2010

The comparison between nanostructure control and other modifications to improve the electrochemical performance of SnO

Yong-Mook Kang
Kongju National University

Min-Sik Park
msp532@uow.edu.au

Hua-Kun Liu
University of Wollongong, hua@uow.edu.au

S. X. Dou
University of Wollongong, shi@uow.edu.au

http://ro.uow.edu.au/engpapers/5003

Publication Details

Kang, Y., Park, M., Liu, H. K. & Dou, S. Xue. (2010). Comparison between nanostructure control and other modifications to improve the electrochemical performance of SnO_2. 239th ACS National Meeting and Exposition (p. 1).

The comparison between nanostructure control and other modifications to improve the electrochemical performance of SnO_2

Yong-Mook Kang[a,*], Min-Sik Park[b], Hua-Kun Liu[b], Shi-Xue Dou[b]

[a] Division of Advanced Materials Engineering, Kongju National University, 275 Budae-dong, Cheonan, Chungnam, Republic of Korea
[b] Institute for Superconducting and Electronic Materials and ARC Centre of Excellence for Electromaterials Science, University of Wollongong, NSW 2522, Australia

[*] Corresponding author (Prof. Yong-Mook Kang.) Tel: +82-16-257-9051. Fax: +82-41-568-5776. E-mail: dake@kaist.ac.kr.

With an advent of the ubiquitous era, the demand for rechargeable batteries with a higher energy density is getting more and more critical. It is because applications are emerging such as electric vehicles and various types of portable electronic devices. Carbonaceous materials are commonly adopted as the anode material for commercial lithium-ion secondary batteries because it can reversibly intercalate or de-intercalate Li ion. However, low capacity of carbon (theoretical capacity: 372 $mAh\bullet g^{-1}$) has become a limiting factor in wider applications, and high capacity alternative to carbonaceous material has thus been sought for. Even if tin and silicon have been considered as one of the most attractive options for high energy density purpose, its poor cyclic properties have been delaying its commercialization.

In this presentation, novel synthetic ways using nano-science will be introduced. Massive SnO_2 nanowires with tetragonal rutile structure have been successfully synthesized by a thermal evaporation method without traditional metal catalysts. The enhanced electrochemical performances of SnO_2 nanowires resulted from the combination of unique nanostructures with high length to diameter ratio and the absence of traditional metal catalysts. The electrochemical performance of nanowire will be compared with those of nanopowder and nanotubes. (Fig. 1) The strategy to improve the electrochemical performance of SnO_2 nanopowders is the encapsulation of carbon around SnO_2 nano-particles. Carbon encapsulated SnO_2 composites were prepared by a thermal evaporation and decomposition of malic acid ($C_4H_6O_5$) at low temperature. Thanks to the low-temperature process, the robust electron pathway could be formed without any disruption of its bulk structure. Finally, MOSN(Mesoporous oragno silica nanoarray) was combined with SnO_2 particles to accommodate their volume expansion during Li^+ insertion. This strategy turned out to be also very effective to improve the electrochemical properties of SnO_2.

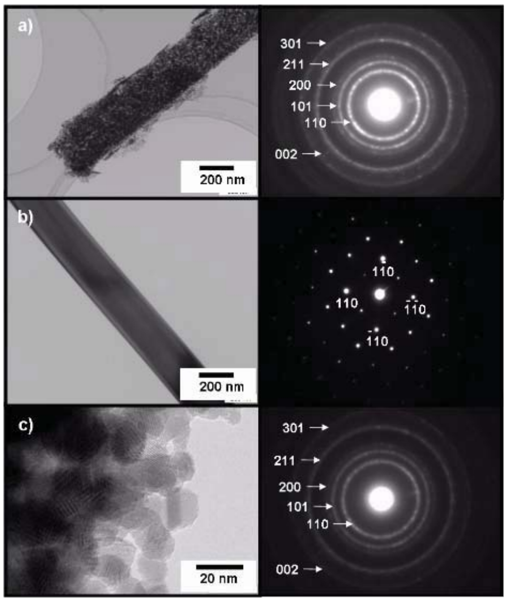

Fig. 1. TEM observations and selected area diffraction (SAD) patterns: (a) SnO_2 nanotubes, (b) SnO_2 nanowires[1], and (c) SnO_2 nanopowders.