Advanced Inorganic Chemistry II - Course Syllabus

Course Number: ChemS 350

Course Title: Advanced Inorganic Chemistry II

Academic Semester:	Spring	**Academic Year:**	2015/ 2016
Semester Start Date:	Jan 24, 2016	**Semester End Date:**	May 19, 2016

Class Schedule: Sunday and Wednesday 9 to 10:30 am

Classroom Number: TBC

Instructor(s) Name(s): Jean-Marie Basset
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Office Location: Bldg 3.level 4, room 4234
Office Hours: 9 am to 6 pm, Appointment by Nathalie Gregoire
Teaching Assistant name:
Email:

COURSE DESCRIPTION FROM PROGRAM GUIDE

Emphasis on concepts and applications of homogenous and heterogeneous catalysis and the impact of such processes on the advancement of different industries.

COMPREHENSIVE COURSE DESCRIPTION

This course attempts to describe homogeneous and heterogeneous catalysis with a particular emphasis on:

The elementary steps of catalysis

All the possible “measures” of catalytic cycle (formal electron counts, formal oxidation states before, during and after catalysis)

The rational design of catalysts (basic concepts for homogeneous and heterogeneous catalysis)

The comparison between homogeneous and heterogeneous catalysis

The description of all the industrial catalytic processes in industry (homogeneous and heterogeneous) including petrochemical, and chemical industry.

In particular the course will deal with the following subjects:

1. 18 electrons rule, pi bonding

2. Sigma bonding

3. Organometallic chemistry and catalysis: Ligands/supports

4. Elementary steps in catalysis: oxidative addition/reductive elimination

5. Elementary steps in catalysis : sigma bond metathesis

6. Elementary steps in catalysis: Insertions reactions, beta elimination

7. Short introduction to catalytic cycles

8. Homogeneous catalysis: Carbonylation

9. Homogeneous catalysis : Hydroformylation

10. Homogeneous catalysis: Monoelectronic transfer

11. Polymerization: olefins, dienes,…

12. Heterogeneous catalysis: the various classes of catalysts

13. Heterogeneous catalysis: The flue gas depollution

14. Heterogeneous Catalysis: Energy and CO2

15. Heterogeneous catalysis: Hydrogenation, Oxidation

16. Heterogeneous Catalysis: Deactivation and regeneration

17. Heterogeneous catalysis: Refining technology

GOALS AND OBJECTIVES

The program offers students a solid theoretical basis in the field of catalysis (molecular and nanomaterials) and develops the experimental skills needed to carry out high-level research as well as industrial position.

The goal is to give a deep knowledge of catalysis whether it is homogeneous or heterogeneous as well as the relationship between both sciences.

The students should be able after this course:

-To understand existing catalytic technologies

-To design a catalyst for any given reaction.

-To adapt his knowledge to various types of catalytic reactions and catalytic type.

-To make a choice between homogeneous and heterogeneous catalysis for a given reaction

REQUIRED KNOWLEDGE

Inorganic chemistry

Nanomaterial (structures determination)

Organometallic chemistry (basic)

REFERENCE TEXTS

RECOMMENDED TEXTBOOK: Didier Astruc “Organometallic Chemistry”

REFERENCES:

Books:

 1. James P. Collman (Author), Richard G. Finke (Author), Jack R. Norton (Author)Principles and Applications of Organotransition Metal Chemistry [James P. Collman, Richard G. Finke, Jack R. Norton] on Amazon.com.(1987)

 Ch. Elschenbroich & A. salzer « Organometallics » IIed, VCH 1992

 Gadi Rothenberg « Catalysis », VCH (2008)

 Piet W. N.M. Van Leeuwen « Homogeneous Catalysis », Kluwer (2004)

 Hans Niemanstsvedriet, “Spectroscopy in Catalysis” Wiley –VCH (2007)

Journals:

1. Journal of Organometallic Chemistry

2. Journal of Catalysis

3. Organometallics

4. ACS catalysis

5. ChemCatChem

6. J. Am. Chem. Soc.

7. Angew. Chem. Intern. Ed.

8. J. Phys. Chem.

9. Science

10. Adv. Cat.

11. Nature

12. Surface Science

13. Langmuir

14. J. Material Chemistry

METHOD OF EVALUATION

Graded content
HOMEWORK: Special topic reading assignments EXAMS: 1. Mid term exam march 2016 (40%) 2. Final: May 2016 (individual projects – report and oral exam): 60% No make-up exams will be provided.

COURSE REQUIREMENTS

Assignments

Written assignment and assigned reading.

Course Policies

In accordance with the University policy and professional standards, the highest levels of academic integrity are expected in this class. The code of student conduct is strictly enforced. Academic dishonesty will result in reductions in grades and/or expulsions from this class and/or the University.

Additional Information

NOTE
The instructor reserves the right to make changes to this syllabus as necessary.