

Nanocrystalline luminescent manometers based on transition metal ions emission

Abstract for the general public

The growing interest in the use of nanoparticles for biological applications, observed in recent years, is associated with the possibility of merging diagnostic and therapeutic functionalities of this type of systems in the form of single multifunctional particle. Noncontact reading of scalar parameters such as pressure with submicrometric spatial resolution gives the opportunity to collect information relevant to understanding many biological processes. A change in local pressure at the cellular level is the first symptom of many diseases such as cancer and Alzheimer's disease. Therefore, the ability to readout pressure without contact at the cellular level can not only provide a lot of information about biological processes, but can also be a source of relevant diagnostic data. The spatial resolution of pressure imaging in most current techniques is insufficient to perform this type of diagnostics. The solution to this problem may be luminescent nanoparticles, whose emission properties depend on pressure. This project proposed the use of luminescence of transition metal ions whose spectroscopic properties strongly depend on the material parameters of the phosphor as well as external parameters such as pressure or temperature, in order to increase the sensitivity of this type of manometers. The goal of this project is to thoroughly investigate and understand which and how material parameters affect the sensitivity of spectroscopic properties of nanoparticles induced by pressure changes. The conducted research will enable to optimize the chemical composition of nanocrystals in order to create nanocrystalline luminescent manometers with high sensitivity to pressure changes. This will increase the pressure reading accuracy and spatial imaging in the future.