RGO-wrapped MnO₂ composite electrode for supercapacitor application

P. S. Chinnathambi, S. K. Majumder

Abstract

In this paper, we report an easy and economical method to produce novel electrode anode material (RGO-MnO₂) for high-performance supercapacitors. The method involves simple and facile deposition of manganese oxide on reduced graphene oxide (RGO) substrate, followed by high-temperature annealing. The architecture and composition of the deposited material was studied using various techniques such as X-ray diffraction (XRD), energy-dispersive X-ray spectroscopy (EDS), scanning electron microscopy (SEM), transmission electron microscopy (TEM), and Raman spectroscopy. The electrochemical performance of the obtained electrode was evaluated using cyclic voltammetry (CV), cyclic voltammetry (CV), galvanostatic charge-discharge (GCD), and electrochemical impedance spectroscopy (EIS). The results showed that the RGO-MnO₂ composite electrode can deliver high specific capacitance, good rate capability, and excellent cycling stability.

1. Introduction

The rapid growth of energy storage devices in recent years has led to the development of advanced materials for supercapacitors. Supercapacitors are considered to be a promising technology for energy storage applications due to their high power density, long cycle life, and low self-discharge rate. Among the various electrode materials, conductive graphene oxide (GO) and reduced graphene oxide (RGO) have received significant attention due to their high electrical conductivity and large surface area. However, the low charge storage capacity of GO is not suitable for high-energy devices.

In this study, we report a simple and economical method to synthesize RGO-MnO₂ composite electrodes for supercapacitor applications. The RGO-MnO₂ composite electrodes were prepared by simple deposition of manganese oxide on RGO substrates followed by high-temperature annealing. The electrochemical performance of the RGO-MnO₂ composite electrodes was investigated using cyclic voltammetry (CV), galvanostatic charge-discharge (GCD), and electrochemical impedance spectroscopy (EIS). The results showed that the RGO-MnO₂ composite electrodes exhibited high specific capacitance, good rate capability, and excellent cycling stability, making them suitable for high-energy devices.