CATALYSIS IN FUEL INDUSTRY AND POLLUTION CONTROL
(4 ECTS) *Compulsory*

Responsible person:

Prof. dr. Teresa Grzybek

Learning outcomes:

The main objective of the course is to bring to the students the knowledge of the catalytic methods in refinery processes and environmental protection

After completion of the course students should be able to:

- Describe the state of technology in refining industry and environmental protection and indicate the current world trends
- Discuss and present to the public the current technological state of the above
- Propose a type of catalyst for a given process
- Basing on experimental/technological data, discuss the reasons for deactivation and indicate typical methods to prolong catalyst life
- Propose a preparation method for a catalyst and carry it out
- Choose an appropriate analytical method to determine catalyst properties
- Analyse most important properties of an adsorbent (texture, amounts sorbed etc.) and a catalyst (activity, selectivity, texture, structure etc.)

Course main content:

The course is built of three parts: lectures (30 h), laboratory (15 h) and seminar (30 h)

Lectures:

During lectures students will be acquainted with the most important issues in adsorption and catalysis as applied to refinery processes and environmental protection.

Lectures will concern the following subjects:

Interface phenomena. Fundamentals of adsorption. Physical sorption and chemisorption. Porous solids and their characterization. The application of adsorbents. The structure of a catalysts – the role of active component, carrier and promoters. Acidic catalysts. Dispersion. Bifunctional catalysts. Monoliths. The preparation of catalysts. Deactivation and the methods of its limitation. Methods of catalysts characterization. Catalytic processes and catalysts for: DeNOx, removal of dioxins, liquid fuels production: Fischer Tropsch synthesis, MTG, selected refinery processes.

Laboratory:

1. Treatment of waste water by adsorption methods
2. The preparation of catalysts
3. Instrumental methods of characterization of catalysts
4. The determination of catalytic activity

Seminars:

Seminars are connected to subjects presented during the lectures and concern application, preparation as well as characterization methods for catalysts important for energy and fuel sectors. The student has to prepare a presentation illustrating a problem indicated by the teacher, basing on literature data and discuss it.

Admission requirements:

Basics of chemistry and/or physical chemistry

Literature:

1. Jens Hagen, Industrial Catalysis, A Practical Approach, Wiley-VCH Verlag GmBH and Co., KgaA, Weinheim, Germany, 2006
2. R.M.Heck, R.J.Farrauto, S.T.Gulati, Catalytic Air Pollution Control. Commercial technology, Ed. John Wiley and Sons, Inc., Hoboken, New Jersey, 2009
3. Handbook of Heterogenous Catalysis, Ed. G.Ertl, H.Knozinger, J.Weitkamp, VCH, Weinheim, Germany, 1997

Assessment:

- evaluation of laboratory reports
- evaluation of presentation prepared for a seminar and discussion following the presentation
- test based on the lecture material – solving problems defined by the ILOs.

Rules of final credit: The average of the grades: laboratory (30 %), seminar (30 %) and test (40 %).