Nanocomposites and nanomaterials

The electrical conductivity of composite material based on nanoporous carbon

B.I. Rachiy[1], I.M. Budzulyak[1], P.I. Kolkovskyi[1], A.M. Kostruba[2],V.O. Bahriychuk[3], , O.I. Demchyna[4], R.Y. Musiy[4]

[1]Vasyl Stefanyk Precarpathian National University, 57 Shevchenko Street, Ivano-Frankivsk, 76025, Ukraine.
[2]Lviv University of Commerce and Economic, 9 Samtshuk Str., Lviv, 79011, Ukraine
[3]The Company "Kartekiya-Build", Ternopil, Ukraine
[4]Department of Physical Chemistry of Fossil Fuels InPOCC, National Academy of Sciences of Ukraine, 3a Naukova Str, Lviv, 79053, Ukraine.
E-mail: rostyslav_musiy@ukr.net

Nanoporous carbon (NC) is one of the most promising electrode material of electrochemical capacitors, lithium primary sources of electric energy and the basis formation of composite materials due to high surface area and porous structure. Electrical conductivity of NC depends on methods of obtaining and further modifications. As a rule, the origin raw material is an insulator. The increased conductivity of carbon material due to increased contents of sp^2-bond of carbon and removal of decomposition products is the result of carbonization methods. The conductivity increase of carbon and variation of structural regularity in the range of amorphous carbon to crystalline of graphite ideal structure formed at ~ 2500˚C are the result of thermal treatment of the material. The obtaining of NC carried out by thermal treatment of carbonized raw material and further thermal activation of potassium hydroxide.

Thus, NC obtaining of predetermined magnitude surface area can be achieved by the process of controlling of the potassium hydroxide concentration. The determination of NC conductivity was carried out using AUTOLAB PGSTAT100. The process of measurement of Z' real and Z" imaginary parts of the resistance system was carried out in the frequency range of 10^{-2}-10^5 Hz at a voltage of 10 mV.

It has been established that value of conductivity of NC, activated by potassium hydroxide, increases in the range of applied pressure 0.5 - 2.5 MPa. The maximum value is 500 S/m. The value of conductivity is inversely proportional to the specific surface area. Thus, the main reason of conductivity reducing on 45% is increase area of NC due to increasing of potassium hydroxide concentration.