Microgels are crosslinked polymers of sizes similar to those of colloids. As a consequence of their small size the volume phase transition phenomena, in a response to changes in environmental conditions, such as temperature or pH, occurs almost immediately. The modification of the network with appropriate functional groups should lead to sensitivity to additional stimuli. The modification of polymer network with electroactive compounds should lead to the situation, where the microgel volume phase transition will occur in response to a change in oxidation state of the electroactive compound.

The aim of the studies will be:

1. Microgels, based on biocompatible polymers, synthesis, which will contain in their structure the electroactive groups, what will make them sensitive to electrochemical potential changes.
2. Physicochemical and electrochemical characteristic of obtained microgels.
3. Modification of conducting surface with electrosensitive microgel monolayer.
4. Loading of model substances into the microgel monolayers and controlled release of them through the application of appropriate potential.
5. Examination of modified with electroactive microgels layers nanoelectrodes for their possible use as a specific electrochemical sensors.

The studies will be carried out with such techniques as: dynamic light scattering, UV-VIS spectroscopy, cyclic voltammetry, chronoamperometry and quartz crystal microbalance with dissipation. Surface morphology of the obtained materials will be examined with a scanning electron microscope and a transmission electron microscope.

The search for new material, which can undergo, after exposition to a given potential, the swelling and shrinking processes, similar to the muscle-fibers behavior, should help much in the preparation of artificial muscles controlled by electrical pulses. The study of the electrochemically induced drug release from electrosensitive microgel layer on the electrode surface seems to be very promising in construction of new advance drug delivery systems. These volume changes are also interesting in terms of the construction of chemical microvalves, where the flow would be controlled by size of the microgels and, in fact, by changing the imposed potential. Microscopic size of the materials and their ability to undergo oxidation and reduction reactions should create also new possibilities in the construction of specific chemical/electrochemical sensors.