Electronic Supplementary Information

Superior Energy Capacity of Graphene Nanosheets for Nonaqueous Lithium-Oxygen Battery

Yongliang Li, Jiajun Wang, Xifei Li, Dongsheng Geng, Ruying Li and Xueling Sun*

Department of Mechanical and Materials Engineering, The University of Western Ontario, ON, Canada N6A 5B9

Experimental details:

Synthesis of Graphene Nanosheets (GNSs)
Graphene nanosheets (GNSs) were prepared by the oxidation of graphite powder using the modified Hummers’ method. Typically, graphite powder (1 g), sodium nitrate (0.75 g) and potassium permanganate (4.5 g) were added to concentrated sulphuric acid (37.5 mL) and stirred for 2 h in an ice water bath. Then the mixture was stirred for five days at room temperature. 100 mL of 5 wt% H2SO4 and 3 g of 30 wt% H2O2 were added into the above mixture in sequence under stirring with interval of 1 h. After stirring for 2 h, the sample was filtered and washed until the pH=7. The as-received sample was dried and heated at 1050 °C for 30 s under Ar to produce GNSs.

Physical Characterizations
The morphology and structure of GNSs were characterized by a Hitachi S-4800 field emission scanning electron microscopy (FESEM) and a Hitachi H-7000 transmission electron microscopy (TEM). N2 adsorption/desorption isotherms were obtained using a Folio Micromeritics TriStar II Surface Area and Pore Size Analyser. The XRD pattern was recorded by a Bruker-AXS D8 Discover diffractometer employing a Co-Kα source (λ=1.7892 Å).

Electrochemical Measurements
Cathode was prepared by casting a mixture of carbon materials (GNSs, BP-2000, or Vulcan XC-72), and PVDF (Alfa Aesar) with a weight ratio of 9:1 onto a separator (Celgard 3500). The electrode is 7/16 inch in diameter and the loadings were 0.3 mg. Swagelok type cells composed of lithium foil anode, Celgard 3500 separator, different cathodes and a stainless steel (SS) mesh as current collector
were used to carry out the electrochemical measurements. The electrolyte was 1 mol LiPF₆ dissolved in propylene carbonate (PC)/ethylene carbonate (EC) (1:1 weight ratio). The discharge/charge characteristics were performed by using an Arbin BT-2000 battery station in a voltage range of 2.0-4.5 V in a 1 atm oxygen atmosphere at room temperature (25 °C).

References

Table S1. Physical properties of GNSs, BP-2000, and Vulcan XC-72.

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<thead>
<tr>
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<th>GNSs</th>
<th>BP-2000</th>
<th>Vulcan XC-72</th>
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<tbody>
<tr>
<td>Surface area / m$^2$ g$^{-1}$</td>
<td>524.99</td>
<td>1401.00</td>
<td>232.79</td>
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<tr>
<td>Mesopore volume / cm$^3$ g$^{-1}$</td>
<td>1.1729</td>
<td>1.1139</td>
<td>0.2739</td>
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