In view of limited resources of conventional sources of energy and increasing environmental pollution, solar energy and methods of conversion of sunlight into electricity and chemical energy are becoming increasingly important. For this reason, research concerning preparation and testing of materials exhibiting visible light activity is very important. Research concerning preparation and testing of materials exhibiting visible light activity are in the field of highly developed interdisciplinary science. The use of new materials in systems capable of converting sunlight into electricity (photovoltaics cell) or chemical energy (photoelectrochemical water splitting, photocatalytic degradation of organic compounds) is conditioned not only by their **ability to absorb radiation in the visible range**, **but also their chemical stability and a small amount of recombination centers for charges generated by light**. An important aspect of the ongoing studies is also the **use of synthesis methods, which would allow a quick and relatively inexpensive way to give the desired material, the form of which would enable its further commercial application.**

Thus, in the project a simple and successful electrochemical method is proposed to prepare MoO_3 directly on the conductive substrate. Molybdenum trioxide has gained interest due to its promising properties (photocatalytic - photoactive material, electrochromic) and possible applications (photovoltaic cells, supercapacitors, batteries). This method was chosen due to the ease of carrying out the process and the ability to control the morphology of the obtained nanostructures. In the literature one can find only one report about this synthetic method and results limited to the possibility of material synthesis and its application in a photoelectrochemical cell. However, no detailed studies of electrochemical properties had been carried out, i.e. faradaic and pseudofaradaic activity, location of the flatband potential, efficiency of the photoelectrocatalytic and photocatalytic process of the degradation of organic contaminants and investigation on the impact of process conditions on the properties of the resulting material. Above described studies will be carried out within the project in order to recognize the mechanism of processes with the use of a molybdenum plate, a thin film and the obtained molybdenum oxide.

The main objective of this project is to determine the effect of morphology andthe structure of the molybdenum trioxide layer on its electrochemical, photoelectrochemical and photocatalytic activity. Thin films are planned to be obtained under various conditions of electrochemical anodization of a molybdenum (Mo) plate and a metallic molybdenum layer deposited onto a semitransparent conductive glass (FTO - Fluorine doped Tin Oxide).

Molybdenum trioxide nanostructures will be prepared by electrochemical anodization of a Mo plate and FTO/Mo materials in different electrolytes. The kinetics and mechanism of this process will be studied using electrochemical methods. The final stage of electrode material preparation will be the crystallization process which will be conducted in a temperature-controlled oven. In order to optimize the preparation of MoO_3 nanostructures, the impact of current-voltage conditions, as well as the composition of the electrolyte on properties of MoO_3 will be determined.

The obtained electrode materials will be examined using various methods for defining the structure (e.g. Raman spectroscopy), optical properties (UV-Vis spectroscopy), composition (X-ray Photoelectron Spectroscopy), surface morphology (Scanning Electron Microscopy) and also photocatalytic properties will be examined.

In comparison with current knowledge, innovation of the planned research includes the method of MoO_3 synthesis (on Mo foil and FTO) and comprehensive studies which allow to characterize the obtained materials and determine the mechanism of MoO_3photoactivity. Therefore, scientific research carried out during project execution will allow to develop areas related to photovoltaic cells, electrochromic devices and photocatalysts, wherein optical and electrochemical properties play the most important role.