Nanocomposites and nanomaterials

Structural and functional properties of N-doped nanoporous activated carbon studied by magnetic resonance spectroscopy.

A.K. Melnyk[1], V.V. Trachevskyi[2], V.A. Trychlib[1], V.V. Strelko[1]

[1] *Institute for sorption and problems of endoecology, NAS of Ukraine. Naumov str.,13, Kyiv- 03164, Ukraine*
E-mail: mak106@ukr.net

[2] *Technical centre, NAS of Ukraine. Pokrovska str., 13, Kyiv-04070, Ukraine*

Nanoporous activated carbon (NAC) and its derivatives, such as nitrogen-enriched activated carbon, are widely used as a base material for electrochemical double layer capacitors (supercapacitors), a promising hydrogen storage media [1] and as the effective adsorbents of technogenic pollutants [2]. In the present study commercial nanoporous carbon ZL302 (Huzhou Sensheng Activated Carbon Co., Ltd) with primary pore size of 0.7 – 6 nm was mixed with different amount of melamine and then thermally treated for the preparation of N-doped NAC.

EPR studies of paramagnetic centers (dangling bonds) have revealed drastic changes in the carbon structure even for low nitrogen heteroatoms content, the highest nitrogen substitution level (near 12%) resulted in low oxygen adsorption and/or the closed-pore formation. Effect of spin exchange of aggregated nitroxide spin probes TEMPOL (2,2,6,6,-tetramethylpipreidne-1-oxyl) was used for the investigation of the solvent penetration ability into the nanopore volume. Adsorption capacity versus nitrogen substitution percentage growth shows decreasing nature for water and increasing for benzene, toluene and petrol, relatively low filling values were discovered for acetonitrile, chloroform and dimethylformamide. It also was found that the presence of new surface groups lead to the better extraction of copper (II) ions from aqueous solutions.

Determination of water vapour adsorption and kinetics of this process were studied by ^{1}H NMR spectroscopy. Different temperature annealing of NAC was employed for modeling of water distribution between the nano-, micro- and mesopores and between the inner and outer surface as well.

1. *L.Wang and R.T. Yang*. Hydrogen storage properties of N-doped microporous carbon // J. Phys. Chem. C. - 2009. – **113(52)** - P. 21883-21888.
2. *E. Lorenc-Grabowska, G. Gryglewicz, M.A. Diez.* Kinetics and equilibrium study of phenol adsorption on nitrogen enriched activated carbons // Fuel - 2013.- **114** - P. 235-243.