

Solid Carbon Capture Utilisation and Storage (SCCUS)

Catalytic conversion of CO₂ into stable solid carbon materials

The goal is to further develop and validate an SCCUS technology that converts CO₂ into solid carbon materials. This opens up new opportunities for carbon management, integration into industrial processes, and carbon-based value creation by transforming CO₂ from an emission stream into a potentially usable solid carbon raw material.

Background

The defossilisation of industrial processes requires not only the reduction of CO₂ emissions, but also new approaches for dealing with unavoidable carbon streams. While conventional Carbon Capture and Storage (CCS) concepts focus on the geological storage of CO₂, converting CO₂ into solid carbon materials offers additional opportunities for carbon management and carbon cycles. Against this background, University of Applied Sciences Zittau/Görlitz and the German Aerospace Center (DLR) are jointly developing an SCCUS (Solid Carbon Capture, Utilisation and Storage) technology in which CO₂ is catalytically converted into solid carbon.

Technology Approach

The SCCUS process is based on a two-step reaction process. First, CO₂ and methane are catalytically converted into syngas. In a subsequent reaction step, solid carbon is formed from the syngas. The approach therefore combines CO₂ conversion, carbon capture, and material production in an integrated process (TRL 4). The produced carbon is a solid, highly space-efficient material that can be stored, transported, or potentially used as a raw material.

Research Questions

The research focuses in particular on:

- Process design to improve efficiency
- Adaptation of process units to different material streams
- Reaction kinetics and mechanisms of carbon formation
- Catalyst development and catalyst stability
- Structure-property relationships of the produced carbon materials
- Process modelling and scale-up
- Integration of the process into industrial material and energy flows

A particular focus is on controlling the material properties of the produced carbon, as these are important for potential applications and utilisation pathways.

Project Expertise

German Aerospace Center (DLR)

- Analysis of reaction kinetics and kinetic modelling
- CFD simulation
- Thermogravimetric analysis (TGA)
- Material characterisation (XRD, SEM)

University of Applied Sciences Zittau/Görlitz (HSZG)

- Development and operation of the SCCUS pilot plant (TRL 4)
- Process and measurement technology
- Experimental validation
- Plant operation and scale-up studies

Opportunities for Collaboration

For the next development and demonstration phase, we are looking for industry and research partners interested in further developing SCCUS and testing it in real-world applications:

- Material companies for the application and evaluation of carbon products
- Industry partners interested in carbon management and circular economy concepts
- Partners providing pilot and demonstration environments
- Plant engineering and engineering companies for scale-up and system integration
- Operators of facilities with relevant CO₂ or process gas streams