

## PHYSICAL CHEMISTRY

### **Degradable biomaterials with the controlled drug release.**

supervisor: prof. RNDr. Renáta Oriňaková, DrSc. (renata.orinakova@upjs.sk)

study form: full time

Annotation: Preparation of degradable metal implants from elementary metallic powders (Fe, Zn ...). Surface modification of prepared materials with bioactive coatings based on ceramics or based on organic polymeric materials, or their combinations. Incorporation of the drug component into the structure of the prepared coatings, study and characterization of their properties and release kinetics. Detailed study of degradation properties and properties of modified surfaces by electrochemical methods.

### **Metallic degradable implants with bioactive surface.**

supervisor: prof. RNDr. Renáta Oriňaková, DrSc. (renata.orinakova@upjs.sk)

study form: full time

Annotation: Preparation of foam-like metallic biomaterials with defined porosity. Surface modification of prepared foams in order to improve the resulting corrosion, biological (antiocoagulant, antibacterial ...) and mechanical properties. Selection of suitable organic or inorganic coatings and comparison of their influence on the degradation and biological activity of potential degradable orthopedic implants with a porous structure.

### **Development and study of hybrid electrodes for electrochemical detection of viruses.**

supervisor: prof. RNDr. Renáta Oriňaková, DrSc. (renata.orinakova@upjs.sk)

study form: full time

Annotation: The aim of this work is to study the suitable electrode materials for the electrochemical sensors development that would be able not only qualitatively but also quantitatively to determine the amount of virus particles in a sample. It will be primarily the SARS-CoV-2 virus and influenza virus. Next aim is to study the effective immobilisation of nucleic acid aptamers on the electrode surface for the specific detection of viral particles.

### **Preparation and characterization of electrode materials for post-Li ion batteries.**

supervisor: doc. RNDr. Andrea Straková Fedorková, PhD.

(andrea.fedorkova@upjs.sk)

study form: full time

Annotation: Preparation and characterization of new composite materials based on sulfur with conductive additives such as carbon, graphite, graphite oxide, polypyrrole and other. These materials will be tested as new cathodes for post-Li ion batteries where heavy metals are replaced by cheaper and environmentally benign materials. Different electrochemical techniques as cyclic voltammetry, electrochemical impedance spectroscopy or galvanostatic charge/discharge measurements will be

used for characterization of as prepared materials. The main goal of this research is to improve the capacity and performance of new composite materials.

**Modulation of surface energy of the circulation tumor cell as a tool of metastasis inhibition formation.**

supervisor: prof. RNDr. Andrej Oriňak, PhD. (andrej.orinak@upjs.sk)

study form: full time

Annotation: Inhibition of CTC adhesion is formation of metastasis blocked. These are reason that it dies over 99% patients with cancer illness. Modulation of surface energy CTC, binding of specific molecule at receptor of CTC membrane, it decreases/increases surface energy of CTC and this dies without forming metastasis at living important organ.

**Study of PLL dendigrafts as carrier of insulin with auto-release function when blood glucose is high.**

supervisor: prof. RNDr. Andrej Oriňak, PhD. (andrej.orinak@upjs.sk)

study form: full time

Annotation: Poly-L-Lysine dendigrafts look to be a suitable structure as a insulin carrier. They are stomach content resistant and they can be oral distributed. At glucose increasing content in blood, it acts as auto – release structure.