Master Thesis

for students of Energy Technologies, Renewable Energies, Mechanical Engineering, Environmental Engineering, WASTE, process Engineering and similar study programs

Blast Furnace Top Gas Recycling with CO₂ capture by Calcium Looping: Process simulation case study for an existing steel mill

Background:
The Calcium Looping (CaL) process is a CO₂ capture technology. It uses natural limestone as sorbent in a high temperature dual fluidized bed process. Due to the high temperature level at which waste heat of this process is available, CaL has the potential for efficient energy recovery, using a steam cycle. Therefore, the process allows for high CO₂ capture rates at relatively low efficiency penalties. The process is based on the equilibrium reaction of limestone (CaO+CO₂→CaCO₃). Through the variation of temperature from 650°C in the carbonation reactor to 900°C in the sorbent regenerator, the equilibrium is shifted from calcium carbonate to calcium oxide and vice versa for capture and release of CO₂. The CaL technology was originally developed for CO₂ capture from power plant flue gases, but recently has been modified for an application in other CO₂ intensive industries (e.g. cement production).

Process:
Within this project, the CaL process shall be investigated for CO₂ capture from blast furnace (BF) top gas. In that way, the top gas can be reused for iron ore reduction in the blast furnace and hence reduce the carbon intensity of the ironmaking process.

Objectives and approach:
Within a master thesis project, a case study on the application of CaL for CO₂ capture from BF top gas of an existing European steel mill shall be conducted using the commercial simulation software Aspen Plus®. An industrial steel mill operator will support the project. The thesis will be based on a previous MSc. project in which a similar but more generic process model was developed to benchmark the CaL process versus other CO₂ capture technologies. The following aspects need to be covered by the project:

1. Familiarization with literature, CaL and BF processes and the existing model
2. Gathering of required site specific information and data from the steel mill
3. Adaption of the process model
4. Determination of key performance indicators

Requirements:
Interest in process technologies and process modelling, good knowledge of English, ability to work independently

Starting date: Immediately

Interested students please contact:

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