Investigation of the influence of surface plasmons on stimulated emission in plasmonic nanocomposites doped with rare earth ions

The aim of the project is to investigate the influence of localized surface plasmon resonance (LSPR) on the phenomenon of stimulated emission in plasmonic nanocomposites doped with rare earth ions (Fig. 1). The stimulated emission is the phenomenon which is commonly exploited in lasers, and also in optical amplifiers used in fiber optic telecommunications. One way to increase efficiency of the devices whose operation is based on this phenomenon is exploitation of surface plasmons from metal / semiconductor nanostructures. As demonstrated by the latest scientific discoveries, these materials use a special feature of metallic (semiconductor) nanostructures, which could focus the light in their very small volumes. As a result a number of optical phenomena could be amplified such as spontaneous emission, Raman scattering, stimulated emission and others. Currently plasmonic materials were studied for their use in biosensors, in photo-thermo-cancer therapy, photovoltaic systems, nanolasers.

To the best of our knowledge there are no references in the literature of studying the influence of surface plasmons on stimulated emission from the rare-earth ions. Rare earth ions (mainly lanthanides) found a number of applications in relation to solid-state lasers and solid-state optical amplifiers. For this reason, it is interesting from the point of view of both the scientific and application purposes studying the stimulated emission of rare-earth ions by their interaction with surface plasmons.

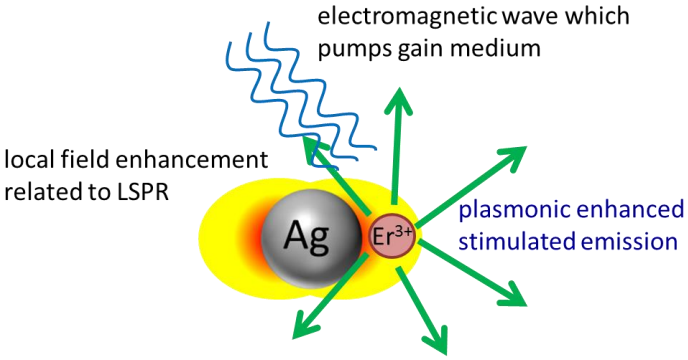

Fig. 1 Scheme which presents main concept of the project

Composites produced in the project will be manufactured by the innovative micro-pulling down method. This is the only case in the world of using the micro-pulling down technique to obtain the plasmonic composites containing metallic (or semiconducting) nanoparticles and rare earth ions. The series of measurements such as spectroscopic measurements, photoluminescent, photoluminescence decay kinetics in order to prove the influence of surface plasmon on stimulated emission of rare-earth ions is planned. Moreover we will also perform measurements of stimulated emission in fabricated materials.