29940 - Catalysis and Catalytic Processes of Industrial Interest

Información del Plan Docente

Academic Year	2017/18
Faculty / School	110 - Escuela de Ingeniería y Arquitectura
Degree	435 - Bachelor's Degree in Chemical Engineering
ECTS	6.0
Year	4
Semester	Second semester
Subject Type	Optional
Module	---

1.General information

1.1.Introduction

1.2.Recommendations to take this course

1.3.Context and importance of this course in the degree

1.4.Activities and key dates

2.Learning goals

2.1.Learning goals

2.2.Importance of learning goals

3.Aims of the course and competences

3.1.Aims of the course

3.2.Competences

4.Assessment (1st and 2nd call)

4.1.Assessment tasks (description of tasks, marking system and assessment criteria)

5.Methodology, learning tasks, syllabus and resources

5.1.Methodological overview

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.

5.2.Learning tasks

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

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.Syllabus

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).

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Heterogeneous Catalysis

Unit 6.- Heterogeneous Catalysis : Differences between homogeneous and heterogeneous catalysis. Stages in the catalytic reaction. Catalyst performance diagnosis. (11 h , theory + problems).

Unit 7.- Structure of catalyst : design . Active components. Supports. Promoters. Examples. (3 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. (4 h , theory + problems).

Unit 11.- Heterogeneous catalysis in industry : Inorganic base, oil refining, processing coal and natural gas. Catalytic reactors. (4 h , theory + problems).

5.4.Course planning and calendar

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

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 /

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	Michael Bowker . - 1ª ed. Oxford : Oxford University Press, 1998
BB	Fundamentos y aplicaciones de la catálisis homogénea / editado por Luis A. Oro y Eduardo Sola . 2ª ed. Zaragoza : Luis A. Oro y Eduardo Sola, 2000
BB	Hagen, Jens. Industrial catalysis : a practical approach / Jens Hagen. 2nd completely rev. and extended ed. Weinheim : Wiley-VCH, cop. 2006
BB	Handbook of heterogeneous catalysis / edited by G. Ertl ... [et al.] . - 2nd comp. rev. and enl. ed. Weinheim : Wiley-VCH, cop. 2008
BB	Leeuwen, Piet W. N. M. van. Homogeneous catalysis : understanding the art / Piet W.N.M. van Leeuwen Dordrecht [etc.] : Kluwer Academic Publishers, 2004
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
BB	Richardson, James Thomas. Principles of catalyst development / James T. Richardson . - 2nd pr. New York ; London : Plenum Press, 1992
BB	Rothenberg, Gadi. Catalysis : concepts and green applications / Gadi Rothenberg Weinheim : Wiley-VCH, cop. 2008
BB	Satterfield, Charles N.. Heterogeneous catalysis in industrial practice / Charles N. Satterfield . - 2nd. ed, [repr. with corrections] Malabar, Florida : Krieger Publishing Company , 1991 [reimpr. 1996]