The main goal of the project is to check the temperature response of inorganic luminescent nanomaterials doped lanthanides ions. The synthesis and physicochemical characterization of multifunctional luminescent nanomaterials, hybrid core/shell type compounds and luminescent-plasmonic materials doped Ln^{3+} lanthanide ions will also be carried out. As the luminescence phase were chosen: phosphates, borates, vanadates and fluorides doped rare earth elements. As the emission activators such lanthanide ions will be used Pr^{3+}, Eu^{3+}, Er^{3+}, Ho^{3+} , Tm^{3+} and Dy^{3+}. These compounds will be examined for their use in nanothermometry. It is planned to check the temperature response of these luminescent materials. The luminescent-plasmonic nanomaterials core/shell type, which are characterized by strong resonant absorption of UV-VIS-NIR radiation (e.g. $LnPO_4/SiO_2/Ag$) will be also synthesized and examined. The plasmonic phase can change the luminescence properties of lanthanide ions, thus affecting the temperature dependence of the final products.

The synthesis of materials will be carried out in a way that allows obtaining the smallest particles, taking into account the small dispersion of their size and relatively high crystallinity. For this purpose will be used: co-precipitation methods, microemulsions methods and the Stöber method to obtain core/shell type structures. Subsequent research will be carried out, which will consist in thorough analysis of the composition and structure of the obtained products, be using such research techniques as: TEM (transmission electron microscope), SEM *(*scanning electron microscope), EDX (energy dispersive X-ray), FT-IR (Fourier transform infrared spectroscopy), DLS (dynamic light scattering), ICP-OES (inductively coupled plasma optical emission spectrometry) and spectrofluorimetry.

During high-temperature tests the influence of temperature on photophysical properties taking place in the obtained materials such as: emission intensities, band ratios their displacement, bandwidth, luminescence lifetime as well as structural and morphological changes, will be determined. These changes result from the use of light (mainly laser) in the UV-VIS-NIR range on the sample. These research will be carried out using tube furnace. The comparison will include: nanoluminophores as well as luminescent core/shell type products containing a silica shell coating and materials containing plasmonic nanoparticles (Au, Ag) on their surface.

The essence of the phenomenon, the impact of temperature changes on intensity of luminescence and the ratio of band intensities, is the occurrence of several high-energy thermal levels in ion, which are close to each other (in the emission spectrum) and do not differ significantly in energy ($\approx$200-2000cm^{-1}). When the electron is transferred to the excited energy level, due to the supply of additional thermal energy (vibrations of crystal lattice), it can go to the higher level and emit radiation from it, returning to the ground state. The consequence of this process will be the reduction of the intensity of the initial emission band and the appearance of a new band coming from a higher energy level. This feature gives the possibility of using ions such as Tm^{3+}, Nd^{3+}, Pr^{3+} or Er^{3+} as optical nanothermometers by analyzing changes in the intensity of emission of their individual bands. The practical use of many luminescent materials is very difficult due to the reduced depth of penetration of visible light in the human body, which is associated with the light scattering and absorption of light through the tissues. This technical obstacle will be removed by developing up-converting sensors with excitation in the "biological windows" (first "biological window" - 650-950 nm, second - 1000-1400 nm, third 1500-1800 nm), the aforementioned disturbing factors, like the reduced depth of penetration of visible light in the human body, are diminished, thanks to which it is possible to obtain a better penetration depth of light.

A thorough examination of the spectroscopic properties of the synthesized materials will allow to obtain new temperature sensors and the improvement of the quality previously obtained. It will also enable the creation of new sensors and the creation of specialized low-temperature sensors intended mainly for biological research and the potential in in-vivo analyzes, useful in the detection of cancer cells in the human body.