Lehrstuhl für Energiesysteme
TUM School of Engineering and Design
Technische Universität München

Semesterarbeit

(Theoretical)

Development of Direct Air Capture Plant Model at Pressurized Operation for Holistic Process Integration

Description:

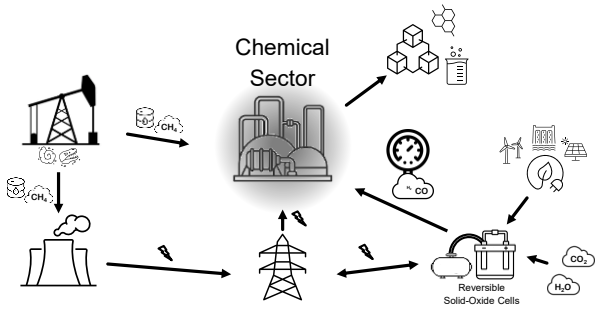
Direct Air Capture (DAC) technologies are gaining increasing attention as a key component of future carbon-neutral energy and industrial systems. By extracting carbon dioxide directly from ambient air, DAC enables the provision of sustainable carbon feedstock for Power-to-X (PtX) applications, synthetic fuel production, and long-term carbon management strategies. In particular, the combination of DAC with high-temperature electrolysis technologies offers significant potential to produce renewable synthesis gas and downstream chemicals.

This work focuses on the development of a process model of a Direct Air Capture (DAC) plant in Aspen Plus. The model will represent the main process units as well as the associated mass and energy flows of a selected DAC process concept. The developed model will be used to analyze process performance under different operating conditions and to identify key factors influencing energy demand and overall system efficiency. Furthermore, it will provide a basis for future studies on the integration of DAC technologies into Power-to-X and carbon utilization pathways.

Building upon the developed process model, selected operating strategies and process configurations will be evaluated through sensitivity studies. In particular, the influence of operating pressure in key process units will be investigated to assess its impact on process performance, energy consumption, and overall plant operation.

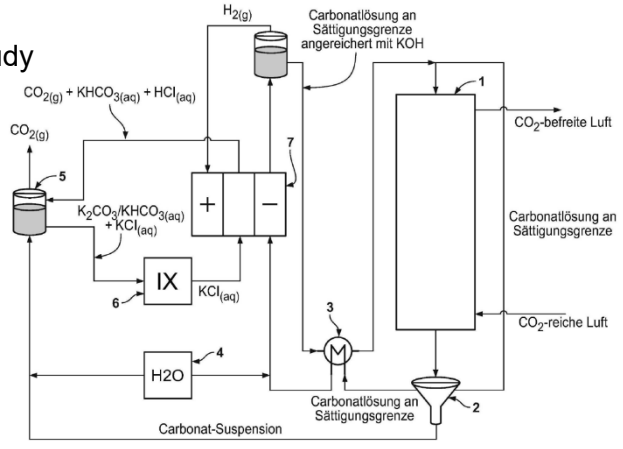
Requirements

- Interest in process modeling and simulation
- Basic knowledge about energy conversion technologies
- Motivation to learn or experience with Aspen Plus or familiar simulations software



Work packages:

- Literature review on DAC technologies
- Evaluation of the state of the art of DAC modeling
- Development of a DAC process model in Aspen Plus
- Parametrization of the DAC and BOP and evaluation of mass and energy balances
- Analysis of different operating conditions via sensitivity study
- Investigation of selected process modifications, such as pressurized operation of key process units



Start: immediately

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