

Academic Year: ( 2019 / 2020 )

Review date: 05-11-2019

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

Coordinating teacher: JIMENEZ MORALES, ANTONIA

Type: Electives ECTS Credits : 3.0

Year : 1 Semester : 2

**STUDENTS ARE EXPECTED TO HAVE COMPLETED**

It is recommended, although not mandatory, to have passed the subject "Coatings technology and surface treatments" included in Module 2-Advanced Technologies of the Master's Degree in Materials Science and Engineering (UC3M)

**COMPETENCES AND SKILLS THAT WILL BE ACQUIRED AND LEARNING RESULTS.**

All competences relating to electrochemical characterization techniques and corrosion tests:

CB6, 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.

CB7, 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.

CB8, 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.

CB9, 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.

CB10, Students will acquire learning skills that allow them to continue studying in an autonomous and self-paced way.

CG1, Understand the challenges associated to Materials Science and Engineering in an industrial and research environment.

CG2 ¿ Know the disciplines appropriated for working in a laboratory of materials and for optimizing the obtaining of results.

CG3, Develop team working skills in a research environment.

CG6, Acquire the required skills to defend a research project and its results.

CG7, Develop creative strategies for decision making to solve problems associated with materials, their design, processing and behaviour.

CE5 Be able to develop creative strategies and decision-making facing problems related to materials, manufacturing and behavior.

CE6, Know the techniques of characterization of materials and personally experiencing its handling in the laboratory.

CE9, Consolidate specific research skills in Materials Science and Engineering.

CE10 Acquire knowledge and useful scientific and technical skills to solve specific problems associated with the work in a research laboratory in the field of material development and characterization.

**LEARNING RESULTS**

Passing this matter implies that the student has learned to:

- ¿ Select a proper characterization technique for a specific information about a material.
- ¿ Know the basics of the different techniques and electrochemical corrosion tests.
- ¿ Use each of the experimental techniques detailed in the program of the subject and get acquainted with its management.
- ¿ Use the techniques of treatment of experimental data.
- ¿ Interpret results obtained applying the techniques of characterization studied.
- ¿ Deduce and draw general conclusions from the electrochemical properties of the materials from the results of various experimental measures and know express adequately the main implications that can have those results in practice.

**DESCRIPTION OF CONTENTS: PROGRAMME**

Specific topics electrochemical characterization of materials and corrosion tests:

- ¿ Atmospheric corrosion tests. Classification of corrosivity of the atmosphere.
- ¿ Accelerated corrosion test chambers and accelerated immersion tests.
- ¿ Electrochemical tests (non-destructive and destructive) DC.
- ¿ Design, preparation, characterization and study of behavior in working conditions of materials with electrochemical properties of interest in health sciences, of the environment and energy.
- ¿ Electrochemical techniques used in the field of Materials Science and Engineering, especially nondestructive technique known as electrochemical impedance spectroscopy (EIS) and localized techniques.

## 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

### METHODOLOGIES

- MD1, Explanations in class, so the professor develops main concepts of the subject, practical examples or problems
- MD2, Critical reading by students of textbooks and scientific publications recommended by the teacher
- MD3, Practical resolution of examples, problems or exercise, by the student (alone or in groups)
- MD5, Obtaining experimental results in the lab, using research equipment and techniques, under professor supervision
- MD6, Elaborating Works and reports, alone or in groups

## ASSESSMENT SYSTEM

- Participation in lectures and laboratories and capacity for critical analysis demonstrated on the topics raised (SE1) 5% of final mark
- Realization and or exhibition of projects, exercises or individually or collectively along the course (SE2) 20% of final mark
- Carrying out laboratory practice, preparation, presentation and discussion of reports or detailed questionnaires on the techniques used and the experimental results. (SE3) 25% of final mark
- Exam final evaluation of the subject made individually, in writing or orally. (SE4) 50% of final mark

<b>% end-of-term-examination:</b>	50
<b>% of continuous assessment (assignments, laboratory, practicals...):</b>	50

## BASIC BIBLIOGRAPHY

- Andrzej Wieckowski Interfacial electrochemistry : theory , experiment, and applications, New York, Basel : Marcel Dekker, 1999
- Enrique Otero Huerta Corrosión y degradación de materiales, Síntesis,. D. L. Madrid, 2001
- J.A. González Fernández Control de la corrosión. Estudio y medida por técnicas electroquímicas, CSIC, 1999
- Jacek Lipkowski and Philip N. Ross Electrochemistry of novel materials, New York:VCH, 1994
- M. Carmen Andrade and S. Feliu Corrosión y protección metálicas, Consejo Superior de Investigaciones Científicas, 2001
- Manuel E. Sastre de Vicente, Roberto Herrero Rodríguez. siglo XXI. Universidade da Coruña Electroquímica y medio ambiente en el umbral del siglo XXI, Universidade da Coruña, 2000
- Manuel María Domínguez Pérez Cuestiones y problemas de electroquímica, Madrid. Helice, 2000
- R. Baboian Corrosion tests and standards : application and interpretation, American Society for Testing and Materials, 2002
- R. Baboian. ¿¿. . Corrosion tests and standards : application and interpretation, American Society for Testing and Materials, 2002

## ADDITIONAL BIBLIOGRAPHY

- Peter G. Bruce Solid state electrochemistry, Cambridge Univ. Press, cop, 1995
- S.K. Sundaram, Dennis F. Bickford, E.J. Hornyak Jr. Electrochemistry of glass and ceramics, The American Ceramic Society, 1999
- Sato, Norio Electrochemistry at metal and semiconductor electrodes, Amsterdam [Etc.] Elsevier, 1998