DESCRIPTION FOR THE GENERAL PUBLIC

Nanotechnology is one of the most intensively developing and interdisciplinary field of research combining various science achievements. All over the world, the scientists are constantly looking for new phosphors designed for displays (LCD - ***L**iquid-**C**rystal **D**isplay*, FED - ***F**ield **E**mission **D**isplay*) or lighting applications as light emitting diode and white light emitting diode (LED, WLED), infrared light sensors, medical treatment and temperature measurements – nano(thermo)metry. It is expected that the new phosphors will be more efficient, their excitation will be cheaper from an energy consumption point of view comparing to commercially used materials. Furthermore, the color rendering index (CRI) as well as temperature index (TI) will be as high as possible and finally, the excitation source will be safe for the environment (withdrawal of mercury or tungsten lamps). The high-technology materials in the form of scientific and engineering thought are essential at that part of the market. The luminophore, which is characterized by the highest efficiency of energy conversion in the form of the highest brightness and color of light or nanothermal sensor, is highly expected. Lanthanide ions have extraordinary spectroscopic properties, but they are expensive and their quantum efficiency is low. The main drawback of these ions is their high cost, which make the production of high-technology materials and devices based on this materials very expensive. Increasingly importance is paid to "s^2-like" ions, which are cheap and possess interesting luminescence properties depending on crystal field. It could be used to modulate the luminescence properties by crystal field, especially in mixed-compounds (vanadate-arsenates, phosphate-arsenates) to obtain material with desirable properties. Especially interesting can be co-doped materials with lanthanide and "s^2-like" ions.

The project is aimed at development of highly crystalline nanoparticles of arsenates, vanadates, vanadate-arsenates and phosphate-arsenates type compounds ($MX_{1-x}Z_xO_4$ doped with "s^2-like" ions - Pb^{2+}, Bi^{3+} and Sb^{3+} and co-doped with lanthanide ions - Ce^{3+}, Eu^{3+}, Pr^{3+} and Tb^{3+}; where M - rare earth ions; X, Z = P^{5+}, As^{5+}, V^{5+}; $0 \leq x \leq 1$) obtained by wet chemistry synthesis for their potential application as luminophores and laser materials. As a dopant lanthanide ions, "s^2-like" ions as well as both kinds of these ions will be used. The crystal structures and optical properties of the obtained materials will be investigated. Moreover, the impact of the synthesis conditions on the structure and grain size of the nanoparticles as well as the efficiency of the emissions will be investigated. The energy transfer and energy conversion efficiency in the studied systems will be determined by lifetime measurements as a function of the dopant ions concentration and the crystalline grain size. Special attention will be paid to spectral bands, which convert UV light to visible one, because they increase the overall efficiency of phosphor.

The phase purity of synthesized materials will be determined by using X-Ray powder diffraction (XRPD) and the morphology will be carried out by transmission electron microscopy (TEM). The absorption, emission and excitation spectra as well as decay times will be measured to study their spectroscopic properties. As a result, a number of specimens with defined physicochemical properties will be obtained, which will allow to evaluate their potential use as luminophores and laser materials.