Porous MnNi$_2$O$_4$ Nanorods as an Efficient Bifunctional Catalyst for Rechargeable Li–O$_2$ battery

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Spinel-type porous MnNi$_2$O$_4$ nanorods are prepared using a facile electrospinning and subsequent calcination approach. A MnNi$_2$O$_4$ 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 MnNi$_2$O$_4$ nanorods electrode exhibits better activities in oxygen reduction and evolution reactions than the prepared MnNi$_2$O$_4$ 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 MnNi$_2$O$_4$ nanorods present improved rate capability and cyclability compared with the MnNi$_2$O$_4$ nanoparticles and Ketjenblack. This enhanced performance is explained by the large surface area, mean pore diameter, and pore volume of the MnNi$_2$O$_4$ nanorods. These results highlight the importance of porous MnNi$_2$O$_4$ nanorods as a prospective bifunctional catalyst and a potential method of electrospinning to scale up the preparation of catalysts for rechargeable Li–O$_2$ batteries.

Keywords: Lithium–air batteries, Bi-functional catalyst, MnNi$_2$O$_4$, Porous nanorods

FULL TEXT

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