ChE-410

Catalysis for emission control and energy processes

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Cursus	Sem.	Type
Ing.-chim.	MA2, MA4	Opt.

Language of teaching	English
Credits	2
Session	Summer
Semester	Spring
Exam	Written
Workload	60h
Weeks	14
Hours	**2 weekly**
Lecture	2 weekly
Number of positions	

Summary

The course is an introduction to heterogeneous catalysis for environmental protection and energy production. It focusses on catalytic exhaust gas cleaning for stationary power plants and internal combustion engines as well as catalytic systems relevant for gaseous and liquid fuel production.

Content

- Basic introduction into heterogeneous catalysis
- Preparation of heterogeneous catalysts
- Characterization of heterogeneous catalysts
- Exhaust gas catalysis for stationary power plants and internal combustion engines: Three-way-catalysis, oxidation catalysts, selective catalytic reduction, NOx storage reduction catalyst, soot filtration/oxidation, methane oxidation, SOx, volatile organic compounds, ...
- Short introduction to gaseous and liquid fuels: refinery, coal, biomass gasification and renewable fuel production
- Control the CO/CO2/H2 ratio and downstream synthesis: water-gas-shift (WGS) reaction, partial oxidation (POX), reforming reactions, methanation, Fischer-Tropsch synthesis

Emission control and energy processes will be teached partly by means of examples from research, showing how the basics of catalysis, advanced catalyst preparation and catalyst characterization are used to understand and develop catalytic systems in this field.

Keywords

Heterogeneous catalysis
Emission control
Exhaust gas catalysis
Fuel synthesis
Renewable fuels

Learning Prerequisites

Recommended courses

Introduction to chemical engineering
Chemical engineering of heterogeneous reactions
Chemical kinetics and thermodynamics
Mass & heat transfer

Learning Outcomes

By the end of the course, the student must be able to:

- Select appropriately catalytic systems for different reactions
- Describe different catalytic exhaust cleaning technologies
- Explain the composition and structure-function relationships of different catalytic systems
- List the relevant chemical reactions
- Design an experiment for catalytic tests
- Select appropriately catalyst characterization methods
- Use the specific nomenclature in the field and calculate basic parameters
- Assess / Evaluate the performance of heterogeneous catalysts

Teaching methods

Ex cathedra using Powerpoint slides. Examples will be shown to illustrate theory.

Expected student activities

Taking notes in the course hours.

Assessment methods

One final written exam.

Supervision

Office hours	Yes
Assistants	Yes
Forum	No

Resources

Notes/Handbook

Students have access to the slides few days before each lesson.