

Project 3.12. Photoproduction of hydrogen in biphasic systems with electron donor recycling.

Promotor: Prof. dr hab. Marcin Opallo

ICP PAS Group: Team no. 23 Modified electrodes for potential applications in sensors and cells

WWW: <http://groups.ichf.edu.pl/opallo>

Background:

Development of modern societies depends on the way we master sustainable sources of energy. This project is oriented towards mastering hydrogen: an excellent energy carrier and zero-emission fuel. Its use in fuel cells enable diversification of the energy supply and contribute to clean environment. Hydrogen popular use to obtain important substances like ammonia, indispensable for fabrication of numerous products, cannot be overlooked.

Unfortunately hydrogen cannot be easily collected from atmosphere. It has to be acquired from most abundant hydrogen compound - water. Traditional methods of hydrogen production like methane reforming and coal gasification relies on fossil fuels. Still the generation of pure hydrogen by electrolysis depends on the same resources, which are running out. Societies and politicians start to understand that further use of fossil fuels in some technologies and for electricity generation results in irreversible climate changes and is dangerous for our civilization.

The technologies of hydrogen generation based on solar energy emerge as one of the simple and sustainable methods. Solar energy is used for generation of electricity in so called photovoltaic cells to power electrolyzers generating hydrogen or generate hydrogen directly. This project focus on photoelectrochemical system, where hydrogen is generated directly at the interface between water and oil (organic solvent which does not mix with water).

Aim:

Project is aimed at screening and studying efficient systems for the photogeneration of hydrogen based on liquid-liquid interfaces. We propose to reduce the size of the organic phase containing electron donors to droplets or emulsions. In addition, then droplets or a liquid film will be assembled on the flat or porous electrode surface. Target here is to reduce the distance between the reaction (liquid-liquid interface) and electron donor regeneration sites (electrode-liquid interface).

Requirements:

The project combines essential methods physical chemistry, especially electrochemistry, photochemistry and spectroscopy. The successful candidate is expected to show scientific initiative, perform experiments independently, plan the workflow, maintain research notes and participate in the decision making process. He/she will need to build and understand experimental setups, plan and perform control experiments and analyze the data. Contribution through regular reporting and publishing, taking part in and presenting at group meetings and meeting of grant consortium members (from University of Turku, Turku, Finland and from Ecole Polytechnique Federale Lausanne, Sion, Switzerland) is mandatory. Therefore proficiency in English speaking and writing are required.

The background in chemistry, chemical engineering or physics mandatory. Experience in photochemistry, spectroscopy and electrochemistry highly desirable.

Successful candidate is expected to contribute to the functioning of the lab by providing help and supervision to other members of the group and fulfilling necessary administrative and organizational tasks.