Course guide
220071 - CTMA - Characterization Techniques for Metallic Alloys

Last modified: 19/04/2023

Unit in charge: Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit: 702 - CEM - Department of Materials Science and Engineering.

Degree: BACHELOR'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR'S DEGREE IN TEXTILE TECHNOLOGY AND DESIGN ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR'S DEGREE IN AEROSPACE TECHNOLOGY ENGINEERING (Syllabus 2010). (Optional subject).
BACHELOR'S DEGREE IN AEROSPACE VEHICLE ENGINEERING (Syllabus 2010). (Optional subject).
BACHELOR'S DEGREE IN INDUSTRIAL DESIGN AND PRODUCT DEVELOPMENT ENGINEERING (Syllabus 2010). (Optional subject).
BACHELOR'S DEGREE IN INDUSTRIAL TECHNOLOGY ENGINEERING (Syllabus 2010). (Optional subject).

Academic year: 2023 **ECTS Credits:** 3.0 **Languages:** English

LECTURER

Coordinating lecturer: MARIA NURIA SALAN BALLESTEROS

Others:

TEACHING METHODOLOGY

The course is divided into parts:
? Theory classes
? Practical classes
Self-study for doing exercises and activities.
In the theory classes, teachers will introduce the theoretical basis of the concepts, methods and results and illustrate them with examples appropriate to facilitate their understanding.
In the practical classes (in the classroom), teachers guide students in applying theoretical concepts to solve problems, always using critical reasoning. We propose that students solve exercises in and outside the classroom, to promote contact and use the basic tools needed to solve problems.
Students, independently, need to work on the materials provided by teachers and the outcomes of the sessions of exercises/problems, in order to fix and assimilate the concepts.
The teachers provide the curriculum and monitoring of activities (by ATENEA).

LEARNING OBJECTIVES OF THE SUBJECT

Knowing the different techniques of study, analysis and characterization of materials, and the differences between them in order to make a correct choice in case of requirement.

Testing protocol drawing, as practical cases, related to material suitability definition (for general or a particular use) and for knowing more about failure reasons.

STUDY LOAD

Type	Hours	Percentage
Hours large group	30,0	40.00
Self study	45,0	60.00

Total learning time: 75 h

CONTENTS

Module 1: Microstructural Materials Characterization Techniques

Description:
- Light Microscopy (OM-Biological, OM-Metallographic, Stereoscopy)
- Electronic Microscopy (SEM, TEM)
- Other techniques (CONFOCAL, AFM, FIB)

Related activities:
Individual questionnaire
Team work

Full-or-part-time: 25h
Theory classes: 10h
Self study : 15h

Module 2: Estructural and Chemical Characterization Techniques

Description:
- Principles of Electron Diffraction Patterns: X-Ray Diffraction (XRD), Selected Areas Diffraction Patterns (SAPD)
- Chemical Characterization techniques: Auger Electron Spectroscopy, Energy Dispersive X-Ray Analysis (EDX), Photoelectron Spectroscopy (XPS, ESCA), Secondary Ion Mass Spectroscopy (SIMS)

Related activities:
Individual questionnaire
Team work

Full-or-part-time: 25h
Theory classes: 10h
Self study : 15h

Module 3: Mechanical and Micromechanical Characterization

Description:
- Macromechanical testing techniques: Tensile test, impact test, hardness test
- Micro&nanomechanical testing techniques: Microindentation, Nanoindentation
- Friction and Wear testing techniques

Related activities:
Individual questionnaire
Team work

Full-or-part-time: 25h
Theory classes: 10h
Self study : 15h

GRADING SYSTEM

EXAMINATION RULES.

Deliverables modules 1-2: 40%
Teamwork: 40%
Subjective qualification: 20 %

BIBLIOGRAPHY

Basic:
- Eaton, Peter Jonathan; West, Paul. Atomic force microscopy. Oxford: Oxford University Press, 2010. ISBN 9780199570454.
- Bermúdez Polonio, Joaquín. Métodos de difracción de rayos X : principios y aplicaciones. Madrid: Pirámide, cop. 1981. ISBN 8436801806.
- Beeston, B. E. P. Electron diffraction and optical diffraction techniques. Amsterdam: North-Holland, 1972. ISBN 0720442532.
- Heimendahl, Manfred von. Electron microscopy of materials : an introduction. New York: Academic Press, 1980. ISBN 0127251502.

Complementary:
- Cullity, B.D.; Stock, S. R. Elements of X-ray diffraction. 3rd ed. Essex: Pearson, cop. 2014. ISBN 9781292040547.
- Ashby, Michael F; Shercliff, Hugh; Cebon, David. Materials : engineering, science, processing and design. Oxford: Butterworth-Heinemann, 2014. ISBN 9780080977737.
- Dieter, G. E.; Schmidt, L. C. Engineering design. 6th ed. New York: McGraw-Hill, 2021. ISBN 9781260575279.