

Master thesis

as of now

Commissioning of a microwave plasma reactor for thermal cracking of tar compounds.

One research focus of the Chair of Energy Process Engineering is the gasification of biomass and the subsequent methanation of the synthesis gas produced to substitute fossil methane. As an alternative to methanation, the gas produced can serve as a base material for a wide variety of syntheses in the chemical industry. The importance of such gasification processes has increased rapidly in recent years due to climate change and the price increase on the natural gas market as a result of the Ukraine war. In addition to the desired product, synthesis gas, large quantities of tar-containing components may also be formed, depending on the design of the gasifier. These can be separated from the synthesis gas by condensation and scrubbing. The liquid phase (pyrolysis oil) can still contain large amounts of the fuel energy used and can be further processed into a wide variety of products and synthetic fuels by suitable process steps. Alternatively, the tar compounds contained in pyrolysis oil and condensate can be thermally or catalytically cracked to maximize the synthesis gas yield. In the future, electrical heating of such high-temperature processes will offer the possibility of using inexpensive surplus energy and thus not having to expend the chemical energy bound up in the oil, which can significantly increase the calorific value of the resulting synthesis gas.

Within the scope of this master thesis, a microwave plasma reactor is to be put into operation and initial experiments on the thermal cracking of lean gases and pyrolysis oils dissolved in condensate are to be carried out. The aim is to identify stable operating points of the reactor and to analyze the temperature-dependent gas composition.

Tasks:

- Set-up and recommissioning of a microwave plasma reactor
- Planning and execution of cracking experiments
- Systematic evaluation and classification of the results
- Written documentation of the work

Requirements

- Interest in experimental development
- Laboratory experience is an advantage, but not mandatory

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