

Author's Accepted Manuscript

A high-performance solid-state lithium-oxygen battery with a ceramic-carbon nanostructured electrode

Xingbao Zhu, Tianshou Zhao, Peng Tan, Zhaohuan Wei, Maochun Wu



PII: S2211-2855(16)30192-6
DOI: <http://dx.doi.org/10.1016/j.nanoen.2016.06.010>
Reference: NANOEN1328

To appear in: *Nano Energy*

Received date: 22 March 2016
Revised date: 27 May 2016
Accepted date: 7 June 2016

Cite this article as: Xingbao Zhu, Tianshou Zhao, Peng Tan, Zhaohuan Wei and Maochun Wu, A high-performance solid-state lithium-oxygen battery with a ceramic-carbon nanostructured electrode, *Nano Energy* <http://dx.doi.org/10.1016/j.nanoen.2016.06.010>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting galley proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain

A high-performance solid-state lithium-oxygen battery with a ceramic-carbon nanostructured electrode

Xingbao Zhu, Tianshou Zhao*, Peng Tan, Zhaohuan Wei, Maochun Wu

Department of Mechanical and Aerospace Engineering The Hong Kong University of Science and Technology Clear Water Bay, Kowloon, Hong Kong SAR, China

*Corresponding author. Tel.: +852 2358 8647. metzhao@ust.hk

Abstract

Ceramic lithium-oxygen batteries that use non-flammable and non-volatile electrolyte have the potential to store a large amount of energy in a relatively safe way. However, the performance of this type of battery has been extremely low due primarily to the large ohmic-resistance from a thick electrolyte and the limited triple-phase boundaries (TPBs) in conventional cathodes. In this work, we fabricate a seamless electrolyte-electrode structure by one-step sintering a rather thin $\text{Li}_{1.3}\text{Al}_{0.3}\text{Ti}_{1.7}(\text{PO}_4)_3$ (LATP) electrolyte layer (20 μm thick) onto a porous LATP substrate. A hierarchical carbon is then grown in the pores of the porous LATP, uniquely forming three-dimensional pathways for the transport of lithium-ions, electrons, and oxygen throughout the entire cathode. It is found that the cathodic TPBs are 330 times larger than those of conventional solid-state lithium-oxygen batteries. As a result, the battery is capable of operating in O_2 for over 1,174 cycles (~150 days) and for over 450 cycles (75 days) with degradation of <3% in ambient air when RuO_2 and NiO are used as the catalysts. Moreover, the charge/discharge rate reaches as high as 15 mA cm^{-2} , 2-4 orders of magnitude higher than that of conventional lithium-oxygen batteries.

Keywords: lithium-air battery, solid-state LATP, electrolyte, membrane, mechanism

Download English Version:

<https://daneshyari.com/en/article/7953499>

Download Persian Version:

<https://daneshyari.com/article/7953499>

[Daneshyari.com](https://daneshyari.com)