The aim of the project is to investigate and to understand the processes of energy transfers which lead to temperature dependent changes of the emission spectra of nanocrystalline powders and water colloidal solutions of oxide phosphors doped lanthanide ions. During the project both synthesis of nanocrystalline powders and colloidal systems and characterization of temperature dependent luminescent properties. Thanks to this it will be possible to use obtained phosphors as a luminescent thermometers. Changes of the temperature lead to changes of the relative emission intensities as well as luminescent decay times of lanthanides. It is related with physical processes which depends on the temperature like: thermal population of the particular electronic states of lanthanides, broadening of the emission bands and temperature dependent probability of the energy transfer processes between dopant ions. Taking advantage of emission spectra analysis it is possible to analyze the temperature of the cells with nanocrystals via noncontact measurement both in *in vivo* and *in vitro* experiments. As a result of conducted research new, nanosized luminescent thermometers will be created. Except the photodynamic therapy the analysis of the cell temperature allows for analysis of the temperature dependent processes which take place in the living organisms. In order to provide non-contact temperature measurement optically active ions will be used which emits in spectral range called "first and second optical window of biological tissues" – near infrared range. For this spectra range absorption and scattering of light by biological chronophers is reduced. Thanks to this depth on which temperature readout will be possible is significantly extended. Great majority of already reported luminescent thermometers for biological application is based on emission in first optical window of biological tissue (700-950 nm). Number of lanthanide ions emitting in this spectral range is relatively limited therefore possibility of improvement of sensitivity of temperature measurement is reduced. Taking advantage from using proposed in this project second optical window of biological tissue (1000-1400 nm) significantly increases number of ions that can be used and therefore number of combination of emitting ions is extended. This allows, by proper choice of dopants, for enhancing of sensitivity of temperature measurements.