

POPULAR PROJECT DESCRIPTION

Project aim, proposed basic research, justification of Project topic.

Organic complexes with lanthanide cations are of great interest not only as targets for basic scientific research, but also as advanced materials for numerous applications. The most interesting applications are listed below:

- Labeling of confident and classified documentation and banknotes
 - **Applications in high-sensitivity medical diagnostics**
 - Military applications as composite nanopowders to label the military field command posts
 - Applications in “niche” OLED technologies as electroemitters
 - Application of paramagnetic gadolinium complexes in medical diagnostics as contrast agents in Magnetic Resonance Imaging
- The purpose of this Project is a Basic research in the field of advanced photoluminescent materials composed of elaborated europium and terbium complexes and their applications in modern medical diagnostics based on FRET phenomena. One of the most prominent World experts In lanthanide chemistry and physics, Prof. Jean-Claude G. Bünzli, pointed out that “The main challenge in bioanalytics is to design robust complexes, which dissociate as little as possible under biological conditions and feature bioconjugation capabilities in order to specifically target an analyte or a biomarker.” Frontiers in Chemistry, 2013, DOI: 10.3389/fchem.2013.00002.**

Despite the existing commercial bioimmunoassay solutions, still there is a need for innovative discoveries for pathogens diagnosis as In the earliest possible stage, in order to implement the most effective therapies. Based on our earlier experience in numerous domestic and European projects with lanthanide complexes, we want to undertake the challenge of design, synthesis of the novel lanthanide photoluminescent complexes and their physicochemical and biological studies

Tb(III) and Eu(III) cations do not absorb the light in a broad range, thus they do not emit light by themselves. But, in the combination with organic ligands there is the Absorption-Energy Transfer-emission process involving the ligand singlet state excitation, radiationless energy migration to the ligand triplet state, and energy transfer from the triplet state to the emissive level of lanthanide cation. Excited lanthanide cation emits the visible light, or in near infrared.

Medical applications of lanthanide complexes are being used in high-sensitivity screening for pathogens, and also in photodynamic tumor therapy.

The following tasks are planned to be executed In this Project:

1. Design, synthesis and analytical characterization of photoluminescent Eu(III) and Tb(III) complexes – pyridine and 1,10-phenanthroline derivatives.
2. Spectral studies of Eu(III) and Tb(III) complexes – pyridine and 1,10-phenanthroline derivatives. In particular: UV spectra, fluorescence, phosphorescence, photoluminescence quantum yields and lifetimes, evaluation of the singlet S1 and triplet T1 energy levels photostability, stability in buffer solutions.
3. Functionalization of biomaterials with lanthanide complexes (project partner: dr P. Cywi ski, Fraunhofer Institute, Potsdam)
4. Spectroscopic studies of bioconjugates (project partner: dr P. Cywi ski, Fraunhofer Institute, Potsdam)
5. in-vitro studies of bioconjugates in biological systems (project partner: dr P. Cywi ski, Fraunhofer Institute, Potsdam)