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Characterization of the Lithium/Oxygen Organic Electrolyte Battery

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Abstract

The effects that electrolyte and air cathode formulation have on discharge capacity, rate capability, and the rechargeability of the lithium/oxygen organic electrolyte cell were characterized. To characterize the effects of cell formulation on the discharge reaction, we used techniques including static and dynamic gas consumption measurements and scanning electron microscopy. It was found that electrolyte formulation has the largest effect on discharge capacity and rate capability. Electrode processing is also important in determining discharge capacity at low rate. The Brunauer-Emmett-Teller surface area of the carbon black used to prepare the air electrode is not a significant factor in determining discharge capacity. The discharge product was found to depend on both discharge rate and electrolyte formulation. This is understood in terms of the concentration of oxygen in the electrolyte during discharge.

Key Words

lithium oxygen secondary cells electrochemical electrodes scanning electron microscopy

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Articles citing this article

Carbon-based electrocatalysts for advanced energy conversion and storage
Sci Adv 2015 1(7): e1500564
Full Text (PDF)

Pore-Scale Transport Resolved Model Incorporating Cathode Microstructure and Peroxide Growth in Lithium-Air Batteries
J. Electrochem. Soc. 2015 162(7): A1135-A1145
Abstract Full Text Full Text (PDF)

Monitoring the Location of Cathode-Reactions in Li-O2 Batteries
J. Electrochem. Soc. 2015 162(2): A3126-A3132
Abstract Full Text Full Text (PDF)

A Modeling Study of the Pore Size Evolution in Lithium-Oxygen Battery Electrodes
J. Electrochem. Soc. 2015 162(8): A1636-A1645
Abstract Full Text Full Text (PDF)

Optimization of Catalytically Active Sites Positioning in Porous Cathodes of Lithium/Air Batteries Filled with Different Electrolytes
J. Electrochem. Soc. 2015 162(14): A2796-A2804
Abstract Full Text Full Text (PDF)

Analysis and Multi-Dimensional Modeling of Lithium-Air Batteries
J. Electrochem. Soc. 2015 162(1): A114-A124
Abstract Full Text Full Text (PDF)

Changing the Cathode Microstructure to Improve the Capacity of Li-Air Batteries: Theoretical Predictions
J. Electrochem. Soc. 2014 161(14): A2068-A2079
Abstract Full Text Full Text (PDF)

Evaluation of the Electrochemical Performance of a Lithium-Air Cell Utilizing Diethylene Glycol Diethyl Ether-Based Electrolyte
J. Electrochem. Soc. 2014 161(6): A856-A862
Abstract Full Text Full Text (PDF)

Analytical Electrochemical Impedance Modeling of Li-Air Batteries under D.C. Discharge
J. Electrochem. Soc. 2013 160(11): A2033-A2045
Abstract Full Text Full Text (PDF)

Controlled Nucleation and Growth Process of Li2S2/Li2S in Lithium-Sulfur Batteries
J. Electrochem. Soc. 2013 160(11): A1992-A1996
Abstract Full Text Full Text (PDF)

Carbon-Based Electrodes for Lithium Air Batteries: Scientific and Technological Challenges from a Modeling Perspective
ECS J. Solid State Sci. Technol. 2013 2(10): M3084-M3100
Abstract Full Text Full Text (PDF)

A High-Rate Rechargeable Li-Air Flow Battery
J. Electrochem. Soc. 2013 160(10): A1619-A1623
Abstract Full Text Full Text (PDF)

Carbon Nanofoam-Based Cathodes for Li-O2 Batteries: Correlation of Pore-Solid Architecture and Electrochemical Performance
J. Electrochem. Soc. 2013 160(9): A1510-A1516
Abstract Full Text Full Text (PDF)

A Novel On-Line Mass Spectrometer Design for the Study of Multiple Charging Cycles of a Li-O2 Battery
J. Electrochem. Soc. 2013 160(3): A471-A477
Abstract Full Text Full Text (PDF)

High Energy Density Metal-Air Batteries: A Review
J. Electrochem. Soc. 2013 160(10): A1759-A1771
Abstract Full Text Full Text (PDF)

