Universidade Federal do Rio Grande do Sul
Instituto de Química
Graduate Program in Chemistry (Grade 7/CAPES)
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# COURSE SYLLABUS

## 1. Identification

Code and title: QUP 009 – Organometallic Chemistry
Professor: Jairton Dupont
Level: Master and Doctorate
Credit hours: 3
Revised: August_2021

## 2. Summary

Properties. Formation of the Metal-Carbon Bonds of the Representative Elements. Organometallic compounds of transition metals: chemical bonding and reaction mechanisms. Organometallic catalysis. Applications in organic synthesis and in materials.

## 3. Objective

To develop the basic tools (structural and mechanistic) necessary to understand the transformations that occur between organic and inorganic substrates when connected to metallic centers.

## 4. Contents

- Introduction: properties, classification and stability of organometallic compounds;
- Formation of the metal-carbon bonds of the representative elements: reaction between metal and a halogenated organic compound. Metal exchange. Insertion of olefins and acetylenes in M-H. Other insertion reactions. Reactions of diazo and boronic compounds.
- Organometallic compounds of the representative elements: groups I-V: general characteristics, preparation, reactions, applications and toxicity;
- Organometallic compounds of the transition metals: classifications of ligands, 18-bond rule. Preparation and reactions;
- Mechanisms of reactions: determination of the speed laws of organometallic reactions (substitution, oxidative addition-reductive elimination, insertion-migration, metallacyclo-addition, nucleophilic and electrophilic addition and elimination). Deduction of reaction mechanisms and experimental determination of reaction rates;
- Organometallic catalysis. Isomerization. Oligomerization. Hydrogenation. Carbonylation.
- Hydroformylation and hydrosilylation of alkenes; polymerization, metathesis; etc. Asymmetric Catalysis (hydrogenation, epoxidation, hydroformylation, etc.)
- Applications in organic synthesis. Coupling reactions (Heck, Suzuki, Stille, Ulmann, etc.). Epoxidations (Sharpless, Jacobsen, etc.), reductions, chrome-arenes,
- Asymmetric Synthesis;
- Applications in synthesis of materials: polyolefins, liquid crystals, magnets molecular, non-linear optics, nano-technologies, etc.

## 5. Assessment

Exam (last week, 70%) and individual seminar (30%). The student, who obtains a final grade of A, B or C, awarded as per the list below, will be considered approved:
A: grade equal to or above 9.0

B: grade equal to or above 7.5 and below 9.0
C: grade equal to or above 5.0 and below 7.5
D: grade below 5
FF: lack of frequency

## 6. Methodology

Lectures, exercises lists, seminars and examinations.

## 7. Bibliography

- R. H. Crabtree, The Organometallic Chemistry of the Transition Metals – 6th edition, John Wiley & Sons, N. Y., 1988.
- C. Elschenbroich and A. Salzer, "Organometallics: A Concise Introduction," 2nd Edition, Wiley-VCH, Weinheim, 1992.
- C. Elschenbroich, Organometallics -3rd edition, Wiley-VCH, Weinheim, 2006.
- G. O. Spessard, G. L. Miessler, Organometallic Chemistry, Prentice-Hall, New Jersey, 2014.
- J. P. Collman, L. S. Hegedus, J. R. Norton, R. G. Finke, Principles and Applications of Organotransition Metal Chemistry, University Science Books, Mill Valley, 1987.
- J. D. Atwood, Inorganic and Organometallic Reaction Mechanisms - 2nd edition, John Wiley & Sons, N. Y., 1997