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Gel polymer electrolyte based on flexible solid-state supercapacitors appropriate for energy storage in small flexible electronics devices

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Electrical energy storage devices such as batteries and supercapacitors are essential elements in many portable and wearable electronics. However, conventional energy storage devices are usually bulky and solid, not being very suitable for applications that need mechanical flexibility. In this work, we have presented a fully flexible supercapacitor device made from two carbon nanotube (CNT) paper based electrodes with a layer of a gel type electrolyte between the electrodes. The electrodes were fabricated by spreading a suspension solution of CNT over a piece of Xerox paper and dry the paper in a vacuum oven. The gel was made by adding polyvinyl alcohol (PVA) to an acid solution and stir the solution for a few hours. Despite the simple method of fabrication, the fabricated devices presented relatively high capacitances. Devices were made with two different gel electrolytes, using H_2SO_4 and H_3PO_4 acids. Electrochemical study of the devices showed 39.39 mF and 30.44 mF capacitances for the H_2SO_4-PVA and H_3PO_4-PVA electrolytes, respectively. Also, the devices presented series resistances about 30 Ω which is low enough for many small electronic applications. The device characteristics were also measured while bending them under various curvatures. Less than 15% change in capacitance was observed when devices were bent up to 1.6 cm^{-1} curvature. However, the capacitance was return to the original value after relaxing the device. The excellent electrochemical properties and the mechanically stability of the devices are promising for low-cost electronic applications.

Biography

Belqasem Aljafari has completed his MS at the age of 29 years from Northern Illinois University school of engineerin. He is pursuing his education by studying currently the PhD degree schoold of engineering.

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