Aims

The aim of subproject L-III is the development and implementation of gas cleaning and processing technologies for steel mill gases. In this context, the thermocatalytic deoxygenation represents a substep for gas cleaning and conditioning.

The aim of this specific subproject is the conversion of oxygen traces from process gases, which are produced during the coke production in the coking plant process (coke oven gas).

Background

Within the Carbon2Chem® project, technologies are being developed to reduce CO₂ emissions at large industrial sites by using the emissions as a new source of raw materials for the chemical industry. The focus lies on forming cross-industrial value creation chains and increasing energy efficiency by establishing cross-industrial networks.

This will be shown using the steel production site Duisburg/NRW as an example.

Aims

The aim of subproject L-III is the development and implementation of gas cleaning and processing technologies for steel mill gases.

In this context, the thermocatalytic deoxygenation represents a substep for gas cleaning and conditioning.

“Without suitable gas treatment, it is not possible to use the CO₂-containing gas streams of a steel mill.”

1 Dr.-Ing. Barbara Zeidler-Fandrich, Head of Carbon2Chem® subproject “Synthesis Gas”.

Fraunhofer Institute for Environmental, Safety, and Energy Technology UMSICHT
Osterfelder Strasse 3
46047 Oberhausen
Germany

Thomas Wiesmann, M. Ing.
Catalytic Processes
Phone +49 208 8598-1527
thomas.wiesmann@umsicht.fraunhofer.de

Dr.-Ing. Barbara Zeidler-Fandrich
Head of Department
Chemical Energy Storage
Phone +49 208 8598-1143
barbara.zeidler-fandrich@umsicht.fraunhofer.de

www.umsicht.fraunhofer.de
The Carbon2Chem® project was launched on March 15, 2016. After the first project phase focused on process development under laboratory conditions, the second project phase (start: June 1, 2020, duration: 4 years) will focus more strongly on the operation of the catalysts with real gases from the steel mill process.

Further project partners in L-III
- Linde GmbH (coordination)
- thyssenkrupp AG
- Clariant Produkte (Deutschland) GmbH
- Ruhr-Universität Bochum

Tasks
Project duration 2020 to 2024

The catalytic removal of oxygen traces from complex gas mixtures such as those found in the steel and steel mill industry has not yet been sufficiently researched.

In this context, Fraunhofer UMSICHT is researching the thermocatalytic conversion of oxygen traces from coke oven gas. The work focuses on the identification of suitable low-cost catalysts and the determination of suitable process parameters.

For this purpose, in the second phase of Carbon2Chem®, investigations with model gases in the Carbon2Chem® laboratory in Oberhausen as well as with real coke oven gas in the Carbon2Chem® technical shop in Duisburg are carried out. In laboratory investigations with model gases under defined reaction parameters, such as pressure, temperature and gas compositions, are carried out.

Based on these investigations catalysts and their operating conditions in real coke oven gas are selected.

Milestones
Project duration 2016 to 2020

- A synthesis gas test rig was set up in the Carbon2Chem® laboratory to investigate complex gas mixtures.
- A specific analysis allows a time-resolved measurement of the main and trace components in the range of seconds.
- Up to now three different catalyst systems (precious and non-precious metals) have been tested with synthetic model gases at atmospheric pressure under laboratory conditions.
- The non-precious metal systems investigated showed a fundamental potential for oxygen removal and may represent a cost-effective alternative to precious metal systems.
- The most promising catalyst system showed a constant oxygen conversion of more than 80 % at a temperature of 250 °C and the presence of about 100 ppm H₂S.

Project duration

The Carbon2Chem® project was launched on March 15, 2016. After the first project phase focused on process development under laboratory conditions, the second project phase (start: June 1, 2020, duration: 4 years) will focus more strongly on the operation of the catalysts with real gases from the steel mill process.

Further information
www.umsicht.fraunhofer.de/carbon-cycle
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