NiFe₂O₄-Coated Activated Carbon Composite as a Cathode Material for Lithium–Sulfur Batteries

Riguang Cheng, Lixian Sun*, Fen Xu*, Yumei Luo, Chenchen Zhang, Yongpeng Xia, Sheng Wei, Yanxun Guan, Mengmeng Zhao, Qi Lin, Hao Li

Guangxi Key Laboratory of Information Materials, Guangxi Collaborative Innovation Center of Structure and Property for New Energy and Materials, School of Material Science and Engineering, Guilin University of Electronic Technology, Guilin, 541004, P. R. China

*E-mail: sunlx@guet.edu.cn, xufen@guet.edu.cn or 1732211579@qq.com

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Lithium–sulfur batteries are promising as next-generation rechargeable energy-storage devices because of their high energy density, low cost, and environmental friendliness. However, sulfur cathodes suffer from low specific capacity caused by the poor electrical conductivities of the active materials and fast capacity decay resulting from polysulfide dissolution/shuttling. Herein, we report a facile and low-cost method to solve these problems using an activated carbon (AC)–NiFe₂O₄/S hybrid material in which NiFe₂O₄ is uniformly distributed on AC through a simple wet impregnation method. The AC–NiFe₂O₄/S material not only has a strong catalytic effect on sulfur reduction, but also provides strong binding sites to trap polysulfide intermediates. An AC–NiFe₂O₄/S electrode shows favorable electrochemical properties including stable reversible capacity (0.24% capacity decay per cycle at 0.1 C, retaining a capacity of 602.7 mAh g^{−1} after 170 cycles; stable cycling at 0.5 C, retaining a capacity of 501.9 mAh g^{−1} after 100 cycles), excellent rate performance, and fast electrochemical reaction kinetics compared with those of a reference AC/S electrode, which are attributed to the synergistic effects between NiFe₂O₄ and AC.

Keywords: lithium–sulfur batteries; activated carbon; NiFe₂O₄

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