Data Article

Data on unstable charge/discharge behavior of composite anode composed of Sn compound and multi-walled carbon nanotube

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ABSTRACT

This data is related to the article entitled “Effect of Composite Structure on Capacity Instability of SnO\textsubscript{2}-Coated Multiwalled Carbon Nanotube Composite Anode” (Kim et al., 2018) \cite{1}. This data provides the information about capacitance instability of a composite anode material based on multiwalled carbon nanotube (MWCNT) coated with crystalline and amorphous SnO\textsubscript{2} and Sn on the inner and outer walls of MWCNT fabricated by a simple wet synthesis method.

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Specifications Table

| Subject area | Materials         |
|--------------|-------------------|
| More specific subject area | Composite Anode |
| Type of data | Table, figure     |
| How data was acquired | BioLogic EC-Lab, VSP-300 |
| Data format  | Analyzed          |

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Half cell performance was measured with metal Li foil at RT

Coin cell performance

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This article.

1. Data

This dataset provides information on the capacitance instability of MWCNT-Sn compound composite anode and the capacity variation characteristics of the composite with the progress of charge-discharge when the Sn compound is predominantly located on the outer surface of the MWCNT. Fig. 1 shows the TEM image of MWCNT-Sn based composite. Fig. 2 gives the graph for capacities vs. cycle number for MWCNT-Sn based composite anode materials obtained using the 2032 coin cell with metal Li. Table 1 shows representative values of the specific capacity according to the cycle number of the MWCNT-Sn compound composite anode synthesized at a precursor concentration of 0.5 M.

2. Experimental design, materials and methods

In order to chemically activate the surface of the MWCNT having an average diameter of 500 nm, a chemical surface treatment was carried out by the liquid phase method as follows. 1 g of MWCNT was stirred in 1 mol of nitric acid solution at 120 °C for 4 h and then washed with distilled water until pH 7. The resulting reaction product was then dried at 60 °C for 24 h. 0.105 g of SnC2O4·2H2O was mixed with 3 ml of distilled water and stirred at room temperature for 60 min. 3 ml of ethylene glycol and 0.25 g of poly-vinylpyrrolidone (PVP) were stirred at room temperature for 10 minutes. 0.33 g of the surface-treated MWCNT and thus obtained solution were mixed and heated to 195 °C and then stirred for another 5 h. The obtained reaction product was centrifuged, washed with distilled water and centrifuged again to obtain a precipitate. The precipitate was again dried in an electric oven at 50 °C for 5 h to obtain a composite anode in the form of a black powder.

A high resolution TEM analysis was performed to identify the shape and location of the hybridized Sn compounds in the MWCNT composite anode. An anode electrode slurry composed of 86 wt% of active material, 9 wt% of conductive material, and 5 wt% of binder was directly applied on the aluminum current collector to have a thickness of 50 μm and dried at 80 °C for 4 h. A CR2032 coin cell was prepared in a glove box using Li metal as the counter electrode and 1 M LiPF6 (EC: DMC: EMC = 1: 1: 1) as the electrolyte. Specific capacities were measured using a cycling voltage and current method (CV) at a scan rate of 0.1 mV/s in the potential range of 0.1 and 2.5 V at room temperature (298 K).
Fig. 1. TEM image of a tin oxide coated MWCNT (white cursors show the tin oxide materials on outer and inner sides of MWCNT).

Fig. 2. Capacities vs. cycle number for composite anode consisting of MWCNT- Sn compound.

Table 1
Specific capacity according to the cycle number of the composite anode synthesized at a precursor concentration of 0.5 M.

| Cycle Number | Specific capacity (mA h g\(^{-1}\)) |
|--------------|-----------------------------------|
| 20th         | 610                               |
| 30th         | 670                               |
| 40th         | 570                               |
Supplementary data associated with this article can be found in the online version at http://dx.doi.org/10.1016/j.dib.2018.02.023.

Reference

[1] S.H. Kim, J.Y. Lee, Y.S. Yoon, Effect of composite structure on capacity instability of SnO$_2$-coated multiwalled carbon nanotube composite anode, J. Alloy. Compd. (2018).