Materials Behavior under extreme conditions

Academic Year: (2022 / 2023) **Review date: 26-05-2022**

Department assigned to the subject: Materials Science and Engineering and Chemical Engineering Department

Coordinating teacher: BAUTISTA ARIJA, MARIA ASUNCION

Type: Electives ECTS Credits : 3.0

Year : 1 Semester : 2

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Having basic knowledge about corrosion (of mechanisms, of Pourbaix diagrams and their interpretation and of polarization curves) or attending to Corrosion testing and electrochemical performance of materials.

OBJECTIVES

This subject contributes to the development of the following BASIC SKILLS:
- Acquire and understand concepts that provide the foundation or opportunity to be original on the development and/or application of ideas, often in a research context.
- Students will be able to apply the acquired knowledge and skills on problem resolution in new or hardly known environments in the context of wide (or multidisciplinary) contexts related to the area under study
- Students will be able to integrate knowledge to face the complexity of making assessments based on limited or incomplete information, but considering the ethical and social responsibilities associated to the application of their knowledge and assessments.
- Students will be able to communicate their conclusions and the knowledge and reasons that support them to specialized and the wide public in a clear and unambiguous manner
- Students will acquire learning skills that allow them to continue studying in an autonomous and self-paced way.

This subject contributes to the development of the following GENERAL SKILLS:
- Understand the challenges associated to Materials Science and Engineering in an industrial and research environment
- Know the disciplines appropriated for working in a laboratory of materials and for optimizing the obtaining of results
- Develop team working skills in a research environment
- Combine the interest on innovation and process optimization, with the need of doing so in an environmentally friendly manner.
- Acquire the required skills to defend a research project and its results.
- Develop creative strategies for decision making to solve problems associated with materials, their design, processing and behaviour.

This subject contributes to the development of the following SPECIFIC SKILLS:
Contribute to the consolidation of research skills in the field of Materials Science and Engineering, specifically with respect to their behavior in extreme conditions
Acquire knowledge and useful scientific and technical skills for solving specific problems associated with working in a research laboratory in the field of development and characterization of materials for extreme conditions.

The passing of this subject assures the following LEARNING OUTCOMES:
- Know and understand how aggressive chemical environments affect the behavior of materials in service conditions.
- Know and understand how extreme physical exertion and radiation affect the behavior of materials.
- Know and understand how extreme temperatures affect the behavior of materials.

DESCRIPTION OF CONTENTS: PROGRAMME

Specific topics in this subject:
- Deeping into degradation mechanism of materials.
- Degradation of material in power generation plants: thermal, nuclear new solar plants using

thermal storage systems based on melted salts. Mechanisms and possible solutions for the chemical attack enhanced by the high temperatures. Effect of irradiation on the mechanical properties.
- Degradation of materials in the petrochemical industry: Failures in oil rings, oil refineries and pipes. Role of CO2 and H2S. Strategies for achieving a good service performance.
- Degradation of materials in paper industry and chemical industries where aggressive chemical products are used.
- Materials behavior in the space. Problems associate to launching conditions.

LEARNING ACTIVITIES AND METHODOLOGY

LEARNING ACTIVITIES
AF1, Theoretical-practical classes.
AF2, Lab practices
AF3, Tutorials
AF4, Work in groups
AF5, Individual work from the student

TEACHING METHODOLOGIES
MD1, Explanations in class, so the professor develops main concepts of the subject, practical examples or problems
MD2 - Critical reading by the student of science text and papers recommended by the supervisor
MD3, Practical resolution of examples, problems or exercise, by the student (alone or in groups)
MD5, Obtaining experimental results in the lab, using research equipments and techniques, under professor supervision
MD6, Elaborating Works and reports, alone or in groups

ASSESSMENT SYSTEM

Active participation in theoretical session and laboratories. Critical analysis ability about the subjects: 5%
Exercises realized at home: 25%.
Attendant to the laboratory practices and answering of the proposed questions about techniques and/or obtained experimental results: . 20%
Final assessment carried individually and written: 50%

% end-of-term-examination:	50
% of continuous assessment (assigments, laboratory, practicals…):	50

BASIC BIBLIOGRAPHY

- ASM International ASM Handbook ¿ Vol. 13: Corrosion, American Society for Materials.
- E. Otero Huerta Corrosión y Degradación de Materiales, Sintesis, 2012
- R. A. Cottis Shreir¿s corrosion, Elsevier, 2010

ADDITIONAL BIBLIOGRAPHY

- J.A. González Fernández Control de la corrosión : estudio y medida por técnicas electroquímicas , CSIC, 1989