Nanocomposites and nanomaterials

The use of nanoporous carbon for supercapacitors electrodes

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The advantages of supercapacitors (SC) over other portable electronic devices and power sources include improved specific characteristics, longer life and a greater number of charge-discharge cycles. Specific capacitance of SCs depends on the electrodes characteristics, for which the nanoporous carbon (NPC) is the most promising material, and the electrolyte type [1].

NPC can be obtained by method of hydrocarbonization of fruit stones, husks of sunflower seeds and other plant raw materials. This carbon has a highly developed surface with a specific area of $S > 1000$ m^2/g, but its specific conductivity is low. In order to overcome this drawback, we have developed a nanocomposite material (NCM) made of a mixture of NPC powders and thermally-exfoliated graphite (TEG). The resistance of TEG with $S \sim 50$ m^2/g is significantly lower than the resistance of NPC and its value is approximately $2 \cdot 10^{-3}$ ohm· m. Since electric charge is accumulated by a SC mainly due to formation of the double electrical layer at the electrode-electrolyte boundary, its capacitance becomes greater the larger is the electrode surface area. Particles size of NPC varies in the range of 60 to 240 micrometers, and the size of transport pores is from 4 to 20 nm. Values of specific capacitance of the studied samples at the variation rate of applied potential of 5 mV/s were calculated using cyclic voltamperograms of the composite material. All in all, it has been established that the use of the developed NCM on the basis of NPC and TEG for manufacturing of electrodes of SC allows to obtain SCs with maximum specific capacitance $C_{NCM} = (155…160)$ F/g, with the dispersion degree of TEG particles $d = (160...200)$ micrometers and its concentration in NCM composition $C_V = 15$ vol.%.

1. *Revo S.L., Budzulyak I.M., Rachiy B.I., Kuzishin M.M.* Electrode Material for Supercapacitors Based on Nanostructured. Surface // Engineering and Applied Electrochemistry.-2013.-**49**(1).-P. 68-72.