

Nanocomposites and nanomaterials

Ultrasonic modification of carbon materials for electrochemical capacitors

M.O. Nykoliuk, B.I. Rachiy, I.M. Budzulyak, A.I. Kachmar

Vasyl Stefanyk Precarpathian National University, 57 Shevchenko Street, Ivano-Frankivsk, 76025, Ukraine. E-mail: bogdan_rachiy@ukr.net

Fig.1.The dependence of NCM capacity C (F/g) for different series (1,2,3,4) from the charge/discharge current I (mA).

The paper is devoted to study the ultrasonic impact on the biomass of natural raw materials, which were used for the creation a nanoporous carbon material (NCM). NCM was used as an electrode material for electrochemical capacitors (EC). The dry shells of apricot seeds were a feedstock, which were modified by the chemical treatment in the phosphoric acid and part of them were impacted by ultrasonic waves for 25 minutes. The carbonization of feedstock was carried at 550 °C and after that part of them were modified by chemical treatment in the nitric acid. In the result we have four different series of samples: series 1 - samples were modified by the chemical treatment in the phosphoric acid; series 2 - samples were modified by the chemical treatment in the phosphoric acid and were impacted by ultrasonic waves for 25 minutes; series 3 - samples were modified by the chemical treatment in the phosphoric and nitric acid; series 4 - samples were modified by the chemical treatment in the phosphoric and nitric acid, and were impacted by ultrasonic waves for 25 minutes. The all series of samples were washed up to neutral pH and dried at 90 °C up to constant weight. The formed electrodes were placed in 2-electrodes cell with type size "2525". The 33% solution of KOH was used as an electrolyte. The research of electrochemical properties of EC were done by galvanostatic and potentiodynamic cycling. The chemical treatment in nitric acid makes it possible to enhance the capacity almost 1,5-2 times. And ultrasonic modification as a result also shows significant improvement of the capacitance characteristics by 10-25%. Also all these materials for EC give us possibility to operate the cell at very high speed of the charge/discharge current more than 150-200 mA.