Supporting Information

Ultra-high performance and flexible polypyrrole coated CNT paper electrode for all-solid-state supercapacitors

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Keyword: polypyrrole; carbon nanotube; interfacial polymerization; flexible; supercapacitor.
Figure S1. (a-h) CV curves and GCD curves of the 210-, 260-, 310-, and 360-PPy/CNTP electrodes.
Figure S2. CV curves (a) at 5 mV s$^{-1}$ and GCD curves (b) at 1mA cm$^{-2}$ of the 210-, 260-, 310-, and 360-PPy/CNTP electrodes. (c) Nyquist plots for the different electrodes measured at frequency ranging from 100 kHz to 0.01 Hz. (d) Areal capacitance as a function of loading mass.
Figure S3. Schematic diagram of the preparation of the PPy/CNTP electrode.
Figure S4. SEM image of the 210-(a), 310-(b), and (c) 360-PPy/CNTP electrodes. TEM (d) and HRTEM (e) images of the CNTs without coated with PPy.
### Table S1. The electrical conductivity of the samples.

<table>
<thead>
<tr>
<th>Sample</th>
<th>Electrical conductivity (S/cm)</th>
<th>Thickness (μm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CNTP</td>
<td>28.35±0.10</td>
<td>103</td>
</tr>
<tr>
<td>210-PPy/CNTP</td>
<td>51.00±0.06</td>
<td>184</td>
</tr>
<tr>
<td>260-PPy/CNTP</td>
<td>55.86±0.07</td>
<td>200</td>
</tr>
<tr>
<td>310-PPy/CNTP</td>
<td>41.09±0.04</td>
<td>215</td>
</tr>
<tr>
<td>360-PPy/CNTP</td>
<td>38.23±0.11</td>
<td>247</td>
</tr>
</tbody>
</table>

### Table S2. Comparison of the electrochemical performances for conducting polymer based and carbon-based material supercapacitors in acidic solution.

<table>
<thead>
<tr>
<th>Flexible materials</th>
<th>Capacitance (mF·cm⁻²)</th>
<th>Cycling capability (cycles)</th>
<th>Ref.</th>
</tr>
</thead>
<tbody>
<tr>
<td>PPy/carbon cloth</td>
<td>136.99</td>
<td>85% after 10,000</td>
<td>1</td>
</tr>
<tr>
<td>PEDOT-graphene film</td>
<td>448</td>
<td>95% after 10000</td>
<td>2</td>
</tr>
<tr>
<td>PPy/print paper</td>
<td>420</td>
<td>75.6% after 10,000</td>
<td>3</td>
</tr>
<tr>
<td>PPy/RGO/BC electrode</td>
<td>2100</td>
<td>64.6% after 5,000</td>
<td>4</td>
</tr>
<tr>
<td>PPy-CNT film</td>
<td>~280</td>
<td>95% after 10000</td>
<td>5</td>
</tr>
<tr>
<td>Functionalized CNT film</td>
<td>150</td>
<td>90% after 10000 cycles</td>
<td>6</td>
</tr>
<tr>
<td>β-Ni(OH)₂-graphene film</td>
<td>3.3</td>
<td>100% after 2000</td>
<td>7</td>
</tr>
<tr>
<td>V₂O₅·H₂O-graphene film</td>
<td>11.7</td>
<td>95% after 2000</td>
<td>8</td>
</tr>
<tr>
<td>VOPO₄-graphene film</td>
<td>8.36</td>
<td>96% after 2000</td>
<td>9</td>
</tr>
<tr>
<td>Mo₂N-graphene paper</td>
<td>142</td>
<td>85.7% after 4000</td>
<td>10</td>
</tr>
<tr>
<td>MnO₂-graphene paper</td>
<td>897</td>
<td>78% after 3600</td>
<td>11</td>
</tr>
<tr>
<td>260-PPy/CNTP</td>
<td>8604.5</td>
<td>107% after 12,000</td>
<td>This Work</td>
</tr>
</tbody>
</table>

### Table S3. Mass of the 260-PPy/CNTP electrode before and after ultrasonic treatment.

<table>
<thead>
<tr>
<th>Sample</th>
<th>Ultrasonic time (min)</th>
<th>M (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>260-PPy/CNTP</td>
<td>0</td>
<td>22.6</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>22.6</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>22.6</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>22.6</td>
</tr>
</tbody>
</table>
Figure S5. Digital photos of the 260-PPy/CNTP electrode before and after 30 min ultrasonic treatment.

References