GeO_2-SnCoC composite anode material for Lithium batteries: Li insertion and de-insertion study

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Abstract

A novel oxide alloy composite material GeO_2-$Sn_{30}Co_{30}C_{40}$ was prepared by mechanical alloying method and tested as a negative electrode for Lithium ion batteries. The composite anode shows a reversible capacity over 800 mAh/g with good capacity retention. It combines combine the advantageous properties of both Sn-Co-C (long cycle life) and GeO_2 (high capacity) and, thereby, improve the overall electrochemical performance. Furthermore, the 1st cycle coulombic efficiency has been improved up to 80%, which much higher than that (34.6%) of pure GeO_2. The X-ray diffraction reveals that the high temperature phase Co_3Ge_2 was obtained during milling. The EXAFS data illustrated that GeO_2 and SnO_2 had existed after mechanical milling. The pair distribution function (PDF) demonstrated the reversibility of the conversion reaction (eq. 1) and the alloying reaction (eq. 2) of both GeO_2 and SnO_2 the main active materials. This could be the key point of improved coulombic efficiency in the first cycle.

$MO + 2Li+ \rightarrow Li_2O + M$ (eq. 1)

$M + x\ Li+ \rightarrow Li_xM$ (eq. 2)

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