

Bachelor / Master Thesis

Integration and Commissioning of an Extended Gas Control System on a FLOX Burner for Biogenic Synthesis Gas

Content:

In industry, fossil fuels – particularly natural gas – continue to be the primary source of (high-temperature) process heat. The BioProcessHeat research project is investigating a CO₂-saving process pathway in which fossil natural gas is replaced by climate-friendly, biogenic synthesis gas produced through the thermochemical gasification of biomass. The aim is to develop efficient and economically competitive process chains for the provision of renewable process heat. A central component of this process chain is the combustion of the synthetic gas produced. For this purpose, a FLOX® burner from the company e-flox is used, which enables low-emission and stable combustion through flameless oxidation. The burner is currently designed to switch automatically between flame operation (high-calorific gas) and FLOX operation (low-calorific gas) once a certain temperature (approx. 850 °C) is reached.

As part of this final thesis, the burner's existing gas control system is to be upgraded and adapted. A new gas control system will enable syngas to be used even in flame mode, as well as allowing for more precise control of the switch between operating modes. Furthermore, the new gas control system is designed for higher temperatures, so that, in the future, hot synthesis gas can also be fed directly from the gasification process to the burner. The aim of the thesis is to integrate the new gas control system into the existing pilot plant and to adapt the control and regulation structure. In particular, the temperature enable signal, which was previously linked directly to the burner control system, is to be integrated into the PLC in order to enable a more flexible and better-controlled switchover between flame and FLOX operation. Finally, the functionality of the system is to be verified experimentally.

Task Description:

- Familiarisation with the operation of the FLOX burner and the existing gas control system
- Analysis of the existing plant and control structure (including sensors and CBFF connection)
- Mechanical integration of the new gas control system onto the burner
- Integration of the existing and new sensor systems into the existing plant control system
- Adaptation of the control logic, in particular integration of the temperature signal into the PLC for controlled activation of FLOX operation
- Verification and implementation of appropriate safety and operational logic
- Commissioning of the adapted plant
- Documentation of the work, as well as evaluation and presentation of the results

Requirements:

- An interest in experimental work, plant operations and control engineering
- Experience with PLCs or industrial control systems is an advantage
- Good manual skills
- A structured and independent approach to work
- Working language: German or English

Start: from April 2026



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