1-1-2010

Three-Dimensional C/SnO2 composites as anode materials for lithium ion batteries

C F. Zhang
University of Wollongong, czhang@uow.edu.au

M Quince
University of Wollongong

P Zhang
University of Wollongong

Z X. Chen
University of Wollongong, zchen@uow.edu.au

Z P. Guo
University of Wollongong, zguo@uow.edu.au

Three-Dimensional C/SnO2 composites as anode materials for lithium ion batteries

Abstract

The nano-carbon materials have attracted a lot of research interests since the discovery of C60 molecule in 1985 by Kroto et al. (1), and the first experimental evidence of tabular carbon structure from Iijima in 1991 (2). Current methods used for the preparation of nano-carbon materials, including chemical vapour deposition (CVD) and arc vaporisation (3), are commonly characterized by high cost and the high-pure carbonaceous precursor gasses. In this work, the potential of using coconut shell which is very cheap and readily available for the production of graphitic nano-carbon three-dimensional networks was investigated.

Keywords

anode, dimensional, three, lithium, composites, ion, batteries, sno2, materials, c

Publication Details

Zhang, C. F., Quince, M., Zhang, P., Chen, Z. X. & Guo, Z. P. (2010). Three-Dimensional C/SnO2 composites as anode materials for lithium ion batteries. The 15th International Meeting on lithium batteries (p. 1).

Three-dimensional nano-carbon/tin oxide composites as anode materials for lithium-ion batteries

C.F. Zhang [a, b], M Quince [a], P. Zhang [b], Z.X. Chen [a], Z.P. Guo [a, b, *]

[a] *School of Mechanical, Materials & Mechatronic Engineering, University of Wollongong, NSW 2522, Australia*

[b] *Institute for Superconducting & Electronic Materials, University of Wollongong, NSW 2522, Australia*

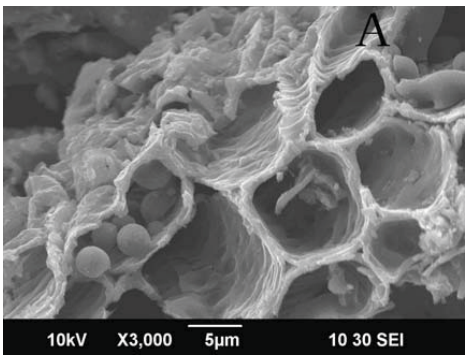
**Corresponding author; Fax: 61 2 2215731; Email: zguo@uow.edu.au*

The nano-carbon materials have attracted a lot of research interests since the discovery of C_{60} molecule in 1985 by Kroto et al. (1), and the first experimental evidence of tabular carbon structure from Iijima in 1991 (2). Current methods used for the preparation of nano-carbon materials, including chemical vapour deposition (CVD) and arc vaporisation (3), are commonly characterized by high cost and the high-pure carbonaceous precursor gasses. In this work, the potential of using coconut shell which is very cheap and readily available for the production of graphitic nano-carbon three-dimensional networks was investigated.

The three-dimensional carbon (Figure 1A) has been produced via the wet-impregnation of coconut shell powder with a transition metal catalyst, prior to a graphitisation heat treatment process between 725°C and 800°C for up to 1.5 hours under vacuum. The novel process employed offers low costs and environmental advantages with biological waste used in place of carbonaceous precursor as the feedstock. Nano-carbon/tin oxide (Figure 1B) was prepared via the wet-impregnation of tin chloride solution with the activated nano-carbons which were chemically activated through a heat treatment process at 800°C for 2 hours following the wet-impregnation of graphitised nano-carbons with potassium hydroxide, and subsequent heat treatment at 500°C for 6 hours. Samples were characterised by using X-ray diffraction, scanning electron microscopy, transmission electron microscopy and gas adsorption porosimetry.

The electrochemical performances of the three-dimensional nano-carbon doped with tin oxide and activated nano-carbon were investigated as anode materials in rechargeable lithium-ion batteries.

It was demonstrated that nano-carbon/tin oxide could provide an initial reversible capacity of 777 mAh/ g at a current density of 0.2 C over the voltage range from 0.01 to 2 V. The capacity retention upon the 20th cycle was 51 and 55% at 0.2 C and 0.3 C, respectively.



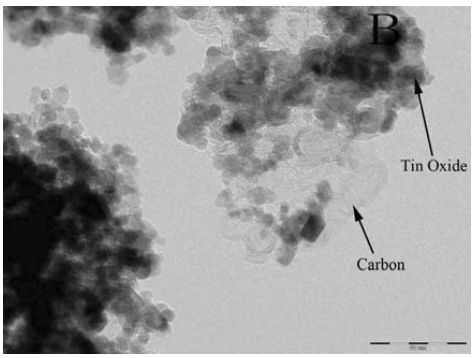


Figure 1, (A) SEM image of sample after hydrochloric acid treatment, (B) TEM image of tin-rich particles dispersed in the nano-carbon matrix.

1. H. W. Kroto, J. R. Heath, S. C. O'Brien, R. E. Smalley, *Nature*, **318**, 162 (1985).
2. S. Iijima, *Nature*, **354**, 56 (1991).
3. M. J. O'Connell, in Carbon Nanotubes: Properties and Applications, P. 19-49, CRC Press, Boca Raton, USA (2006).