Analysis of Air Cathode Perfomance for Lithium-Air Batteries
J. Electrochem. Soc. 2013 160(10): A1847-A1855
Abstract Full Text Full Text (PDF)

The Effect of Operation Conditions on the Performance of Lithium/Oxygen Batteries
J. Electrochem. Soc. 2012 160(1): A25-A30
Abstract Full Text Full Text (PDF)

A Flexible Framework for Modeling Multiple Solid, Liquid and Gaseous Phases in Batteries and Fuel Cells
J. Electrochem. Soc. 2012 159(9): A1528-A1542
Abstract Full Text Full Text (PDF)

A Reversible and Higher-Rate Li-O2 Battery
Science 2012 337(6094): 563-566

Abstract Full Text Full Text (PDF)

Reactivity of Electrolytes for Lithium-Oxygen Batteries with Li2O2
ECS Electrochem. Lett. 2012 1(2): A38-A42
Abstract Full Text Full Text (PDF)

Optimization of the Cathode Structure of Lithium-Air Batteries Based on a Two-Dimensional, Transient, Non-Isothermal Model
J. Electrochem. Soc. 2012 159(10): A1747-A1754
Abstract Full Text Full Text (PDF)

Modeling of Li-Air Batteries with Dual Electrolyte
J. Electrochem. Soc. 2012 159(6): A770-A780
Abstract Full Text Full Text (PDF)

The Effect of Water on the Discharge Capacity of a Non-Catalyzed Carbon Cathode for Li-O2 Batteries
Electrochem. Solid-State Lett. 2012 15(4): A45-A48
Abstract Full Text Full Text (PDF)

Oxygen Reduction by Lithium on Model Carbon and Oxidized Carbon Structures
J. Electrochem. Soc. 2011 158(10): A1177-A1184
Abstract Full Text Full Text (PDF)

Methoxybenzene as an Electrolyte Solvent for the Primary Lithium Metal Air Battery
Electrochem. Solid-State Lett. 2011 14(8): A113-A115
Abstract Full Text Full Text (PDF)

{alpha}-MnO2/Carbon Nanotube/Carbon Nanofiber Composite Catalytic Air Electrodes for Rechargeable Lithium-air Batteries
J. Electrochem. Soc. 2011 158(7): A822-A827
Abstract Full Text Full Text (PDF)

Current Collectors for Rechargeable Li-Air Batteries
J. Electrochem. Soc. 2011 158(6): A658-A663
Abstract Full Text Full Text (PDF)

Method Development to Evaluate the Oxygen Reduction Activity of High-Surface-Area Catalysts for Li-Air Batteries
Electrochem. Solid-State Lett. 2011 14(5): A70-A74
Abstract Full Text Full Text (PDF)

Stability of Li/Polymer Electrolyte-Ionic Liquid Composite/Lithium Conducting Glass Ceramics in an Aqueous Electrolyte
Electrochem. Solid-State Lett. 2011 14(4): A45-A48
Abstract Full Text Full Text (PDF)

Identifying Capacity Limitations in the Li/Oxygen Battery Using Experiments and Modeling
J. Electrochem. Soc. 2011 158(3): A343-A351
Abstract Full Text Full Text (PDF)

Electrodes for Nonaqueous Oxygen Reduction Based upon Conductive Polymer-Silver Composites
J. Electrochem. Soc. 2011 158(3): A223-A226
Abstract Full Text Full Text (PDF)

A Critical Review of Li/Air Batteries
J. Electrochem. Soc. 2011 159(2): R1-R30
Abstract Full Text Full Text (PDF)

Mesoporous {beta}-MnO2 Air Electrode Modified with Pd for Rechargeability in Lithium-Air Battery
J. Electrochem. Soc. 2011 158(12): A1483-A1489
Abstract Full Text Full Text (PDF)

The Theoretical Energy Densities of Dual-Electrolytes Rechargeable Li-Air and Li-Air Flow Batteries
J. Electrochem. Soc. 2011 158(1): A43-A46
Abstract Full Text Full Text (PDF)

