

A growing demand for new, better, more selective and more reliable tools in the science is seen. This demand is a result of the tendency towards expectation of better scientific diagnosis, the use of more sensitive and selective sensors and simply the better and all-purpose electrodes. An increase in the interest in modification and engineering of electrode surfaces appeared. This is because of searching for required electrode properties and their usefulness in solving a growing number of analytical and catalytic problems.

The main direction in our investigations will be the search for new materials that offer new properties, new activities and new responses at the surfaces of electrodes. We are pressing particularly for a possibility of the control of the electrode electroactivity, its electroactive centers and the electrochemical signal that is a function of the electrode state. We would like to get it and to use it by employing particular changes in the environmental conditions. These changes may involve a drop or a rise in temperature, pH and concentration of particular ions and molecules.

The modified electrodes will be of very different size. The experiments will involve regular electrodes, microelectrodes and nanoelectrodes. All sizes are needed in electrochemical research; the particular need is related to the particular task and examination. Regarding the modified materials, we will start with the polymer nets and gels well known to us: PAA and PNIPAA (monomers: acrylic acid and N-isopropylacrylamide). A variety of polymer morphology and structure will be used. They will include, among others, interpenetrating nets and micro- and nanoparticles. We intend to employ also composites of other polymers and materials to get matrices that can form a magnetic field at the electrode surface. The modification of the synthesized polymers/gels will be done through the use of monomers that contain functional groups capable of complexing metal cations and anions and forming the systems of the guest-host type. Other functional groups will be also added to the monomers. We think about red-ox groups and the groups that are able to anchor/bind macromolecules of substantial biological/medical importance. These biomolecules are DNA, enzymes, antigens and antibodies. The crosslinkers in the polymer nets will be modified similarly. In the case of appropriately modified DNA strands that are used as the linkers we expect substantial changes in the functionality of the nets and in extent of the phase transformations just because of denaturation and hybridization of DNA strands and the intercalation of the double helix.

Substantial decrease, to nanometric scale, in the electrode size and the polymer particle size is expected. In the case of smart or intelligent polymeric hydrogels the substantial decrease in the particle size will cause a significant increase in the response time of the particles to a change in the environmental conditions and the presence of particular ions and molecules. Improved and advanced stoichiometry of the gels may lead to an increase in number of environment parameters the gels are sensitive to. It is expected that a thin layer of the appropriately modified gel deposited on the electrode surface will get some new analytical and electrocatalytic significance.