**MnO₂ Ultralong Nanowires with Better Electrical Conductivity and Enhanced Supercapacitor Performances**

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**Part I: Experimental**

All the reagents used in the experiments were analytical grade (purchased from Sinopharm) and used without further purification. In a typical synthesis, 0.05g of polyvinylpyrrolidone (PVP) and 40 mL of 0.015 M KMnO₄ aqueous solution were mixed with vigorously magnetic stirring and then transferred into a 50 mL Teflon cup. A Teflon lined autoclave was sealed and maintained at 160 °C for 10 h and then naturally cooled down to room temperature. The precipitates were collected by filtration, washed several times with distilled water and absolute ethanol, successively, and then dried at 60 °C for 8 h. Finally, MnO₂ ultralong nanowires were obtained after calcined at 300 °C for 10 h. For a comparison, MnO₂ nanoflowers and nanorods were also synthesized simply by changing the surfactant while keeping other parameters constant.

As-prepared MnO₂ products were characterized with D/max-2550 PC X-ray diffractometer (XRD; Rigaku, Cu-Kα radiation) at a scan rate of 2 °C min⁻¹, scanning electron microscopy (SEM; HITACHI, S-4800) and transmission electron microscopy (TEM; JEOL, JEM-2100F) equipped with a x-ray energy-dispersive spectrometer (EDS). Electrochemical performances of the as-obtained products were performed on an Autolab (PGSTAT302N potentiostat) using a three-electrode mode.
a 0.5 M Na$_2$SO$_4$ solution. Working electrodes were prepared by mixing the as-synthesized MnO$_2$ products (80 wt%) with acetylene black (15 wt%), and poly(tetrafluoroethylene) (5 wt%). A small amount of N-methylpyrrolidinone was then added to the mixture. The mixture was then dropped onto graphite paper and dried at 80 °C overnight to remove the solvent. The reference electrode and counter electrode were saturated calomel electrode (SCE) and platinum (Pt), respectively. Standard current-voltage (C-V) curves were measured between -0.1 and 0.9 V. The specific capacitance of the electrode was calculated from the C-V curves according to the following equation, $C = \frac{Q}{(\Delta V \cdot m)}$, where $C$ (F g$^{-1}$) is the specific capacitance, $m$ (g) is the mass of the MnO$_2$ in the electrodes, $Q$ (C) is an average charge during the charging and discharging process, and $\Delta V$ (V) is the potential window. The discharge specific capacitance is calculated from the discharge curves using the following formula, $C = \frac{I \cdot \Delta t}{(\Delta V \cdot m)}$, where $I$ (A), $\Delta t$ (s), $m$ (g), and $\Delta V$ (V) are the discharge current, discharge time consumed in the potential range of $\Delta V$, mass of the active materials (or mass of the total electrode materials), and the potential windows, respectively.$^1$


**Part II: Supplementary Figures**

![Fig S1. High magnification SEM image of the MnO$_2$ ultralong NWs.](image)
**Fig S2.** TEM view of the framed area where a MnO$_2$ NR was mounted between a Pt cantilever and an Au tip.

**Fig S3.** C-V curves of MnO$_2$ ultralong NWs under different scan rates.

**Table 1** The specific capacitance of MnO$_2$ ultralong NWs under different scan rates

<table>
<thead>
<tr>
<th>Scan rate (mV/s)</th>
<th>10</th>
<th>20</th>
<th>50</th>
<th>75</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specific capacitance (F/g)</td>
<td>262.4</td>
<td>237.0</td>
<td>183.5</td>
<td>152.5</td>
<td>137.1</td>
</tr>
</tbody>
</table>
**Fig S4.** SEM image of the MnO₂ nanoflowers (a) and MnO₂ nanorods (b).