, (a) CHC-700, (b) CHC-1100, (c) CHC-1300 and (d) CHC-1500.

Fig. S11 E vs. t profile for one GITT test. \( D_{Na^+} \) was predicted by the following equation:

\[
D = \frac{4}{\pi \tau} \left( \frac{n_m V_m}{s} \right)^2 \left( \frac{\Delta E_s}{\Delta E_r} \right)^2
\]

Where \( n_m \) is the amount of active substance of electrode material, \( V_m \) is the molar volume, and \( S \) represents geometric area. \( \Delta E_s \) and \( \Delta E_r \) can be obtained from the GITT curves.
Supporting Information

Table S1. Physical parameters of CHC-T from XRD

<table>
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<tr>
<th>Sample</th>
<th>$\theta$ (°)</th>
<th>$d_{(002)}$ (nm)</th>
<th>$L_a$ (nm)</th>
<th>$L_c$ (nm)</th>
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<tbody>
<tr>
<td>CHC-700</td>
<td>22.9</td>
<td>0.388</td>
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<td>CHC-1100</td>
<td>23.6</td>
<td>0.376</td>
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<td>CHC-1300</td>
<td>24.3</td>
<td>0.365</td>
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<td>CHC-1500</td>
<td>25.1</td>
<td>0.355</td>
<td>3.02</td>
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Table S2. Specific surface area and pore diameter of CHC-T from BET

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<th>Sample</th>
<th>$S_{BET}$ (m$^2$ g$^{-1}$)</th>
<th>$d_{pore}$ (nm)</th>
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<tbody>
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<td>CHC-700</td>
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<td>CHC-1100</td>
<td>9.068</td>
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<td>CHC-1300</td>
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<td>CHC-1500</td>
<td>4.490</td>
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References