Some Possible Approaches for Improving the Energy Density of Li-Air Batteries
J. Electrochem. Soc. 2010 157(12): A1287-A1295
Abstract Full Text Full Text (PDF)

Metal-Air Electrochemical Cells: Silver-Polymer-Carbon Composite Air Electrodes
Electrochem. Solid-State Lett. 2010 13(11): A162-A164
Abstract Full Text Full Text (PDF)

Pd / MnO2 Air Electrode Catalyst for Rechargeable Lithium/Air Battery
Electrochem. Solid-State Lett. 2010 13(11): A165-A167
Abstract Full Text Full Text (PDF)

High Capacity Li - O2 Cell and Electrochemical Impedance Spectroscopy Study
Electrochem. Solid-State Lett. 2010 13(9): A121-A124
Abstract Full Text Full Text (PDF)

Electrocatalytic Activity Studies of Select Metal Surfaces and Implications in Li-Air Batteries
J. Electrochem. Soc. 2010 157(9): A1016-A1025
Abstract Full Text Full Text (PDF)

Lithium-Air Batteries Using SWNT/CNF Buckypapers as Air Electrodes
J. Electrochem. Soc. 2010 157(8): A953-A956
Abstract Full Text Full Text (PDF)

High Capacity Pouch-Type Li-Air Batteries
J. Electrochem. Soc. 2010 157(7): A760-A764
Abstract Full Text Full Text (PDF)

The Influence of Catalysts on Discharge and Charge Voltages of Rechargeable Li-Oxygen Batteries
Electrochem. Solid-State Lett. 2010 13(6): A69-A72
Abstract Full Text Full Text (PDF)

Optimization of Air Electrode for Li/Air Batteries
J. Electrochem. Soc. 2010 157(4): A487-A492
Abstract Full Text Full Text (PDF)

Crown Ethers in Nonaqueous Electrolytes for Lithium/Air Batteries
Electrochem. Solid-State Lett. 2010 13(4): A48-A51
Abstract Full Text Full Text (PDF)

Hybrid Air-Electrode for Li/Air Batteries
J. Electrochem. Soc. 2010 157(3): A294-A297
Abstract Full Text Full Text (PDF)

Polarization of Oxygen Electrode in Rechargeable Lithium Oxygen Batteries
J. Electrochem. Soc. 2010 157(3): A362-A365

Abstract Full Text Full Text (PDF)

Effects of Nonaqueous Electrolytes on the Performance of Lithium/Air Batteries
J. Electrochem. Soc. 2010 157(2): A219-A224
Abstract Full Text Full Text (PDF)

Stability of a Water-Stable Lithium Metal Anode for a Lithium-Air Battery with Acetic Acid-Water Solutions
J. Electrochem. Soc. 2010 157(2): A214-A218
Abstract Full Text Full Text (PDF)

Optimization of Nonaqueous Electrolytes for Primary Lithium/Air Batteries Operated in Ambient Environment
J. Electrochem. Soc. 2009 156(10): A773-A779
Abstract Full Text Full Text (PDF)

Water-Stable Lithium Anode with the Three-Layer Construction for Aqueous Lithium-Air Secondary Batteries
Electrochem. Solid-State Lett. 2009 12(7): A132-A135
Abstract Full Text Full Text (PDF)

High-Capacity Lithium-Air Cathodes
J. Electrochem. Soc. 2009 156(1): A44-A47
Abstract Full Text Full Text (PDF)

Theoretical Energy Density of Li-Air Batteries
J. Electrochem. Soc. 2008 155(6): A432-A437
Abstract Full Text Full Text (PDF)

Li Ion Conducting Polymer Gel Electrolytes Based on Ionic Liquid/PVDF-HFP Blends
J. Electrochem. Soc. 2007 154(11): A1048-A1057
Abstract Full Text Full Text (PDF)

Ether-Based Electrolytes for the Lithium/Oxygen Organic Electrolyte Battery
J. Electrochem. Soc. 2006 153(1): A96-A100

Oxygen Transport Properties of Organic Electrolytes and Performance of Lithium/Oxygen Battery
J. Electrochem. Soc. 2003 150(10): A1351-A1356
Abstract Full Text Full Text (PDF)