Electrospun TiO_2 Nanofiber Electrode with Optimized Diameters for Lithium Ion Battery

Yanhua Cui[a], Ke Sun[b], Qian Sun[b], Xiaojiang Liu[a], Zhengwen Fu[b]

[a] *Institute of Electronic Engineering, China Academy of Engineering Physics, 64 Mianshan Road, Mianyang, Sichuan, China,621900*

[b] *Department of Chemistry and Laser Chemistry Institute, Shanghai Key Laboratory of Molecular Catalysts and Innovative Materials, Fudan University, Shanghai, China, 200433*

In recent years there has been the realization that improved battery performance can be achieved by reconfiguring the electrode materials currently employed in 2D batteries into 3D architectures. In a typical three dimensions (3D) battery design, a 3D-array electrode is composed of parallel nanotubes that are perpendicular to the substrates. These nanotubes can also be approximately considered as circular cylinder. Apparently, our works suggest that it is very important to design the suitable size of circular cylinder for three-dimension (3D)-array electrodes.

In this work, the TiO_2 nanofibers with four different diameters are fabricated by electrospinning method with simple control of the concentration of the precursors. The electrochemical performance and the relationship with their diameters are revealed. The cycling stability of TiO_2 nanofiber electrode with the diameter around 250 nm under high current density is the best in TiO_2 nanofiber electrodes with the diameters around 100 nm, 400 nm, and 500 nm. The chemical diffusion coefficients corresponding to lithium insertion and extraction processes are estimated to be 3.067×10^{-13} cm^2 s^{-1} and 4.128×10^{-13} cm^2 s^{-1} in TiO_2 nanofiber electrode with the diameter around 250 nm, respectively.

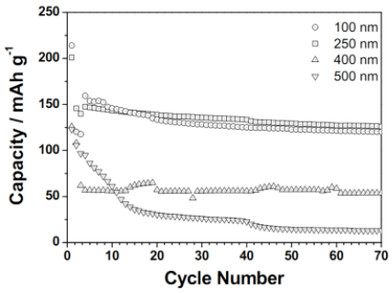

Fig.1 The cycling performance of 3d TiO_2 nanofiber electrodes with different diameters

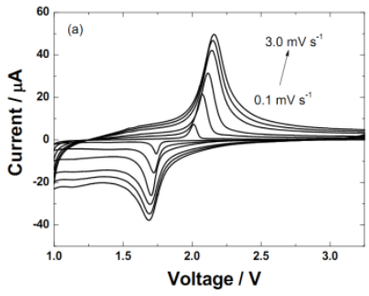

Fig.2 CV measurements for Li/TiO_2 nanofiber cell with the diameter around 250 nm

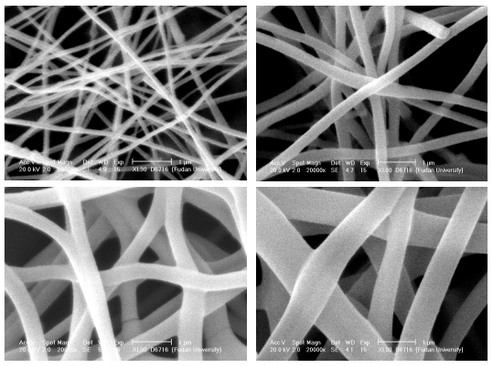

Fig.3 The SEM image of TiO_2 nanofibers with different diameters(a)100nm;(b)250nm;(c)400nm;(5)500nm

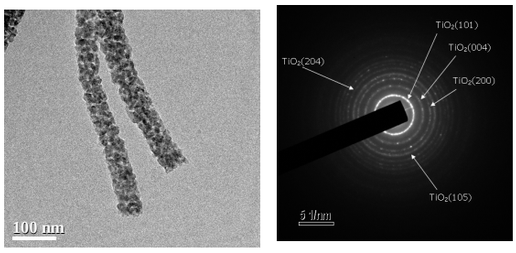

Fig.4 HRTEM image and SAED pattern of TiO_2 nanofiber

Acknowledgements

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