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Short communication

Direct growth of $FePO_4$/graphene and $LiFePO_4$/graphene hybrids for high rate Li-ion batteries

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HIGHLIGHTS

- $FePO_4$/graphene and $LiFePO_4$/graphene hybrids were synthesized by a simple method.
- A simple and environmentally friendly RAAP-induced growth method was used.
- $FePO_4$ and $LiFePO_4$ were direct grown on the graphene-assembled scaffolds.
- $FePO_4$/graphene hybrids present superior electrochemical properties.
- $LiFePO_4$/graphene hybrids present superior electrochemical properties.

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ABSTRACT

$FePO_4$/graphene and $LiFePO_4$/graphene hybrids have been synthesized by an eco-friendly RAAP-directed growth method. With this strategy, $FePO_4$ and $LiFePO_4$ particles have been grown on the exfoliated graphene-assembled scaffolds. Both of the hybrids present superior electrochemical properties, i.e., high rate capability combined with good capacity retention upon cycling, indicating the great potential as the cathode materials for Li-ion batteries.

1. Introduction

Due to the significant requirements of renewable green energy technology, Li-ion battery(LIB)becomes the predominant power source for home electronics and large-scale energy storage devices [1,2]. Developing new cathode materials which deliver more energy density is important for us to achieve better LIBs [3–8]. Among various cathode materials, phosphate ion-based materials ($LiFePO_4$ and $FePO_4$) come into prominence with regard to their relatively high theoretical capacity, excellent cycling performance, low cost, nontoxicity, environmental friendliness and safe nature, leading to strong focus on polyanionic chemistries [4,9–17]. However, both of the two cathode materials suffer from poor electronic conductivity and poor transport, resulting in reduced utilization at high charge/discharge rates. A common solution is to use carbon nanotubes (CNTs) and graphene as carriers for insulating $LiFePO_4$ or $FePO_4$ nanoparticles, because both can produce highly conductive networks in the cathodes [12,18–22]. In order to improve the dispersity of the carbon material and modify the connection between the active materials and the carriers, CNTs and graphene were usually pre-oxidized in the synthesize process. However, such processing destroys the intact structures of carbon materials, leading to the relatively low utilization of the active materials.

Herein, a facile synthesize method was developed to grow the $FePO_4$ and $LiFePO_4$ particles on the thermally exfoliated graphene-

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