

## **MODIFIED ANODIC TIN OXIDE LAYERS WITH COMPLEX INTERNAL ARCHICECTURE AS PROMISING PHOTOANODES FOR PHOTOELECTROCHEMICAL WATER SPLITTING**

Rapid development of civilization results in continuously growing request for energy. With the increasing energy consumption and the depletion of fossil fuels, it is urgent to develop clean, earth-abundant, and renewable energy sources.

In this context, possibility of generation of gaseous hydrogen by photoelectrochemical water splitting seems to be very promising strategy. This method, originally proposed by Fujishima and Honda in 1972 is continuously being improved in order to increase the efficiency of photoelectrolysis of water. Nowadays, the scientific attention is focused mainly on the fabrication of novel semiconducting materials offering the most promising properties.

Therefore, the main aim of the project is the fabrication of highly-efficient photoanode that can be used for photoelectrochemical water splitting. The research proposed within this project innovatively combines several strategies that will allow for fabrication of cheap, stable photoactive material, which will be effectively operating under irradiation with visible light.

Here we propose a novel “host-guest” system composed of two semiconductors with different, precisely adjusted band gaps. Nanoporous tin oxide layer formed by anodic oxidation (anodization) of metallic tin will serve as a “host” material. The most innovative part of the project will be the use of nanostructured tin oxide scaffold with precisely designed, periodical internal structure. Such kind of morphology will significantly enhance optical properties of the material. Moreover, it will be possible to precisely tune the band gap of such semiconductor by its simple thermal annealing under appropriate condition. In addition, an increase of electrical conductivity of the system will be achieved by controlled Sb-doping. Finally, another narrow band gap semiconductor (“guest”) deposited on the porous tin oxide scaffold will be responsible for the effective absorption of visible light.

Synthesis and characterization of novel semiconducting materials is one of the most important issues for increasing renewable energy. The strategy proposed within the project is based on cheap, environmentally-friendly methods which, after suitable optimization, will allow for fabrication of promising materials that can be successfully employed as photoanodes for photoelectrochemical water splitting. The results obtained so far in this area are very promising and were taken into consideration during precise planning of the project.

A great experience of the Nanostructured Materials Group in the fabrication and characterization of anodic metal oxides as well as the access to various research techniques ensure the possibility of complex characterization of as obtained materials and exhaustive analysis of all obtained results.