Review

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A review on manifold synthetic and reprocessing methods of 3D porous graphene-based architecture for Li-ion anode

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Abstract

At present, active materials have been introduced with the drawback of low specific capacity of commercial graphite electrodes and to meet the increasing demands for lithium-ion batteries with high energy density. However, volume expansion of active materials and poor electrical conductivity of them are deadly problems in charge transportation and cycle stability. Confronting with these problems, three-dimensional porous graphene sheets combining with active substances show great promise, which have much more new physiochemical properties and present excellent electrochemical performances in anodes, getting a great deal of attention. Therefore, in this review, we summarize manifold synthesis methods, such as hydrothermal/solvothermal, chemical vapor deposition and self-assembly methods of three-dimensional porous graphene-based composite for lithium ion anodes, aiming to illustrate synthesis methods may affect the structure of materials and anode performances. And we also present two main methods in reprocessing three-dimensional porous graphene materials to improve Li-ion storage. We hope that this article which reviews the synthesis and reprocessing methods of three-dimensional porous graphene-based composite anode can give inspirations for readers.

Keyword: active material, synthesis method, three-dimensional porous graphene-based composite, reprocessing method, anode

1. Introduction

Currently, energy researches have drawn a great deal of attention due to energy crisis[1, 2]. Many countries in the world want to use clean and sustainable energies such as solar power, wind energy, hydroelectric power and chemical source of electric energy (i.e. Li/Na ion batteries) to alleviate fossil energy consumption or even to replace it [3, 4].

In recent years, lithium-ion batteries (LIBs) have been widely applied to a variety of portable electronic devices by virtue of their high energy densities and long lifetime [5, 6]. And they become one of the most promising energies in emerging large-scale applications such as stationary grid energy storage system, electrical vehicles and advances electronics [7-9]. At present, most of graphite anodes cannot meet the increasing demands for LIBs with high energy density, because graphite are stacked structure, which have low low Li^+ storage capacity (372mAh g^{-1}) and high introduction content of graphite will reduce the capacity and energy density of battery [10]. For this reason, active materials have been introduced. However, poor electrical conductivity of active materials makes charge transfer difficult and volume expansion of them will cause electrochemical performances drastically decreasing in the processes of charging and discharging. Therefore, to perfectly use LIB as power

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