This project is related to investigation of processes important for preparation and function of optical and electrochemical sensors. In both aspects the emphasis is on nanoparticles of polymers of (relatively) high lipophilicity. Such nanospheres (loaded with receptors/ optical transducers) can be introduced to a defined location in the sample, where they can be useful to acquire information about local qualitative/ quantitative composition. The nanoparticles can also be useful to obtain novel materials (e.g. novel composites of conducting polymers) of improved properties due to the presence of nanoparticles, attractive for electrochemical sensors construction.

In general preparation of nanoparticles is a difficult process, however, in some cases it is possible to take advantage of the spontaneous processes – a significantly simplified nanospheres synthesis.

The aim of this project is to look at phenomena related to spontaneous formation of polymeric nanospheres when polymer dispersion in an organic solvent is introduced to the aqueous solution. This will allow application of spontaneous process to preparation of nanomaterial in optimized way. The key important problem is to get information allowing to obtain stable water suspension of nanoparticles bearing surface charge. Such nanoparticles have high potential to stimulate the research in different fields of science and engineering, including development of improved optical sensors or synthesis of novel composite materials based on conducting polymers. The applicability of obtained nanoparticles as nanooptrodes – i.e. selective nanosized optical sensors will be evaluated. The research related to possibility and effect of introduction of nanospheres with surface charge (e.g. due to presence of ionizable groups) as dopants to the conducting polymers, and the applicability of thus obtained composites for electrochemical sensors will be performed in parallel.

Proposed research is focused on studying basic aspects of processes related to nanooptrode responses and to obtain and to study properties of novel composite materials containing conducting polymers and nanospheres. The research is also intended to give answer to the question, is it possible to obtain nanospheres containing tiny particles of other polymers of defined optical activity, in other words is it possible to obtain nanoinclusions inside the nanospheres.

Although proposed research is not oriented on direct application of nanospheres, clearly the motivation to study these issues is search for novel materials, novel operation mechanisms and novel processes potentially useful for analytical chemistry and in particular novel senors development.