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High-Performance Supercapacitor Based on Three-Dimensional Hierarchical rGO/Nickel Cobaltite Nanostructures as Electrode Materials

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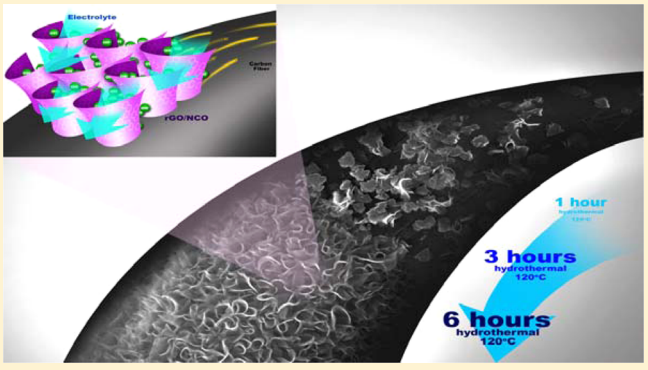
Supporting Information

ABSTRACT: A hybrid supercapacitor that employs nanomaterial has been extensively studied recently. However, inexorable collapse and agglomeration of metal oxide and short cycle stability of graphene sheets greatly hinder their practical applications. Herein, we demonstrate a competent synergic effect between nickel cobaltite (NCO) and reduced graphene oxide (rGO) for synthesizing the three-dimensional hierarchical rGO/NCO nanostructures via a facile one-pot hydrothermal method, followed by subsequent annealing in air. The structural and morphological characteristics of as-synthesized rGO/NCO have been characterized in-depth by FESEM, XRD, XPS, BET, and Raman spectroscopy. When incorporated in a two-electrode system with 2.0 M KOH electrolyte, the three-dimensional rGO/NCO nanostructures exhibit excellent supercapacitive performance. This is due to the unique properties of rGO that provide a flexible and expandable platform for growing NCO nanocrystals, which result in a nanoscopic rose petals morphology. These nanostructures provide a large surface area which facilitates the ion diffusion and eventually enhances the specific capacitance. Furthermore, performance studies between the as-synthesized electrode materials with a commercialized supercapacitor proved that the as-synthesized rGO/NCO electrode possesses a proficient potential to be a supercapacitor material, which provides high energy density as well as power density. A two-electrode system is advantageous over a conventional three-electrode system because it mimics the cell configuration of commercial supercapacitors.



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