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INFLUENCE OF AQUEOUS AND GLYCEROL-BASED ELECTROLYTES ON THE PERFORMANCE OF ACTIVATED CARBON FIBER-FELT ELECTRODES FOR SUPERCAPACITORS

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Resumo:
Due to the rising demand for energy consumption and the development of new energy sources, energy storage devices are needed for balancing energy supply and demand. Among the different types of energy storage systems, electrochemical supercapacitors have received great attention owing to their advantages of long cycle life, high power density, fast charge-discharge rates, and safe operation. This work addresses these storage devices and has been divided into two parts, namely: (1) Production and characterization of activated carbon fiber-felt electrodes from textile PAN fiber and (2) Electrochemical characterization of electrodes in aqueous and glycerol-based KOH electrolytes. In the former, the manufacturing method of activated carbon fiber-felt electrodes has been provided. Pre-oxidized textile PAN-fiber felt underwent four main processes: (a) Drying at 125°C, (b) Overoxidation at 250°C, (c) Carbonization under an inert atmosphere at 900°C, and (d) Physical activation under an oxidizing atmosphere at 1000°C. Surface morphology, porosity measurement, and other physical and chemical properties of the electrodes have also been investigated. Results showed activated carbon fiber-felt electrodes with high BET surface area (>1500 m^2/g) containing mostly micropores (modal distribution at 1.2nm). In the latter, electrochemical impedance spectroscopy (EIS), cyclic voltammetry (CV), and galvanostatic charge-discharge (GCD) techniques were conducted to evaluate the electrochemical characteristics and performance of electrodes. Experiments were carried out in a symmetric two-electrode configuration cell (Swagelok-type) in aqueous and glycerol-based KOH electrolytes. Results showed that the glycerol-based KOH electrolyte enhanced the specific capacitance (>120 F/g) and widened the potential window (2.1 V) of the electrochemical supercapacitors (EDLC). The advantages and disadvantages of aqueous and glycerol-based electrolytes will be discussed.