

Faculty of Biological, Agronomic and Environmental Engineering

BRNA2201 Catalysis

[37.5h] 3 credits

This course is taught in the 1st semester

Teacher(s): Eric Gaigneaux
Language: French
Level: Second cycle

Aims

This course constitutes for the BIR students a first contact with catalysis and is also the only one at the UCL to deal with catalysis, particularly heterogeneous catalysis, in a systematic way.

The first objective (specifically met by partim A) is to increase the students' awareness of the omnipresence of catalysis in the field of chemistry (in a wide acceptance of the word) and particularly in petrochemistry, fine synthesis chemistry (pharmacy, perfumery) and environmental protection (air and water purification, pollution prevention).

The second objective (specifically met by partim B) is to provide the students with the bases required for the understanding of the catalytic process, drawing their attention on the parameters influencing the catalytic performances, in order to improve the catalytic systems performances and their lifetime.

The third objective (specifically met by partim C) is to give the students the bases of the synthesis methods for heterogeneous catalysts, drawing their attention on the parameters likely to influence their performances. This course gives the ability to develop reflexes for adjusting the synthesis to a given catalytic process.

Main themes

This course gives a general view of catalysis, particularly heterogeneous catalysis.

PARTIM A entitled "Catalysts and catalytic processes families" is rather descriptive and accessible without prerequisite. It offers an introduction to catalysis in drawing up an inventory of the catalysts families sorted in the context of industrial processes (petrochemistry, fine chemistry, environmental protection (air and water purification)). The two other sections are more specialized.

PARTIM B "Catalytic mechanisms and kinetics" aims at understanding in depth the laws that govern the catalyst efficiency. The elementary steps of the catalytic act are presented first. Then the major corresponding kinetic laws are introduced taking into account the specificities of the various types of catalytic mechanisms. At this point, a link is made with some phenomena studied in the course BIRCxxxx "Chemistry of solids".

PARTIM C "Catalysts preparation" tackles the various preparation methods of heterogeneous catalysts on the basis of the distinction between bulk catalysts and supported catalysts. The transposition of these preparation methods to the industrial scale ("scaling up") is briefly mentioned.

Content and teaching methods

PARTIM A

- Definition and importance of catalysis
- Homogeneous catalysis vs. heterogeneous catalysis
- Large families of catalysts in relation with the big chemical processes: selective oxidation, total oxidation, isomerisation, cracking, hydrotreatment, #

PARTIM B

- Elementary stages of the catalytic act and kinetics: external and internal diffusion, adsorption, reaction
- Development of the important kinetic reaction laws: Langmuir, Rideal, Mars-van Krevelen
- Link with the nature of the catalysts
- Catalyst deactivation.

PARTIM C

- Mass catalysts: laws governing particles germination and growth, tools for the control of particle size and solids texture
- Supported catalysts: impregnation without interaction, ionic exchange with or without competition, precipitation-deposition, grafting
- Scaling up of the catalysts synthesis.

Other information (prerequisite, evaluation (assessment methods), course materials recommended readings, ...)

Precursory courses PARTIM A accessible without prerequisite

For PARTIMS B and C only: Chemistry of solids Materials surface characterisation (Partims A and B at least)

Other credits in programs

BIR23/3C	Troisième année du programme conduisant au grade de bio-ingénieur : chimie et bioindustries (Nanobiotechnologies, matériaux et catalyse)	(3 credits)
INCH23	Troisième année du programme conduisant au grade d'ingénieur civil chimiste	(3 credits)