Scalable Preparation of Porous Carbon Nanosheet Based Nanocomposite Materials and Their Application in Lithium-ion Batteries

Yuanzhe Piao

Graduate School of Convergence Science and Technology, Seoul National University, South Korea

Parkat9@snu.ac.kr

Abstract

These days, Lithium-ion batteries are widely used as power sources for portable electronic devices such as digital cameras, notebooks, and digital communication devices. Many efforts have been made to improve the electrochemical performance of lithium-ion batteries. Recently, the application of nanomaterials in lithium-ion batteries has received great attention. MoS_2, which features a layered structure resembling that of graphite, is a promising anode material in Lithium-ion batteries because its specific capacity is higher than that of commercial carbonaceous materials. However, because of its high surface energy and interlayer van der Waals forces, two dimensional nanosheets inevitably restack during the cycling process, causing a rapid capacity decrease and poor rate performance. One effective strategy is to assemble the MoS_2 nanosheets into a three-dimensional porous structure able to retain the large surface area and offer more active sites for ion intercalation. [1]

Here, a simple method is described for the preparation of porous carbon nanosheet based nanocomposites by a template method. [2] This process provides a few-layer MoS_2 incorporated into hierarchical porous carbon nanosheet composites. The morphology and composition were characterized by using scanning electron microscopy, transmission electron microscopy, and X-ray diffraction. The electrochemical behaviors of the nanocomposites as anode materials for lithium-ion batteries were studied by cyclic voltammetry and charge/discharge measurements. The nanocomposites exhibited a very high specific capacity and high capacity retention. Even at the very high current density, the composite displays a stable capacity after long cycles. The good performance of the porous carbon nanosheet based nanocomposite at high current density indicates the potential for practical application of the material.

References

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