

Project 3.3 Electrochemical fixation of CO₂ by heterogenous porous catalysts

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Unit: Research group No. 23. Modified electrodes for potential application in sensors and cells - prof. dr hab. Marcin Opałło

www: <https://ichf.edu.pl/zespoly/elektrody-modyfikowane-o-potencjalnym-zastosowaniu-w-czujnikach-i-ogniwach>

Background:

Persistent increase of CO₂ levels associated to the anthropogenic activities is already confirmed. Therefore designing technologies that imply net zero global CO₂ emission by 2050 is indispensable. Among emerging energy storage and conversion technologies electrochemical conversion (reduction) of CO₂ seems to be prospective, because of its low cost and high efficiency. Although a number of catalyst of this process like metals, metal oxides in the form of nanoparticles is known, one has to cope with low concentration of CO₂ in water under atmospheric conditions next to the catalyst surface, CO₂ is well soluble water, however its concentration is determined by its low content (0.04%) in the atmosphere. In order to increase efficiency of electroreduction of CO₂ one has to use porous material capable to increase local CO₂ concentration as a scaffold for nanocatalyst deposited on the electrode surface. Porous organic polymers are one of the possible options. Although one can find examples of polymers based on macrocyclic precursors having extensive chemisorption sites (N atoms) or perfluorinated porous polymers with similar properties. Nevertheless, the development of electrocatalysts based on porous organic precursors exhibiting long term stability is still challenging.

Aim:

The goal of the project is to synthesis of porous organic polymer with CO₂-philic sites, which will be applied as a scaffold for nanocatalyst for CO₂ electrocatalytic reduction deposited on the electrode surface. The project will involve synthesis of selected porous organic polymers, its characterization, deposition on the electrode surface together with metal nanoparticles and electrochemical experiments to explore their electrocatalytic activity and selectivity.

Requirements:

- MS degree in Chemistry or related and interest in physical/polymer chemistry
- Proficiency in English and team player attributes
- Some experience in organic preparative synthesis, and physicochemical techniques for materials characterization
- Basic knowledge about electrochemistry
- Pleasure in experimental work, creativity and problem solving ability