Supporting Information

Bismuth oxide nanosheets coated electrospun carbon nanofibers film: a free-standing negative electrode for flexible asymmetric supercapacitors

Lu Li\textsuperscript{a,b}, Xitian Zhang*\textsuperscript{a}, Zhiguo Zhang\textsuperscript{b}, Mingyi Zhang\textsuperscript{a}, Lujia Cong\textsuperscript{a}, Yu Pan\textsuperscript{a}, Shuangyan Lin\textsuperscript{a}.

\textsuperscript{a} Key Laboratory for Photonic and Electronic Bandgap Materials, Ministry of Education, School of Physics and Electronic Engineering, Harbin Normal University, Harbin 150025, People’s Republic of China.

\textsuperscript{b} Condensed mater science and technology institute, Harbin institute of technology, Harbin 150001, China

*Corresponding author:
E–mail: xtzhangzhang@163.com (X. T. Zhang)
**Calculation methods:**

1. **Single Electrode**

   The areal capacitance \(C_a\) of the electrode could be calculated from their CV curves and galvanostatic charge/discharge curves by the following equations.

   \[
   C_a = \frac{\int I dV}{A \cdot \nu \cdot \Delta V}
   \]

   Here \(C_a\) is areal capacitance (mF cm\(^{-1}\)), \(I\) is the response current (A), \(V\) is the potential vs. Reference electrode, \(A\) is electrode area (cm\(^2\)), \(\nu\) is the scan rate (mV s\(^{-1}\)) and \(\Delta V\) is the potential window (V).

   \[
   C_a = \frac{i \cdot \Delta t}{\Delta V}
   \]

   Here \(C_a\) is areal capacitance (mF cm\(^{-1}\)), \(i\) is the current density (mA cm\(^{-1}\)), \(\Delta t\) is the discharging time (s) and \(\Delta V\) is the potential window (V).

2. **ASC Device**

   The areal capacitance \(C_a\), specific capacitance \(C_s\), energy density \(E\) and power density \(P\) could be calculated by the following equations.

   \[
   C_a = \frac{i \cdot \Delta t}{\Delta V}
   \]

   \[
   C_s = \frac{C_a}{m}
   \]

   \[
   E = \frac{1}{2} C \cdot (\Delta V)^2
   \]

   \[
   P = \frac{E}{\Delta t}
   \]

   Here \(C_a\) is areal capacitance (mF cm\(^{-1}\)), \(i\) is the current density (mA cm\(^{-1}\)), \(\Delta t\) is the discharging time (s), \(\Delta V\) is the potential window (V), \(m\) is the total mass of active materials grown on the two electrodes per unit area.
Table S1. Experimental conditions and chemical component of the prepared samples.

<table>
<thead>
<tr>
<th>Sample</th>
<th>Time (h)</th>
<th>Temperature (°C)</th>
<th>Precursors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Ethylene glycol (mL)</td>
</tr>
<tr>
<td>Bi₂O₃/ESCNF-0.5</td>
<td>6</td>
<td>160</td>
<td>6</td>
</tr>
<tr>
<td>Bi₂O₃/ESCNF-1</td>
<td>6</td>
<td>160</td>
<td>6</td>
</tr>
<tr>
<td>Bi₂O₃/ESCNF-2</td>
<td>6</td>
<td>160</td>
<td>6</td>
</tr>
</tbody>
</table>
Table S2. Electrical conductivity of the aqueous electrolytes used in electrochemical experiments.

<table>
<thead>
<tr>
<th>Electrolyte</th>
<th>Conductivity (mS cm(^{-1}))</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 M KOH</td>
<td>191</td>
</tr>
<tr>
<td>1 M NaOH</td>
<td>141</td>
</tr>
<tr>
<td>1 M LiOH</td>
<td>90</td>
</tr>
<tr>
<td>1 M Na(_2)SO(_4)</td>
<td>87</td>
</tr>
</tbody>
</table>
Fig. S1. TGA curves of bare ESCNF substrate and Bi$_2$O$_3$ nanosheets grown on ESCNF substrate.
Fig. S2. Nitrogen adsorption and desorption isotherms of ESCNF@Bi₂O₃-1. Inset is the corresponding pore size distribution. The specific surface area is determined to be about 75.3 m² g⁻¹ by Brunauer-Emmett-Teller (BET) analysis.
Fig. S3. CV curves at various scan rates in 1 M KOH of (a) ESCNF, (b) ESCNF@Bi$_2$O$_3$-0.5, (c) ESCNF@Bi$_2$O$_3$-1, (d) ESCNF@Bi$_2$O$_3$-2, (e) CV curves of samples at a scan rate of 10 mV s$^{-1}$, GCD curves at different current densities in 1 M KOH of (f) ESCNF, (g) ESCNF@Bi$_2$O$_3$-0.5, (h) ESCNF@Bi$_2$O$_3$-2.
Fig. S4. (a) XRD patterns of the CF@NiCo$_2$O$_4$ and CF substrate. (b) The SEM images of the CF@NiCo$_2$O$_4$. (c) TEM and (d) HRTEM image of the CF@NiCo$_2$O$_4$. 
Fig. S5. (a) CV curves of CF@NiCo$_2$O$_4$ composite electrodes at different scan rates. (b) GCD curves of CF@NiCo$_2$O$_4$ composite electrodes at different current densities. (c) Areal capacitance calculated from GCD curves. (d) Cycling stability at a scan rate of 50 mV s$^{-1}$. 
Fig. S6. (a) Areal and specific capacitance as a function of current density. (b) Areal energy and power of the ASC.