Continuously growing request for energy, together with the depletion of fossil fuels, makes the development of clean, earth-abundant and renewable energy sources one of the most important challenges for the modern science. In this context, gaseous hydrogen has been considered as a very promising alternative fuel, offering very high energy density and environmental friendliness.

Therefore, many different strategies for hydrogen production have been already proposed. However, most of them are either based on fossil fuels or require relatively high production costs. Since the cost of water is negligible, significant attention is recently focused on the methods based on the electricity-driven splitting of water into H_2 and O_2. In 1972 Fujishima and Honda demonstrated for the first time that water splitting could also be achieved by photoelectrolysis. Since then, photoelectrochemical (PEC) water splitting has been attracting a continuously growing interest. However, many challenges still should be solved to improve the energy conversion efficiency to allow a large-scale hydrogen production and practical application of PEC cells.

Therefore, within the proposed project extensive fundamental research will be performed that will result in the development of the new method for fabrication of novel nanostructured photoelectrodes (photoanodes and photocathodes) based on well-ordered arrays of core-shell SnO_2/TiO_2, ZnO/TiO_2, and Cu_2O/SnO_2 nanowires will be developed and optimized. The most innovative aspect of the project will be the use of a new template-assisted electrochemical method to obtain arrays of nanowires with different morphologies (straight, with modulated diameters, Y-shaped and serrated) directly on conductive glass substrates. A complex characterization of as obtained nanostructured photoelectrodes will also be performed in order to establish any correlations between material morphology, composition, structure and its photoelectrochemical activity.

It is strongly expected that the proposed novel core-shell nanowire arrays with unique 3D morphologies will be excellent candidates for efficient photoelectrodes in PEC water splitting systems.