Fraunhofer UMSICHT

L-III | Gas Purification via Thermocatalysis

Heterogenous catalytic conversion of oxygen traces

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-III aims to develop and implement gas purification and treatment technologies for steel mill gases.

In this context, thermocatalytic deoxygenation represents a partial step towards gas purification and treatment.

This specific subproject aims to convert oxygen traces from process gases that arise as part of coke production in the coking plant process (coke oven gas).

> "It is not possible to use gas flows containing CO_2 from a steelworks without suitable gas treatment."
>
> Dr.-Ing. Barbara Zeidler-Fandrich
> Head of the Carbon2Chem®-subproject "Synthesis Gas"

Carbon2Chem®

Tasks

The catalytic removal of oxygen traces from complex gas mixtures, as exist in the steel and metallurgical industry, has so far not been sufficiently researched.

In this context, Fraunhofer UMSICHT is conducting research into the thermocatalytic conversion of oxygen traces from coke oven gas. The work focuses on identifying appropriate cost-effective catalysts and determining suitable process parameters.

To this end, investigations with model gases are carried out in the Carbon2Chem® laboratory in Oberhausen and with real coke oven gas at the Carbon2Chem® pilot plant station in Duisburg in the second phase of Carbon2Chem®. The investigations with model gases are used to specifically examine defined reaction parameters such as pressure, temperature and gas composition.

The knowledge gained from these investigations forms the basis for selecting the catalysts and their usage conditions in real coke oven gas.

Milestones

- To examine complex gas mixtures, a syngas test station was set up in the Carbon2Chem® laboratory.
- Specific analytics enable a time-resolved measurement of the main and trace components in the seconds range.
- Until now, three catalyst systems (precious and non-precious metal systems) have been tested with synthetic model gases under atmospheric pressure in laboratory conditions.
- The investigated non-precious metal systems showed fundamental potential for oxygen removal and may represent an inexpensive alternative to precious metal systems.
- The most promising catalyst system showed constant oxygen conversion of over 80 % with a temperature of 250 °C and the presence of around 100 ppm H_2S.

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Project duration

The green light for the Carbon2Chem® project was given on March 15, 2016. After the focus in the first project phase was placed on process development under laboratory conditions, the focus in the second project phase (start: June 1, 2020, duration: 4 years) is being shifted to a much greater extent onto the operation of catalysts with real gases from the steelworks process.

Further information

Other project partners in L-III

- Linde GmbH (coordination)
- thyssenkrupp AG
- Clariant Produkte (Deutschland) GmbH
- Ruhr University of Bochum

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

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Contact

Sung Youn Suh, M.Sc.
Catalyst Synthesis/
Research assistant in the
Joint project Carbon2Chem®
Phone +49 208 8598-1430
sung.youn.suh@
umsicht.fraunhofer.de

Dr.-Ing. Barbara Zeidler-Fandrich
Head of Department
Chemical Energy Storage/
Head of the Carbon2Chem®-subproject
"Synthesis Gas"
Phone +49 208 8598-1143
barbara.zeidler-fandrich@
umsicht.fraunhofer.de

Fraunhofer Institute for Environmental,
Safety and Energy Technology UMSICHT
Osterfelder Strasse 3 | 46047 Oberhausen | Germany
www.umsicht.fraunhofer.de