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Author: Tao Peng Chang Liu Xiaoyi Hou Zongwen Zhang
Chunlei Wang Hailong Yan Yang Lu Xianming Liu Yongsong
Luo



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Control Growth of Mesoporous Nickel Tungstate Nanofiber and Its Application as Anode Material for Lithium-Ion Batteries

Tao Peng,^{a,b} Chang Liu,^{a,b} Xiaoyi Hou,^{a,b} Zongwen Zhang,^c Chunlei Wang,^{a,b} Hailong Yan,^{a,b} Yang Lu,^{a,b} Xianming Liu,^d Yongsong Luo^{*a,b}

^aSchool of Physics and Electronic Engineering, Xinyang Normal University, Xinyang 464000, P. R. China.

^bKey Laboratory of Advanced Micro/Nano Functional Materials, Xinyang Normal University, Xinyang 464000, P. R. China.

^cInstrumental Analysis and Research Center, Xinyang Normal University, Xinyang 464000, P. R. China

^dCollege of Chemistry and Chemical Engineering, Luoyang Normal University, Luoyang 471022, P. R. China.

Email: ysluo@xynu.edu.cn

ABSTRACT

Achieving a control over the growth of one-dimensional nanomaterial is significant for the study of energy storage material and device. In the present work, nickel tungstate (NiWO₄) nanofiber was synthesized by electrospinning technique combined with subsequent annealing treatment. The obtained NiWO₄ nanofiber is found to be highly crystalline and possesses a diameter of about 180 nm and a length of several millimeters. The influence of severe-annealing treatment on the structure and the electrochemical performance is studied and found that the temperature of annealing is a crucial factor in the crystalline phase, purity, structure and morphology. The impurities in the product of electrospinning disappeared, when the annealing temperature is raised from 650 to 670 °C, and a pure phase of mesoporous NiWO₄ nanofiber is obtained. However, for the temperature raising from 670 to 700 °C, the crystalline grains of the nanofiber grew and merged rapidly, as the mesoporous structure is disappeared. The lithium-ion battery furnished by the NiWO₄ nanofiber annealed at 700 °C as anode material, shows a moderate performance, while the battery provided by NiWO₄ nanofiber annealed at 670 °C exhibits an excellent lithium storage performance with high initial coulombic efficiency, high specific capacity, good cycle performance and rate performance. The initial coulombic efficiency could reach as high as 77.1%. A high reversible capacity of 514 mAh g⁻¹ at a current density of 100 mA g⁻¹ is achieved after 100

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