## Nanocomposites and nanomaterials

# Nanoporous activated carbon as a sensitive paramagnetic probe for study of local environment in liquids.

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Activated carbon (AC) due to its unique physicochemical properties is one of the most prospective materials in the fields of enterosorption and the creation of supercapacitors as well. Nowadays strong potential of such materials as a specific probes and chemical sensors is not fully disclosed.

Our current research is focused on the use of paramagnetic properties of AC, which are mainly determined by the formation of numerous dangling bonds during activation process. When exposed to air, they strongly interact with weakly bonded molecular oxygen, that leads to the drastically lowering of spin-spin relaxation times and therefore extreamly brodeaning of EPR spectral line. On the contrary, in suspension diffusion of diamagnetic solvent into the micropores flushes oxygen molecules and principally changes the surroungings of unpaired electrons and therefore spin density delocalization and relaxation properties.

In the present work suspensions of six commercially available samples of charcoal with dominant micropore diameter of 0.5-10 nm and total surface values up to 1500 $m^2/g$ were studied using EPR spectroscopy. Spectra of all samples consist of classical singlet line with g factor values of 2.001÷2.0055 and "peak-to-peak" linewidth $\Delta H_{pp}$ from 6 G (mostly graphitized carbon) to 100 G (less polycyclic aromatic, more aliphatic or impurity surrounding). It was shown that $\Delta H_{pp}$ is more sensitive to the changes in local environment (different solvents, presence of alkali metal cations in aqueous phase, pH values, binding of protein) than g-factor. Extra sensitivity to some transition metal cations (Fe, Ni, Co) in solution could be explained by the spin exchange and/or dipole-dipole mechanism. Closer values of absolute linewidth changes and the greater relative difference for more graphitized AC make them a better candidate for the potential sensors.

1. *N. A. Travlou, M. Seredych, E. Rodriguez-Castellon and T. J.Bandosz.* Activated carbon-based gas sensors: Effects of surface features on sensing mechanism // Journal of Materials Chemistry A. - 2015. - **3** - P. 3821-3831.
2. *B. F. Jordan, C. Baudelet, B. Gallez.* Carbon-centered radicals as oxygen sensors for in vivo electron paramagnetic resonance: screening for an optimal probe among commercially available charcoals // Magnetic Resonance Materials in Physics, Biology and Medicine -1998.- **7** - P. 121-129.