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Development of carbon composite based on carbon fibers from viscose material for supercapacitor electrodes

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Abstract

Compact carbon material for supercapacitor electrodes (SC), was made from a carbon fiber (CF) derived from viscose materials. Samples of viscose material were impregnated with an aqueous solution of phosphoric acid and were dried for two hours and subjected to carbonization in an argon stream at a heating rate of 50 °C/min to a maximum temperature of 700 to 900 °C. After reaching the maximum temperature, the CF were kept at a constant temperature, and subjected for activation in the gas stream. After activation, the fiber was cooled to room temperature in an argon stream. Activity of adsorption was investigated by sorption of methylene blue indicator. The morphological features were studied by the scanning *JMS-1700F* Japanese company *JEOL* electron microscope. Assembling of electrode were used the CF (C = 80 % wt.), milling in a mortar, a binder which is a suspension of PTFE grade F4D in an amount of 10% by weight. To increase the conductivity of the material was added 10 % wt. of soot (CABOT® VULCAN® X C72). The mixture was rolled on rollers. This method yielded a tape used as a material for electrodes. The tape was pre-dried at 120 °C, a symmetrical supercapacitor cell samples were collected from the tape (SC), consisting of two electrodes and the separator. Conductive carbon was coated on an aluminum foil that served as a current collector. Electrochemical characteristics of SCs cells were examined by galvanostatic charge-discharge analyzer HIT ASK 2.5.10.8 and cyclic voltammetry on potentiostat *JPC 2000*. The salt of triethylmethylammonium tetrafluoroborate $(C_2H_5)_3CH_3N{\cdot}BF_4$ in acetonitrile served as an electrolyte in the cells of the SC. After activation of hydrocarbons in the CO2 stream is characterized by having a developed surface that capable to a high specific capacity of CF. By the value of electrochemical data test the specific capacitance of cells was 120 F/g (18.9 F/cm^3) at current density 1 mA/cm^2. The variation of capacitance depending on the number of cycles indicates a stable capacitance value during the entire process of cycling of SC cells. Residual capacity after 2000 cycles decreased by 14% from the initial value, which indicates a good stability of structure of the electrode material of viscose.

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