3D-Graphene-Carbon Nanotube Hybrid Fibers for Supercapacitor Applications.

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Abstract

In this work, a high performance, supercapacitor is prepared based on three-dimensional graphene (3D-G) - carbon nanotube (CNT) hybrid fiber electrodes (3DGCNT) with gel electrolytes. We describe a simple approach for synthesis of these 3DGCNT hybrid fibers via Chemical Vapor Deposition (CVD) and their doping with nitrogen. The amount of graphene synthesized on the CNT fiber and its properties have been tuned by different processing parameters. The fabricated fibers revealed reasonable mechanical strength of 220.4 MPa and high electrical conductivity up to 649 Scm^{-1}. They also showed excellent electrochemical properties and capacitance that was important for their energy storage application.

The created devices employed an ionic liquid gel electrolyte (PVDF-EMIMBF4) which had a voltage window of 3.2 V, thus increasing greatly the energy densities of the supercapacitors. The tested devices achieved high gravimetric, areal and volumetric energy density and power densities that will be reported in this paper.