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The using of carbon nanotube and graphene oxide composition in making graphene based supercapacitor and the influence of electrochemical reduction.

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Abstract

The composition of graphene and carbon nanotube was used as a considerable key element in the preparation of double-layer super capacitor electrodes where the thickness of the electrode was only a few micrometers. The resultant electrodes showed different specific capacitances after pre-reduction with scanning potential windows of -1.5 to 0 V. Also, a specific capacitance of 133 F/g was obtained as the carbon nanotube and graphene oxide (CNTs/GO) electrode that was reduced with an applied potential for 4000s. This specific capacitance was achieved at 5 mV/s. The influences of the residual oxygen functional groups in electrochemically reduced graphene were determined for capacitance and stability performance by CV test. The supercapacitor was shown to be stable after 4000 charge/discharge cycles.

Key words: graphene, carbon nanotube, super capacitor, electrochemical reduction, CV curves.

Introduction

The syndetic increasing requirements on the world energy expenses and environmental pollution has impeller a fast improvement of electrochemical energy storage devices, e.g., super capacitors, for different serious uses, in particular, in electric conveyance, hybrid electric vehicles (HEV), plug-in HEV, and smart grids. Super capacitors or electrochemical capacitors have three categories, including electric double layer capacitors (EDLCs), pseudo capacitors and hybrid supercapapcitors. In principle, EDLCs electrostatically store charges on the interface of high surface area carbon electrodes, e.g., activated carbon (AC) [7-8], carbon aerogel [9], mesoporous [10], carbon onions [11], carbon nanotube (CNT) [12-13], and graphene, which characterizes the performance of rapid charge storage and limited specific capacitance [1-4]. A super capacitor can be used in a wide range of energy devest and storage applications and are used either by themselves as the primary power source or in combination with batteries or fuel cells [5]. A super capacitor unit cell is comprised of two porous carbon electrodes that are isolated from electrical contact by a porous separator. Current collectors of metal foil or carbon impregnated polymers are used to conduct electrical current from each electrode. The separator and the electrodes are impregnated with an electrolyte, which allows ionic current to flow between the electrodes while preventing electronic current from discharging the cell. A packaged super capacitor module,

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