A Simple Synthesis of Porous Titanium Dioxide Nanofibres with a Large Specific Surface Area by Electrospinning as High-Performance Anode Materials for Lithium-Ion Batteries

Manman Xia, Jun Li*, Ruyan Lei, Baige Yuan, Ying Zhang, Peng Zhao and Xiao Li

School of Materials Engineering, Shanghai University of Engineering Science, Shanghai 201620, China

*E-mail: jacob_lijun@sues.edu.cn

doi: 10.20964/2021.04.55

Received: 18 December 2020 / Accepted: 29 January 2021 / Published: 28 February 2021

Anatase titanium dioxide is considered a promising anode material for lithium-ion batteries (LIBs), however its application is restricted due to the poor Li^+ transport. Nano-crystallization and pore creation are regarded as two effective strategies for solving the above shortcomings. This study aims to realize the combination of the two strategies by synthesizing porous anatase TiO_2 nanofibres by electrospinning with camphene as the pore-creating agent. Porous anatase TiO_2 nanofibres as anode materials for LIBs demonstrated excellent electrochemical performance when a suitable content of camphene was added. The results indicated that a larger specific surface area ($72 \text{ m}^2 \cdot \text{g}^{-1}$) was obtained in anatase TiO_2 nanofibres with 12 wt.% camphene than in those without camphene ($61 \text{ m}^2 \cdot \text{g}^{-1}$). The former exhibited a higher initial discharge specific capacity ($518.71/294.99 \text{ mAh} \cdot \text{g}^{-1}$) than the latter ($305.56/114.68 \text{ mAh} \cdot \text{g}^{-1}$). Moreover, the former demonstrated outstanding cycle performance due to the higher retention rate of 21.7% obtained after 100 cycles. Meanwhile, an excellent rate performance was also achieved due to a larger average discharging specific capacity ($58.96 \text{ mAh} \cdot \text{g}^{-1}$) being when the current density increased from 0.5 C to 10 C and recovered to 0.5 C ($145.71 \text{ mAh} \cdot \text{g}^{-1}$). The improvement in electrochemical performance should be attributed to the low charge transfer resistance (R_{ct}) and large transportation rate of Li^+ resulting from the obtained high specific surface area.

Keywords: Electrospinning, porous anatase titanium dioxide, Camphene, Lithium-ion battery anode

[FULL TEXT](#)

© 2021 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/>).