

29940 - Catalysis and Catalytic Processes of Industrial Interest

Información del Plan Docente

Academic Year	2016/17
Academic center	110 - Escuela de Ingeniería y Arquitectura
Degree	435 - Bachelor's Degree in Chemical Engineering
ECTS	6.0
Course	4
Period	Second semester
Subject Type	Optional
Module	---

1. Basic info

1.1. Recommendations to take this course

1.2. Activities and key dates for the course

2. Initiation

2.1. Learning outcomes that define the subject

2.2. Introduction

3. Context and competences

3.1. Goals

3.2. Context and meaning of the subject in the degree

3.3. Competences

3.4. Importance of learning outcomes

4. Evaluation

5. Activities and resources

5.1. General methodological presentation

The learning process that is designed for this subject is based on the following: The learning process will take place at several levels:

lectures , problem solving (cases) , and supervised lab work , with increasing the level of student participation. In the theory classes they are going to be developing the theoretical bases that make up the course and solving some model problems. The kinds of problems and cases and laboratory practices are effective complement lectures , allowing verify compression of matter and in turn help to develop in students a viewpoint more applied . Finally tutored work will complement the above.

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5.2. Learning activities

The program that the student is offered to help you achieve the expected results includes the following activities

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Lectures (40 h) where the theory of the various issues that have been proposed will be taught and solved problems on the blackboard model.

Face classes and problem solving cases (13 h). In these classes problems will be solved by students supervised by the professor. Problems or cases will be related to the theoretical part explained in lectures.

Laboratory classes (7 h) where the student entrench the contents developed in the master classes.

Tutored work (15 h non-contact), individual or group. 2 or 3 activities to be tutored by teachers will be proposed.

Individual study (71 h non-contact). students perform individual study continuously throughout the semester is recommended.

Final evaluation (4 h). a global test where the theoretical and practical knowledge gained by the student will be assessed will be held.

5.3. Program

Homogeneous Catalysis

Unit 1.-Introduction to catalysis : Basic Concepts . atomic economy. Selectivity in: catalytic processes.Types of catalysis. (4 h theory + problems).

Unit 2.- Homogeneous catalysis : Characteristics of Catalysts. Fundamental reactions and reaction mechanisms: Reactions dissociation and coordination, reactions of oxidative addition and reductive elimination, insertion and β -elimination reactions, and reactions of nucleophilic attack on coordinated ligands. (8 h, theory + problems).

Unit 3.- Hydrogenation. Wilkinson's catalyst. Asymmetric Hydrogenation. Hydrogenation transfer. (10 h, theory + problems + practice).

Unit 5.- Carbonylation: synthesis of acetic acid. Hydroformylation. (4 h theory + problems).

Unit 6.- Polymerization. Ziegler-Natta catalysts and metallocenes. (3 h theory + problems).

Heterogeneous Catalysis

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Unit 6.- Heterogeneous Catalysis : Differences between homogeneous and heterogeneous catalysis. Stages in the catalytic reaction. Catalyst performance diagnosis. (8 h , theory + problems).

Unit 7.- Structure of catalyst : design . Active components. Supports. Promoters. Examples. (2 h theory + problems)

Unit 8.- Preparation of catalysts : impregnation , precipitation , Exchange. Conformed. (4 h theory + problems).

Unit 9.- Characterization of catalysts : Material properties . Particle properties . Surface properties . Activity. (4 h theory + problems).

Unit 10.- Deactivation : Concept. Soiling. Poisoning. Sintering . Other causes . Kinetics. Regeneration. (6 h , theory + problems).

Unit 11.- Heterogeneous catalysis in industry : Inorganic base, oil refining, processing coal and natural gas. Catalytic reactors. (6 h , theory + problems).

5.4.Planning and scheduling

Schedule sessions and presentation of works

Lectures and solving problems classes are held according to schedule established by each teacher EINA also inform its hours of tutoring.

5.5.Bibliography and recommended resources

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| BB | Applied homogeneous catalysis with organometallic compounds : a comprehensive handbook in two volumes / edited by Boy Cornils and Wolfgang A. Herrmann Weinheim : Wiley-VCH, cop. 2000 |
| BB | Bartholomew, Calvin H.. Fundamentals of industrial catalytic processes / Calvin H. Bartholomew, Robert J. Farrauto . - 2nd ed. Hoboken, New Jersey : Wiley, cop. 2006 |
| BB | Behr, Arno. Applied homogeneous catalysis / Arno Behr and Peter Neubert Weinheim : Wiley-VCH, cop. 2012 |
| BB | Bhaduri, Sumit. Homogeneous catalysis : mechanisms and industrial applications / Sumit Bhaduri, Doble Mukesh New York [etc.] : Wiley-Interscience, 2000 |
| BB | Bowker, Michael. The basis and applications of heterogeneous catalysis / Michael Bowker . - 1ª ed. Oxford : Oxford University Press, 1998 |
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- BB** Handbook of heterogeneous catalysis / edited by G. Ertl ... [et al.] . - 2nd comp. rev. and enl. ed. Weinheim : Wiley-VCH, cop. 2008
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- BB** Metal-catalysis in industrial organic processes / edited by Gian Paolo Chiusoli, Peter M. Maitlis . - Softback ed. Cambridge : Royal Society of Chemistry, cop. 2008
- BB** Novel concepts in catalysis and chemical reactors : improving the efficiency for the future / edited by Andrzej Cybulski, Jacob A. Moulijn, and Andrzej Stankiewicz Weinheim (Germany) : Wiley-VCH, cop. 2010
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