

GeO<sub>2</sub>-SnCoC composite anode material for Lithium batteries: Li insertion and de-insertion study

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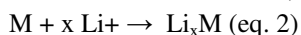
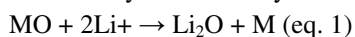
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Abstract

A novel oxide alloy composite material GeO<sub>2</sub>-Sn<sub>30</sub>Co<sub>30</sub>C<sub>40</sub> 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<sub>2</sub> (high capacity) and, thereby, improve the overall electrochemical performance. Furthermore, the 1<sup>st</sup> cycle coulombic efficiency has been improved up to 80%, which much higher than that (34.6%) of pure GeO<sub>2</sub>. The X-ray diffraction reveals that the high temperature phase Co<sub>3</sub>Ge<sub>2</sub> was obtained during milling. The EXAFS data illustrated that GeO<sub>2</sub> and SnO<sub>2</sub> 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<sub>2</sub> and SnO<sub>2</sub> the main active materials. This could be the key point of improved coulombic efficiency in the first cycle.



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