Supplementary Information

Facile Solvothermal Synthesis of CaMn$_2$O$_4$ Nanorods for Electrochemical Oxygen Reduction

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Figure S1. XRD patterns of the samples prepared at 190 °C for 36 h with different solvents.
Figure S2. XRD patterns of the samples prepared at different temperatures for 36 h with ethanol solvent.

Figure S3. XRD patterns of prepared product at 190 °C for different time with ethanol solvent.
Figure S4. Thermogravimetry (TG) curve in air for CaMn$_2$O$_4$ nanorods.

Figure S5. XRD patterns of the precursor after drying at 80 °C. The formation of calcium carbonate may be ascribed to the reaction between calcium hydroxide and carbon dioxide in the air.
Figure S6. XRD pattern (a) and TEM image (b) and corresponding particle size distribution (c) for 30 wt% Pt/C catalyst with 255 counted particles. Pt nanoparticles are well distributed with an average diameter of about 3.2 nm. (d) Cyclic voltammograms of Pt/C in Ar saturated 0.1 M KOH with a sweeping rate of 50 mV/s at room temperature. The Coulombic charge Q for hydrogen desorption was estimated in the potential region between -0.94 V and -0.59 V. The Pt electrochemical surface area (ECSA) was calculated from the equation \[ \text{ECSA} = \frac{Q}{m_P \times C} \], in which \( Q = S/v \) (S peak area, \( v \) scan rate), \( C \) is 210 \( \mu \text{C cm}^{-2} \). We note that the determined Pt/C surface area is similar to reported data.\(^{S3}\)
Figure S7. Nitrogen adsorption and desorption isotherms at 77 K for CaMn$_2$O$_4$ nanorods.

Figure S8. Rotating-disk voltammograms of CaMn$_2$O$_4$ with different amount of carbon additive in O$_2$-saturated 0.1 M KOH with a sweep rate of 2 mV s$^{-1}$ at 400 rpm.
Figure S9. CV curves of CaMn$_2$O$_4$/C (top) and Pt/C (down) on glassy carbon electrodes in O$_2$-saturated 0.1 M KOH at a scan rate of 50 mV s$^{-1}$ for the second and ninetieth cycle. Specific results are shown in the following table. It is noted that the peak potential relevant to the ORR remains almost unchanged for both catalysts while the current decay of CaMn$_2$O$_4$/C is lower that that of Pt/C. The better current retention of CaMn$_2$O$_4$/C is consistent with chronoamperometric testing (Fig. 7).

<table>
<thead>
<tr>
<th>Sample</th>
<th>Peak Potential (V)</th>
<th>Peak Current (mA)</th>
<th>Current Decay</th>
</tr>
</thead>
<tbody>
<tr>
<td>CaMn$_2$O$_4$/C 2$^{nd}$ cycle</td>
<td>-0.22</td>
<td>-0.082</td>
<td></td>
</tr>
<tr>
<td>CaMn$_2$O$_4$/C 90$^{th}$ cycle</td>
<td>-0.22</td>
<td>-0.062</td>
<td>24.3%</td>
</tr>
<tr>
<td>Pt/C 2$^{nd}$ cycle</td>
<td>-0.14</td>
<td>-0.21</td>
<td></td>
</tr>
<tr>
<td>Pt/C 90$^{th}$ cycle</td>
<td>-0.14</td>
<td>-0.14</td>
<td>33.3%</td>
</tr>
</tbody>
</table>
Supplementary References

