

Industrial Electrochemistry and Corrosion

Calendar: 4th semester

Contact Hours: T - 30,0; PL - 22,5; OT - 7,5

Scientific Area: Engenharia Química Industrial

Learning outcomes of the curricular unit

The UC is oriented with a view to ensuring a basic training in electrochemistry mainly addressing the fundamentals of electrochemical processes and corrosion. After UC completing students should have acquired the following competencies:

- Specify the main features of electrochemical methods and their applications.
- Identify the main components of galvanic cells and fuel cells
- Characterize the behavior of galvanic cells and fuel.
- Understand and interpret phenomena of metallic corrosion.
- Evaluate and monitor the corrosion
- Select and use methods of corrosion protection

Syllabus

1. Redox reactions: basic concepts.
2. Electrolyte imbalances: Electrolytic solutions, conductance, conductivity, ion mobility, mass transfer
3. Fundamentals of Electrochemistry: standard potential, Nernst equation, kinetics and electrode reactions mechanisms, mass transfer.
4. Applications of Electrochemistry: Batteries, Fuel Cells, Electrolysis, hydrogen storage.
- 4 Fundamentals of Corrosion: Electrochemical corrosion principles, corrosion processes, galvanic corrosion and differential aeration cells, localized corrosion, passivation, thermodynamic, Evans diagrams, mix potential theory, Pourbaix diagrams, polarization and corrosion rate, polarization curves and experimental methods. Tafel lines, Protection against corrosion, equipment's selection, materials design, corrosion protection by media modification and by potential modification, coatings.

Demonstration of the syllabus coherence with the curricular unit's objectives

Through chapter 1 and 2, students acquire basic skills referring to the oxidation-redox equilibrium and basic electrochemistry fundamentals, in way to secure a basic formation in electrochemistry and the understanding of the bases of electrochemical processes. In the chapter 3, It is showed to the students were the fundamental knowledge acquired before can be applied, giving enfases to industrial applications, demonstrating with real cases. In the chapter 4 and 5, to secure the acquisition of competences associated to the phenomena of corrosion, the students applied the electrochemistry fundamentals previously acquired to corrosion, degradation and passivation of metal materials. Chapter 7 and 8 describes the different corrosion mechanisms and some techniques that can be applied to prevent corrosion.

Teaching methodologies (including evaluation):

The UC is organized with lectures and exercise solving class sessions with assistance of the instructor. The lecture is taught using powerpoint presentations where the fundamental principles and important applications are explained. These sessions are organized in set of problems for each chapter that should be solved by students with minimum assistance.

Demonstration of the coherence between the teaching methodologies and the learning outcomes.

For these basic contents to be correctly acquired by the students, it must be presented in a solid and consistent approach. For that purpose it is necessary that basic concepts, be properly explained. Consequently, it is essential that in theoretical classes the fundamental concepts are exposed.

The acquired knowledge can be consolidate by solving relevant amount of practical problems, either by the teacher or by the student, which is a very important reason for the presence of significant number of practical classes.