Synthesis and Characterization of Carbon Aerogels as Active Material for Double Layer Capacitors

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1. Synthesis of carbon aerogel

2. Electrode Fabrication

3. Supercapacitor fabrication & Test

4. Electrochemical characterization

Carbon Aerogels (CA):
- large specific area
- high electrical conductivity
- chemical stability
- wide operating temperature range [2][3]

Supercapacitors (Electrical double layer capacitor)
- most significant electrochemical storage systems
- not restricted by the electrochemical charge transfer
- high charge and discharge rates [1]

Synthesis Parameter

<table>
<thead>
<tr>
<th>CA-1</th>
<th>CA-2</th>
<th>CA-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reaction ratio</td>
<td>0.044</td>
<td>0.044</td>
</tr>
<tr>
<td>Resonant Water</td>
<td>0.74</td>
<td>0.74</td>
</tr>
<tr>
<td>Resonant Formic Acid</td>
<td>1500</td>
<td>1500</td>
</tr>
<tr>
<td>pK Control</td>
<td>5.5</td>
<td>5.5</td>
</tr>
<tr>
<td>Gelation</td>
<td>@ 80 °C 4 days</td>
<td>@ 80 °C 4 days</td>
</tr>
<tr>
<td>Drying</td>
<td>subcritical at 80°C</td>
<td>subcritical at 80°C</td>
</tr>
<tr>
<td>Carbonation</td>
<td>Pyrolysis</td>
<td>@ 1000 °C for 1 h in Ar</td>
</tr>
</tbody>
</table>

Carbonization: Pyrolysis (PC) 0.74
Electrolyte: 1 M Et4NBF4 in PC
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Morphological & Structural Properties of CA

- Superior performance in terms of specific energy (22.1 Wh·kg⁻¹)
- and power density (2.4 kW·kg⁻¹) at 2 A·g⁻¹
- Cycle durability of 87% over 10,000 cycles

Developement of carbon aerogels with bimodal mesoporous structure and 3-D networked morphology:
- more accessible active sites and
- efficient transport of electrolyte ions during electrochemical reactions

References

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