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Fabrication of flexible free-standing reduced graphene oxide/polyaniline nanocomposite film for all-solid-state flexible supercapacitor

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ABSTRACT: Graphene and polyaniline (PANI) are considered as promising electrode active materials. A rational design of composite structure for graphene and PANI is essential and prerequisite for obtaining excellent properties. In this paper, a flexible free-standing reduced graphene oxide (rGO)/PANI nanocomposite film has been successfully prepared through self-assembly and *in situ* polymerization of anilines in graphene oxide (GO) sheets. Owing to the formation of PANI nanoparticles, the electrochemical capacitance of rGO/PANI nanocomposite film is significantly enhanced. To evaluate electrochemical properties, an all-solid-state flexible supercapacitor is further fabricated through tailoring and assembling the flexible free-standing rGO/PANI nanocomposite film. The nanocomposite film shows high specific capacitance of 0.92 F/cm^2 ($>$1314.3 F/cm^3) and its specific capacitance exhibits no obvious fading under bending state or after bending 200 times. The excellent electrochemical performance can be readily ascribed to the synergistic effect between two-dimensional rGO and PANI nanoparticle in the nanocomposite film. This study demonstrates an efficient approach to prepare flexible free-standing active materials for flexible energy storage devices.

Keywords: free-standing, nanoparticle, supercapacitor, high specific capacitance

1. Introduction

In recent decades, energy and environmental issue has become an enormous challenge and hot spot of academic front attention. Correspondingly, a considerable amount of effort has been dedicated to the development of energy storage devices. Supercapacitor is one of the most promising energy-storage devices due to its possess excellent specific capacitance, high power density, long cycle life and superior charge/discharge rate [1]. The field of supercapacitor has also been witnessed spectacular growth in recent years. Especially, with the development of wearable and portable electronic devices[2], the flexible supercapacitor, which can function well under bending and folding conditions, has attracted significant attention [3, 4]. Thus, rational design of flexible supercapacitor has gradually become the focus of academic research[5, 6].