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One-Step Electrodeposition of Reduced Graphene Oxide on Three-Dimensional Porous Nano Nickel-Copper Foam Electrode and Its Use in Supercapacitor

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Abstract

A new three-dimensional (3D) porous nano-Ni-Cu foam/ electrochemically reduced Graphene Oxide (ERGO) electrode for high performance supercapacitors is represented. In this study, Graphene Oxide (GO) in the form of nanosheets was deposited (0V to –1.5 V vs. Saturated Calomel Electrode (SCE)) and reduced by cyclic voltammetry method under different scan rates in the range of 10-100 mV/s on Ni-Cu foam. Raman spectroscopy and X-ray photoelectron spectroscopy (XPS) indicated that the graphene structure was considerably restored in ERGO. ERGO deposited at the electrochemical scan rate of 50mV/s presented the best capacitance performance. Notably, a high specific capacitance of the 1380.2 F/g at a discharge rate of 2 A/g and also an energy density of 30.01 W h kg^{-1} at a power density of 10.2 kW kg^{-1} was achieved for fabricated nano-Ni-Cu foam/ERGO composite film. Moreover, the designed composite provided an excellent cycling stability, which is a very important requirement for being used as electrodes for high-performance supercapacitors. This work introduces the 3D porous nano-Ni-Cu foam/ERGO procedure an impressive approach in the direction of supercapacitors with high energy and power densities.

Keywords: Electrochemically reduced graphene oxide, Ni-Cu foam, supercapacitor, Porous film, electrochemical reduction

1. Introduction

Graphene is a two-dimensional nanomaterial, which has been increasingly considered for a wide range of applications due to their remarkable physical and chemical properties such as high

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