Semester/MSc project proposal

Process modeling of CO2 conversion and separation systems

General Information:

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Background

Currently, Carbon Conversion and Separation (CCS) technologies are often applied in large-scale industrial plants. However, the chemical conversion and separation of CO2 from exhaust gases is also of importance for small-scale power plants, to decrease their environmental impact. In Solid Oxide Fuel Cell systems, the anode off-gas typically contains H2O, CO2 and unreacted fuel gases. To achieve carbon-negative emissions, it is therefore of interest to find suitable CCS technologies. This student project is part of an EU research project on bio-syngas fed SOFC systems.

Objective

The purpose of this project is to develop a thermodynamic process model in AspenPlus for chosen commercial or precommercial CCS technologies (e.g. catalytic conversion of CO2, separation of CO2 via membranes, etc.) and to validate it with literature data. This model should then be used to compare and rank different precommercial and commercial CCS technologies based on their performance, costs and potential for small-scale SOFC systems. For a Master's project, the model could be further expanded by implementing reaction kinetics.

Tasks

1. Literature review. State of the Art CCS technologies, process modeling
2. Develop process model of different CCS technologies in AspenPlus
3. Validation of model using literature data
4. Sensitivity analysis of main parameters
5. Comparison of CCS technologies with case studies
6. (If master project) Include reaction kinetics
7. Written report

Prerequisites

Fundamentals in thermodynamic and chemical processes, ideally experience in process modeling with AspenPlus. Motivation, structured working and reliability very important.

Note: Adjustments can be done according to progress, results and project duration.