Fraunhofer UMSICHT

L-II | Methanol Synthesis

Investigation of the steel mill gas-based production of methanol

Demonstration plant for methanol synthesis in Oberhausen.

Background

Within the Carbon2Chem® joint project, technologies are being developed to reduce CO_2 emissions at large industrial sites by using gases with CO and CO_2 as a source of raw materials for the chemical industry.

The focus lies on forming cross-industrial value cycles and increasing energy efficiency by establishing cross-industrial networks for a climate-neutral production.

This will be shown using the steel production location Duisburg in North Rhine-Westphalia as an example.

Objective

Subproject L-II aims to demonstrate the production of methanol from steel mill gases containing different concentrations of CO_2, CO, H_2 and other (minor) components. As a result, tests are being conducted in Duisburg on the production of methanol with purified gases from the steel mill. Various testing plants are used for the investigations. The spectrum ranges from the smallest scale (capacity of a few milliliters per day) to a demonstration plant with a daily capacity of 50 liters. A further project objective is the optimized operation of the process under dynamic conditions. New control concepts are being applied here with AI methods, such as model predictive control and co-simulation. This allows the process to be further optimized.

> "The efficient synthesis of methanol from CO_2 and hydrogen represents a central element of the raw material and energy transition."
>
> Dr.-Ing. Andreas Menne
> Head of the Carbon2Chem®-subproject "Methanol Synthesis"

Carbon2Chem®

Tasks

Three testing plants, which can be operated continuously and automatically, are used to work on the project at Fraunhofer UMSICHT. Online analytics make it possible to directly evaluate the test data to determine the influence of the parameters feed gas composition, temperature, pressure and residence time.

Alongside long-term tests on the influence of real gases on the catalyst and the process, the testing plants are used to acquire, save and automatically evaluate process data to further optimize the process. Digitalization tools and process simulations are used here to further adapt the process to a dynamic and flexible operation.

Milestones

- Investigation of the influence of feed gas composition on methanol synthesis
- Identification of catalyst poisons
- Investigation of the dynamic operation of the process
- Long-term tests with a varying feed gas composition
- Construction and commissioning of a demonstration plant with a capacity of 50 liters per day

Project duration

The green light for the Carbon2Chem® project was given on March 15, 2016. In the second project phase (start: June 1, 2020, duration: 4 years), the focus lies on transferring the basic principles on a pilot-plant scale and operating testing plants under industry-oriented conditions. The focal point here is the further evaluation and development of technology. The implementation phase is then planned, in which the results are brought into industrial application.

Further information

Other project partners in L-II

- Nobian (coordination)
- thyssenkrupp AG
- Fraunhofer Institute for Solar Energy Systems ISE
- Ruhr University of Bochum, Laboratory of Industrial Chemistry (LTC)
- Clariant Produkte (Deutschland) GmbH

Project website
www.umsicht.fraunhofer.de/carbon-cycle

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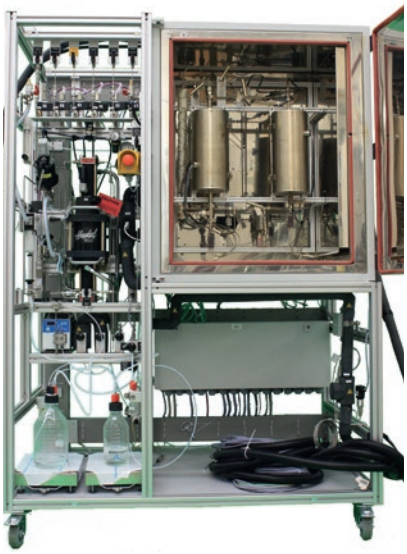
Laboratory facility for methanol synthesis.



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