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A novel P-doped MnCo₂S₄ nanoneedles assembled dandelion-like structure for high performance hybrid supercapacitors

Hong Jia^{a*}, Yingying Song^a, Jie Wu^a, Wenwen Fu^a, Jianguo Zhao^a, Xianming Liu^{a*}

^aHenan Key Laboratory of Electromagnetic Transformation and Detection, Luoyang Normal University, Luoyang 471934, China.

E-mail: jiahong517@aliyun.com

Abstract

A novel electrode material based on P-doped dandelion-like MnCo₂S₄ spheres was fabricated and examined for application in electrochemical supercapacitors. The unique structure made up of nanoneedles endows high electrical conductivity and large accessible ion-diffusion surface area. When used as the electrode, the P-doped MnCo₂S₄ nanostructures give an improved specific capacity of 543.3 F g⁻¹. A supercapacitor employing the P-MnCo₂S₄ and active carbon as the electrodes shows a high energy density of 20.8 W h kg⁻¹ at a power density of 400 W kg⁻¹, and an excellent cycling stability of 91.1% retention after 5000 cycles. As a proof-of-concept demonstration, we show that the as-made supercapacitor is able to drive three LEDs.

Key words: P-doped MnCo₂S₄, hierarchical, dandelion-like, supercapacitor

1. Introduction

Supercapacitor, holding the high energy density and outstanding cycling stability, has attracted great attention in hybrid electric vehicles and portable electronic devices. But its lower energy density compared with that of rechargeable batteries limit the applications of supercapacitors.[1,2] Therefore, there has been a constant search for

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