Control over the spatial structure of the nanoparticles with plasmonic properties is one of the most important and intensively developing issues in contemporary nanotechnology. Efforts of many research groups all over the world have been carried out in order to obtain new materials, in which the spatial arrangement of nanoparticles could have been precisely controlled by a series of easily available, low-energy external stimuli. The particular interest in such type of materials is caused by the fact that physicochemical properties exhibited by these materials are directly related to their spatial structure. Thus, having ability to control these structural parameters we can achieve control on the properties of materials.

Investigations conducted so far have been focused mainly to obtain a dynamic self-assembly of nanoparticles in solutions or static self-assembly of nanoparticles in the solid phase. However, for practical reasons- potential use of these type of materials in modern optoelectronic technologies, it is necessary to obtain nanomaterials with switchable optical properties in the condensed state. This aspect is going to be the main interest of this project.

The key objective of the project is to obtain materials, made of plasmonic silver nanoparticles, which spatial structure and in consequence also their optical characteristics – surface plasmon resonance (SPR) and epsilon near zero properties (ENZ), could have been dynamically and precisely controlled by changes of three various factors simultaneously: temperature, UV-VIS light irradiation and pH. To achieve this goal nanoparticles surface will be covered with a mixture of three various functional organic ligands: liquid-crystalline compound (switchability under temperature changes), azobenzene derivative (switchability under UV light irradiation) and spiropyran derivative (switchability under UV-VIS irradiation and pH changes). The structure of molecules on the nanoparticles surface will change under mentioned above stimuli, what in turn will cause changes within the entire „organic coat” of each nanoparticle. Consequently, it will change the arrangement of nanoparticles throughout the whole volume of the material. Diagram that shows the idea of working of the planned material is given in the figure below (**Fig.1**).

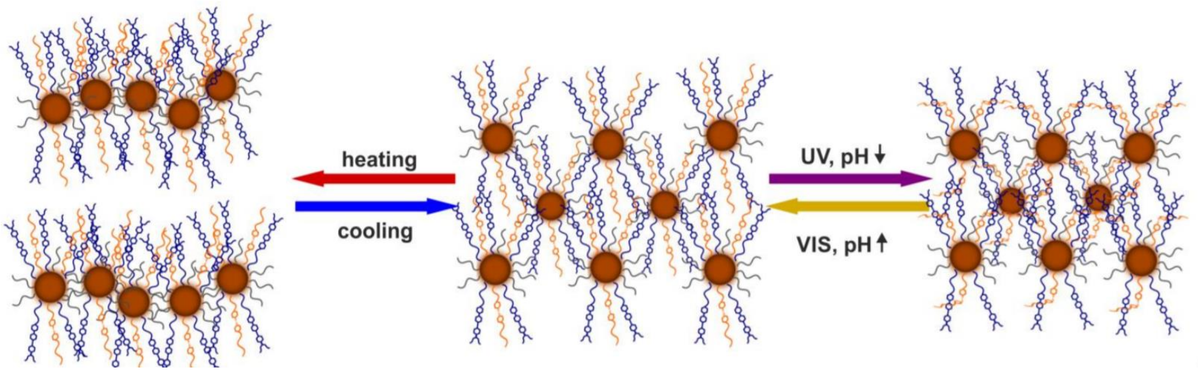

Figure 1. The hypothetical changes in the spatial structure of the planned material under the influence of various external stimuli.

Creation of the outlined in the project new materials will contribute to the development of current optoeletronic technologies, that allow for active control over the light and will be a milestone towards obtaining metamaterials. The most important applications for these systems may be quantum computers and devices with increased data density.