UNIVERSITY OF BORÅS

Modeling of combustion processes – theory and application

Modellering av förbränningsprocesser – teori och tillämpning

7.5 credits

Ladok Code: A506TA
Version: 4.0
Established by: Committee for Education in Technology 2017-09-22
Valid from: Spring 2018

Education Cycle: Second cycle
Main Field of Study (Progressive Specialisation): Energy Technology (A1F)
Disciplinary Domain: Technology
Prerequisites: Fulfills the demand for admission to the master program Resource Recovery.
Subject Area: Energy Technology
Grading Scale: Seven-degree grading scale (A-F)

Content

One important part within combustion processes is the actual combustion of different materials. This course treats the important concepts during combustion and the students will perform calculations in near real process conditions within the laminar region. The students will repeat the fundamental theories regarding transport processes and thereafter apply them. The main focus is heat transfer which includes conduction, convection and radiation but momentum and mass transfer are also included. This means that reaction kinetics as well as kinetic calculations and determination of kinetic expression based on experimental results are included. Beside that an introduction to numerical calculation of differential equations is given and uses of a computer based calculation program will be utilized to perform studies in more complex geometries.

Learning Outcomes

After completing this course, students must be able to:

Knowledge and understanding
1.1. Describe the driving force in different transport processes
1.2. Explain flow field around different objects and the origin of a boundary layer
1.3. Explain how to determine reaction kinetics of thermal processes such as pyrolysis, gasification and combustion
1.4. Explain the basics of numerical calculations of differential equations

2. Skill and ability
2.1. Perform heat balances in one and more dimensions in both stationary and dynamic system
2.2. Perform calculation of coupled heat transport processes including conduction, convection and radiation
2.3. Use a commercial computer software with coupled transport processes
2.4. Determine the rate limiting step for the overall reaction rate in different thermal processes with respect to mass transfer, heat transfer and reaction kinetics.
2.5. Determine the main components and their concentration during gasification when residence times and temperatures change
2.6. Determine the fundamental reaction kinetics during pyrolysis and gasification from experimental data
2.7. Determine the combustion process for a single particle

3. Assessment and attitude
3.1. Select and justify the method for determining reaction kinetics during pyrolysis and gasification and explain its limitations.

Forms of Teaching

The teaching will be in the form of lectures and exercises together with hand-in assignments together with oral and written presentations.

The language of instruction is English.

Forms of Examination

The course is examined by the following examination

- Written exam – Learning outcomes 1.1, 1.2, 1.3, 1.4, 2.1, 2.2, 2.4, 2.6 - 4.5 hec Grading Scale: A-F
- Hand-in assignments- Learning outcomes 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 3.1 - 3 hec Grading Scale: Not passed (U) orPassed (G)

Student rights and obligations at examination are in accordance with guidelines and rules for the University of Borås.

Literature and Other Teaching Materials

Literature:
Incropera, DeWitt, Bergman, Lavine: Principles of Heat and Mass Transfer, 7th edition

Distributed material

The course literature is in English.

Student Influence and Evaluation

The course is evaluated according to current guidelines for course evaluations at University of Borås where the view of the students are collected. The course evaluation report is published and feedback is given to the participants and the coming students according to previous mentioned guidelines, and will be the basis for future course and program developments. The dean of faculty and the course coordinator are responsible that the evaluation is performed in line with the above description.

Miscellaneous

The course is included in the Master program Resource Recovery.

The grade of the course is given by the grade on the written exam.

This syllabus is a translation from the Swedish original.