Porous MnNi₂O₄ Nanorods as an Efficient Bifunctional Catalyst for Rechargeable Li–O₂ battery

Jun Li^{1,2†}, Yuan Li^{3†}, Kun Guo⁴, Liangliang Zou^{1,*}, Qinghong Huang¹, Zhiqing Zou¹ and Hui Yang^{1,*}

¹ Shanghai Advanced Research Institute, Chinese Academy of Sciences (CAS), Shanghai, 201210, China

² University of the CAS, Beijing 100039, China

³ Technology Center, China Tobacco Hebei Industrial Company, Ltd., Shijiazhuang 050051, China

⁴ Department of Petroleum Engineering, University of Stavanger, 4036 Stavanger, Norway

†These authors contribute equally to this work

*E-mail: yangh@sari.ac.cn, zoull@sari.ac.cn

doi: 10.20964/110403227

Received: 17 December 2015 / Accepted: 19 January 2016 / Published: 1 March 2016

Spinel-type porous MnNi₂O₄ nanorods are prepared using a facile electrospinning and subsequent calcination approach. A MnNi₂O₄ nanoparticle material is also synthesized *via* the sol-gel method to explore the effect of surface area, pore diameter and pore volume on catalytic activity. The crystal phase and morphology of the samples are confirmed by X-ray diffractometry and transmission electron microscopy. Linear sweep voltammetry analysis shows that the MnNi₂O₄ nanorods electrode exhibits better activities in oxygen reduction and evolution reactions than the prepared MnNi₂O₄ nanoparticles or Ketjenblack electrodes. The sequenced activities of these three materials are further supported by a reduction in both the discharge and recharge overpotentials during battery tests. Furthermore, batteries with the MnNi₂O₄ nanorods present improved rate capability and cyclability compared with the MnNi₂O₄ nanoparticles and Ketjenblack. This enhanced performance is explained by the large surface area, mean pore diameter, and pore volume of the MnNi₂O₄ nanorods. These results highlight the importance of porous MnNi₂O₄ nanorods as a prospective bifunctional catalyst and a potential method of electrospinning to scale up the preparation of catalysts for rechargeable Li–O₂ batteries.

Keywords: Lithium–air batteries, Bi-functional catalyst, MnNi₂O₄, Porous nanorods

[FULL TEXT](#)

© 2016 The Authors. Published by ESG (www.electrochemsci.org). This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).