

The main goal of presented project is obtaining a group of nanostructural composite materials containing conducting polymers and several of types of nanoparticles (i.e. metal, semiconductor, inert). Due to their unique properties combining what is the best form conducting polymers and nanoparticles those types of materials have a wide range of applications – in biosensors, energy storage and optoelectronics devices construction, as contact catalysts, in medical diagnostics and so on.

The most of the synthesis carried out during this project will be based on the simultaneous redox reaction between oxidant ions and monomer particles separated in two immiscible solutions. For the comparison electrodeposition of the composite materials from one solution will be carried out. Obtained products will be further investigated by using various techniques such as electron microscopy (SEM and TEM), electrochemical methods, Raman and UV-Vis spectroscopy and XRD.

One of the main goals of the presented project will be surface modification of the solid substrate with a thin layer of the nanostructural composite material containing conducting polymer and metal nanoparticles. We will be focused especially on the non-conducting, flexible solid substrates (i.e. textiles). Then obtained materials will be tested for their antibacterial properties. Because of the improving immunity of the microbes for commercially available antibacterial pharmaceuticals there is a great need to obtain new materials which can be used for that.

The next goal of this project is environmentally sensitive hydrogel matrix modification with a layer of nanostructural composite material containing conducting polymers and metal nanoparticles. This experiments should lead to obtained very perspective hybrid material with unique properties and wide range of possible applications. This complex material should be still environmentally sensitive like unmodified hydrogel matrix and on the other hand should be as well conducting as pure conducting polymers. Those materials should be easily adaptive as a sensing layers in biosensors construction. Modified with conducting polymers composites hydrogel can be good matrix for biologically active elements and also can be some kind of a protective layer against denaturation process which can occur on the unmodified electrode surface. Development of the complex versatile material easily adaptive as a sensing layer in biosensors is very important to wider knowledge for both analytical chemistry and medical diagnostics. And this is main reason why we decided to choose this research topic.

Next goal of presented project is a development of the synthesis procedure which lead to obtain layers of the conducting polymers composites decorated with semiconductors nanoparticles. This material should have highly developed surface and good photochemical properties. Aluminium membranes will be used as a templates which allows to obtain well defined nanostructural conducting polymer composites. Those types of materials are very promising as they can be used in photovoltaic cells and optoelectronics devices construction.

Proposed subject of the investigation is very interesting because can wider an elementary knowledge about conducting polymers and nanoparticle composites materials properties. It also will provide some applications which gives further possibilities for commercialization. Due to this results of this project will have big influence on the progress in analytical chemistry, material engineering and medical diagnostics.