Federal Ministry of Education and Research

CO_2WIN Use Carbon Sustainably

CO_2SimO – Photoelectrochemical CO_2 reduction with simultaneous oxidative raw material production

CO_2 as a sustainable source of carbon – Pathways to industrial application (CO_2-WIN)

The project "CO_2SimO" develops a photoelectrochemical cell (PEC), that uses solar light to convert carbon dioxide (CO_2) into the energy carrier methane. Simultaneously, water is oxidized to hydrogen peroxide, an important bleaching and disinfection agent. "CO_2SimO" is a joint cooperation project between two industry partners, two research institutes, and two universities. The results of this project will help to use CO_2 for solar energy storage and can contribute to climate protection. The project is funded as part of the funding measure "CO_2 as a sustainable source of carbon – Pathways to industrial utilization (CO_2-WIN)". The measure supports projects that utlilize carbon dioxide as raw material for the German economy.

Carbon dioxide for solar energy storage

In view to climate change and increasing energy demand it is not enough to reduce CO_2 emissions. It is also necessary to make use of the CO_2 content already existing in our atmosphere.

A promising tool for utilizing CO_2 is solar energy and the solar production of valuable fuels and chemicals by so-called photocatalysts. The solar conversion of CO_2 has the advantage of directly producing a storable and transportable energy carrier. The project "CO_2SimO" develops a photoelectrochemical cell (PEC) for the future use of CO_2 as raw material for the solar production of methane and hydrogen peroxide.

A new approach for CO_2 conversion

The project focuses on developing new photocatalysts which can make solar energy usable to drive a chemical reaction. These new photocatalysts will be transferred into gas diffusion electrodes, which are well known for several decades from fuel cell technology or electrolysis.

This new approach allows for longer lifetimes and higher efficiencies of solar CO_2 conversion. The valuable hydrogen peroxide (compared to oxygen, which is a product in other PEC concepts) is promising to make this approach economically feasible.

The gas diffusion electrode will convert CO_2 to methane directly in the gaseous phase using solar light. Therefore, solubility of the starting materials, the products, or the photocatalyst into a liquid medium is not an issue. This unique and new approach is not investigated to date.

"CO_2SimO": A new approach for CO_2 conversion.

The combination of CO_2 reduction to methane with water oxidation to hydrogen peroxide has not been studied yet and is promising from an economic viewpoint. The product methane can be used not only as a fuel but also as a resource for any process using oil and natural gas as raw material. Hydrogen peroxide is widely used as a bleaching and disinfection agent and is investigated as a potential energy carrier for fuel cells.

From fundamentals to industrial production

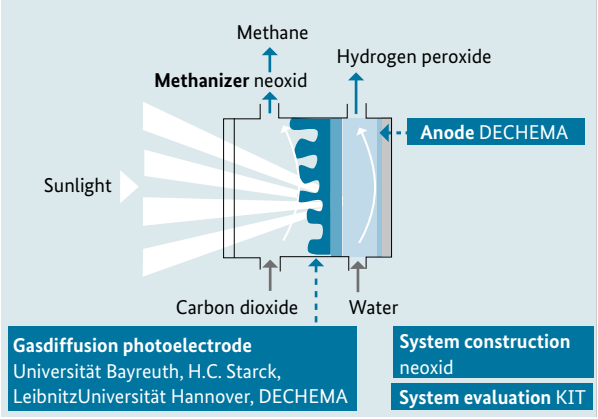
The development of the PEC is realized within this joint research project starting with fundamental research of reaction mechanisms, material optimization, process and system development, as well as sustainability analysis.

"CO_2SimO" is a joint cooperation project between two industry partners, two research institutes and two universities. The University of Bayreuth is searching for new photocatalysts, the Leibniz University Hanover is focusing on fundamentals of the chemical processes. H.C. Starck

Tantalum and Niobium GmbH will prepare the photocatalysts on a larger scale based on the results from the University of Bayreuth.

The DECHEMA Research Institute will develop electrodes for the PEC, while neoxid GmbH will realize the final PEC. With a new methanisator developed by neoxid the methane concentration in the gas mixture from the PEC will be enhanced. With the help of lifecycle analysis, the Karlsruhe Institute of Technology will analyze the "CO_2SimO" concept regarding its contribution to sustainable chemical production.

The project "CO_2SimO" will contribute to the reduction of greenhouse gas emissions and the dependence on fossil fuels. The two industrial partners aim to produce photocatalysts and photoelectrochemical cells in Goslar and Neuss, respectively.



The project and the partners.

Funding initiative
CO_2 as a sustainable source of carbon –
Pathways to industrial utilization (CO_2-WIN)

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CO_2SimO – Photoelectrochemical CO_2 reduction with Simultaneous Oxidative raw material production

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Project partner
University Bayreuth; H.C. Starck Tantalum and Niobium GmbH; DECHEMA-Research Institute; Leibniz University Hannover; neoxid GmbH; Institute forTechnology Assessment and System Analysis at the Karlsruhe Institute for Technology

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