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Electronic Supplementary Information

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

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Experimental details:

Synthesis of Graphene Nanosheets (GNSs)

Graphene nanosheets (GNSs) were prepared by the oxidation of graphite powder using the modified Hummers' method.¹ 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.²

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-K α source ($\lambda=1.7892$ 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

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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

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- 2 H. Schniepp, J.-L. Li, M. McAllister, H. Sai, M. Herrera-Alonso, D. Adamson, R. Prud'homme, R. Car, D. Saville, I. Aksay, *J. Phy. Chem. B*, 2006, **110**, 8535.

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

	GNSs	BP-2000	Vulcan XC-72
Surface area / $\text{m}^2 \text{g}^{-1}$	524.99	1401.00	232.79
Mesopore volume / $\text{cm}^3 \text{g}^{-1}$	1.1729	1.1139	0.2739