Description for General Public

Continuous development of photonic materials implies the possibility of luminescence radiation shape control in order to effectively use them in a specific application. Particular attention, due to the atmospheric pollution sensors, biological analysis or military technology, is focused on the radiation from mid-infrared region (2-5 μm). The solution proposed by the project Author is the use of special glass group based on bismuth and germanium oxides, which unlike to non-oxide materials, could be successfully formed into waveguides (optical fibers). Emission at the band approx. 3 μm have been observed in several rare earth ions e.g. Er^{3+}, Ho^{3+} and Dy^{3+}. Ion direct excitation by laser radiation results in the wavelength emission dependent on the energy difference between excited and lower ion levels. The efficiency of emission transitions in the 2-3 μm range strongly depends on the glass matrix type and the maximum RE ions concentration. Restriction on concentration level, observed as undesirable effect of luminescence quenching, implies a search for another way of increasing the radiation emission efficiency from the mid-infrared region. A new approach to solve this problem is co-doping glass simultaneously with two or three lanthanides. This procedure allows the use of energy transfer mechanisms between ions to optimize the luminescence efficiency.

The scientific aim of the project is to analyze the luminescent properties of bismuth-germanate oxide glasses co-doped with rare earth ions characterized by the mid-infrared region emission. The project implementation will result in determination the mutual concentration of lanthanide co-dopants impact on mid-infrared luminescence parameters in glass and optical fibers based on heavy metal oxides. Active glasses and optical fibers, their thermal, structural and optical properties determination would be distinct effects of the project.