Due to the limited and getting hard to exploration conventional energy sources as well as increasing environment pollution, the actions are undertaken to fabricate materials that can be both used in harvesting energy from alternative sources and in the processes of catalytical purification. An example of such material can be bimetallic Au-Cu nanoparticles homogenously distributed onto the substrate. The combination of these metals as well as their spatial ordering are of great interest because of the possible synergic effect of optical and catalytical properties. Both gold and copper exhibit plasmonic effect. Surface plasmon resonance (SPR) is based on the excitation of plasmons, i.e. collective oscillations of conduction electrons, by light resulting in the enhancement of the electromagnetic field. SPR effect is of key importance for activation of material in visible light that is ca. 43% of whole solar light reaching Earth. Moreover, high catalytic activity of the proposed material can be used for carbon dioxide reduction and selective alcohol oxidation processes.

The aim of this project is to elaborate the fabrication route of **ordered bimetallic mosaic composed of Au-Cu nanoparticles onto conductive titanium substrate and characterization of its morphology, structural and optical properties as well as electrochemical and photoelectrochemical activity**. The substrate will be obtained via electrochemical anodization process resulting in highly ordered titanium dioxide nanotubes that will further undergo chemical etching. In this way, the structured titanium foil will be formed. As-prepared dimpled Ti substrate will be used as a platform for further deposition of thin metallic (Au, Cu) and bimetallic (Au-Cu) layers by means of magnetron sputtering. The thickness of films and the sequence of metallic layers will be changed. In the next step, prepared material will be **thermally treated in gradual and rapid mode** to obtain nanoparticles. In the frames of this project, the research will be carried out in order to determine **correlation between morphology and structure, and optical and electrochemical properties**. Special attention will be put on the in-situ spectroelectrochemical UV-Vis measurements that will allow tracking the changes in the position and shape of the SPR band in dependence on the electrode polarization.

It is foreseen that optimization of processing parameters and the utilization of unique dimpled titanium substrate will lead to formation of ordered bimetallic nanoparticles in configuration of one nanoparticle per one cavity. Additionally, it is predicted that obtained material will show increased absorption in the visible light that is correlated with the increase of its photoactivity understood as photocurrent generation or photoelectrochemical/electrochemical efficiency of CO_2 reduction.