Description for the general public

The research area of the project is in the field of one of the rapidly developing fields of science, which are photonic and concerns new constructions of multicore optical fiber characterized by broadband spontaneous emission (ASE) in the range of 1.0 - 2.1 μm. Sources of radiation characterized by ultra-wideband emission are necessary to use in e.g.: optical telecommunication (2^{nd}, 4^{th} telecommunication windows) medicine (OCT high resolution imaging) and metrological systems. Nowdays the special interest is emphasized into spectral regions 1.0-1.7 μm and 1.5-2.1 μm. Starting from OCT sources, extending the emission range (in the 1 μm band) increases imaging resolution, the 1.5-2.1 μm wavelength range (called eye-safe) is demanding because of the potential applications in both military and civil applications such as telemetry, optical laser systems (LIDAR - Light Detection and Ranging), microsurgery, medical diagnostics and monitoring of industrial and environmental pollution. Current solutions use optical parametric oscillators (OPO) and photonic fibers (supercontinuum). However, they work in pulse mode and usually require excitation with an expensive ns-fs laser. Therefore, new solutions are being sought to build compact broadband radiation sources operating in the near and mid-infrared range.

The main aim of the project is to develop multicore optical fibers from germanate glasses characterized by ASE (continuous wave operation) in the range operating of: 1) 1.5.-2.1 μm - co-doping with rare earth (RE) ions, 2) 1.0-2.1 μm - glass-ceramic (GC) optical fibers. Ultra-broad emission will be obtained by superposition of emission bands from metals (Ni, Cr, Bi) and rare-earth (lanthanides) with power from tens to hundreds of mW. The development of such multicore optical fiber constructions is a challenge (a new approach) and requires optimization of the content of RE - Nd/Yb/ Er/Tm/Ho (controlling donor-acceptor energy transfers), core position (effective absorption coefficient), the number of cores (obtaining a flat spectrum) placed in a common cladding and GC core technology (Bi, Ni, Cr emissions). Such optical fibers will allow the construction of new compact optical fiber sources. The proposed issues represent the innovative nature of research in the field of photonics and materials engineering.

The contribution to the development of science will be a set of basic research on constructions of luminescent multicore optical fibers made of germanate glasses, allowing for obtaining ultra-wideband emission, and in the next steps constructing new sources of radiation operating in the range of 1-2.1 μm.