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Regular helix carbon rods with nitrogen-doped characteristic

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Abstract

Nitrogen-doped carbon and helix carbon are both promising materials for capacitor and electromagnetic absorber. However, a combination of these two characteristics is rarely reported yet. Herein, nitrogen-doped helix carbon rods were prepared via a simple carbonization of self-assembled helix polyaniline rods. The morphology and structure of the polyaniline rods and carbon rods were analyzed. The results displayed that the synthesized carbon rods possessed well-defined helix structure, and the atomic ratio of nitrogen element was up to 7.09 %.

Keywords: self-assembled; helix structure; polymers; carbon materials

1. Introduction

Helix carbon materials with superior electrical and thermal properties have attracted considerable interest because of their potential applications in chiral sensors, optical devices, electromagnetic absorber, etc [1-3]. In the early 1990s, Ihara [4-5] and Dunlap [6] firstly predicted the presence of helix carbonaceous nanotubes (CCNs). From then on, various carbon-based materials with helix conformation were produced [7-9]. Chemical vapor deposition (CVD) method and carbonization of chiral polymer were the two main synthetic approaches. Motojima et al. earlier obtained carbon microcoils using a Ni catalyst [10]. Qing et al. prepared carbon nanocoils with a tube reactor using acetylene as carbon source and copper nanoparticles as catalysts [11]. Che et al. reported a one-step synthesis of CCNTs by carbonization of self-assembled chiral polypyrrole nanotubes [12].

On the other hand, nitrogen-doped carbon materials also are promising candidates for capacitor [13] and electromagnetic absorber [14]. Among all the methods for preparation of the nitrogen-doped carbon, carbonization of nitrogen-containing polyaniline is the most effective method. For instance, M. Trchová et al. prepared granular [15] and tubular [16] morphology of nitrogen-doped carbon via carbonization of polyaniline. However, using polyaniline for preparation of carbon materials with helical and nitrogen-doped characteristics is rarely reported.

Herein, we report that the nitrogen-doped helix carbon rods can be prepared by a facile

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