

Oil shale oxyfuel CFB combustion

Summary

EU has adopted new climate policy also known as Green Deal. This puts energy production into totally new situation. The current PhD topic will deal with energy security and climate neutrality in new perspectives. To be more precise this research will be based on Carbon Capture and Utilization Technologies - Oxyfuel combustion. Tallinn University of Technology has an exciting research opportunity for a motivated graduate to investigate the oxyfuel CFB combustion of low rank coal - Oil Shale, in O₂/CO₂ environment rather than air, and the production of a pure stream of CO₂ for storage. After defense the applicant will receive PhD position in Mechanical Engineering, with the field of Thermal Power Engineering

Research field:	Mechanical engineering
Supervisors:	Prof. Dr. Alar Konist Dmitri Nešumajev
Availability:	This position is available.
Offered by:	School of Engineering Department of Energy Technology
Application deadline:	Applications are accepted between June 01, 2020 00:00 and July 03, 2020 23:59 (Europe/Zurich)

Description

Oxyfuel combustion is one of the leading technologies considered for capturing CO₂ from power plants with CCS. The main difference of oxy-fuel combustion from regular firing is that the combustion occurs in a CO₂-based environment instead of N₂. This affects combustion of organic matter and reactions of mineral matter. In order to control the flame temperature, some part of the flue gas are recycled back into the furnace/boiler. This will enable the use of the power plants burning such as oil shale or other fossil fuels during the period of transition to renewable energy sources.

To capture the CO₂ from a power plant, the main purpose of using this technology is to generate a flue gas with high concentration of CO₂ and water vapour; and then separate the CO₂ from the flue gas by dehydration and low temperature purification processes.

The ultimate goal is to study oil shale oxy-fuel CFB combustion on 60 kWth CFB combustion test facility (<https://www.ttu.ee/institutes/departments-of-energy-technology/laboratories-and-services-10/>). Focus will be on the possible changes in forming ash during oil shale CFB combustion in oxy-fuel mode.

To be more precise, this study will base on the following:

- combustion process of a particle,
- mineral matter behaviour,
- produced flue gas pollutant content, and
- CO₂ formation and emission.

In order to achieve the above goals experimental work is planned on a thermogravimetric analyser, a batch reactor, and a 60 kWth CFB combustor.

Responsibilities and tasks:

- Prepare a research plan with the help of the supervisor and carry out research according to the plan.
- Conduct necessary laboratory experiments.
- The PhD student will work closely with collaborators from TalTech and abroad (e.g. USA) and will be expected to participate in relevant national and international conferences, and develop journal papers within the research field.

Qualifications

The applicants should fulfill the following requirements:

- Master degree in thermal, chemical or mechanical engineering
- Good speaking and writing English
- Practical experience in writing a scientific paper is a plus.



- Previous working in lab.

General info:

PhD studies in Tallinn University of Technology are without *tuition* fee.

The selected candidate will be university employee/student and part of Research Group of Sustainable Energy and Fuels. The title will be Early stage researcher- PhD student. Salary/ income including scholarship is around 1100 EUR net and it is fully funded for 4 years. Health insurance coverage is available for the full nominal study period of PhD studies (4 years).



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