Project 3.6 Synthesis of different dimensional nanopolymers for chemosensing

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www: https://ichf.edu.pl/zespoly/polimery-funkcjonalne

Background:

The fabrication of polymer-based nanomaterials with superior adsorbing properties and enzyme like activity heavily relies on structural aspects. Such nanomaterials are becoming powerful competitors and potential substitutes for natural enzymes because of their excellent performance. Additionally, such nanomaterials give freedom to prepare them from scratch, with controllable activity, and environmental resistance. Their applications in chemosensing and catalysis depend on the composition, size, shape, and architecture. Nanoparticles prepared with electroactive conducting polymers (ECPs) allows excellent control of the electrical stimulus. Additionally, such materials are occasionally optically active, and biocompatible.

Direct polymerization methods for nanostructurization of polymer typically require the use of surfactants. Presence of surfactants can affect the properties of electronic devices. Nevertheless, there is a problem with complete removing the surfactants from the resulting polymer particles. Even if no surfactant is added, the size of polymer nanoparticles prepared by precipitation polymerization is limited to around sub-micro size.

Although great progress has been achieved, the development of polymers with enzymes like properties still faces several difficulties, leading to the poor selectivity, and a low density of active sites. In current project, we plan to prepare polymers in the form of 0D and 3D materials. Active centers in such polymers will be easily accessible because of non-restricted diffusion in pores and high surface of materials.

Aim:

In the proposed Project, we plan to synthesize nanostructured polymers. Nanoscale materials with tailorable functionalities, will be modified to tune their application for chemical sensing of chosen proteins/antibiotics and/or for electrocatalysis purposes. Preparation of 3D polymer will be performed by hard molding technique. Sacrificial mold will prepare polymer in the form of an inverse opal with pores of several hundreds of nanometers in diameter. Additionally, polymer in nanoparticle form will be prepared and applied for sensing and electrocatalysis.

Requirements:

- Master of Science (or equivalent) degree preferably in chemistry or physics awarded not earlier than five years before the deadline of the present recruitment,
- the average grade obtained in the course of study is not less than 4.5,
- ability to work independently as well as in a group,
- basic knowledge of supramolecular chemistry, electrochemistry and spectroscopy,
- knowledge of electrochemical techniques (CV, DPV, EIS, etc.), spectroscopic (UV-vis, XPS) and microscopic (AFM, SEM, SECM etc.) and in particular Langmuir-Blodgett techniques and basic knowledge of nanotechnology will be appreciated,
- proficiency in English speaking and writing.