

COURSE: CHARACTERIZATION OF THE COMPOSITION AND MICROSTRUCTURE OF THE MATERIALS

SUBJECT: Materials characterization and experimentation

MODULE: Specific knowledge module

PROGRAM: Master's degree in Materials Science and Engineering

PAGE 1 OF 4

GENERAL CHARACTERISTICS*

Type: Basic formation, Compulsory, Optional

Master Thesis, External practices

Duration: Semester

Semester / s: 1

Number of ECTS credits: 5

Languages: Spanish, Catalan

DESCRIPTION

BRIEF DESCRIPTION AND JUSTIFICATION

The aim of the course is that the students acquire the knowledge of the tools for characterizing the composition and microstructure of materials in order to know their properties and evaluate their possible future behavior in service. Emphasizes modern techniques of microscopy and microstructural characterization.

The subject uses the knowledge acquired in the courses of metals, ceramics, polymers and composites of the master.

COMPETENCES

- E7 - Have knowledge of the most common spectroscopic, diffraction, microscopy and surface techniques, as well as their limitations, for the characterization of ceramics, metals, polymers and composite materials.
- E8 – Ability to select the most appropriate analysis technique in the characterization of the composition and microstructure of specific materials, as well as to interpret an analytical procedure and characterize it by defining suitable parameters.
- CG2 - The ability to perform a responsible practice of the profession.
- CB6 - To have and understand the required knowledge that provides the basis or opportunity to be innovative in the development and/or application of ideas, often in a research context.
- CB7 - To apply their knowledge and their ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their field of study

PREREQUISITES*

The corresponding to access master studies

CONTENTS

1. Fundamentals and applications of microstructural characterization techniques

* These features should not be modified without the approval of the bodies responsible for academic higher-level structures (field, module and / or system).

COURSE: CHARACTERIZATION OF THE COMPOSITION AND MICROSTRUCTURE OF THE MATERIALS

SUBJECT: Materials characterization and experimentation

MODULE: Specific knowledge module

PROGRAM: Master's degree in Materials Science and Engineering

PAGE 2 OF 4

2. Sample preparation
3. Characterization of the morphology of materials. Microscopy: optics, scanning electronics (SEM), transmission electronics (TEM), atomic forces (AFM), tunneling (STM).
4. Characterization of the composition and microstructure of materials: X-ray diffraction, X-ray fluorescence (XRF), photoelectron spectroscopy (XPS), AES, GDOES.

METHODOLOGY

LEARNING ACTIVITIES *

Learning Activities	ECTS credits	Competences
Lectures	1,15	E7, E8, CG2, CB6, CB7
Seminars	0,07	E7, E8, CG2, CB6, CB7
Case and Problem-Solving Sessions	0,15	E7, E8, CG2
Personal study	3,33	E7, E8, CG2
Presentations	0,15	E7, E8, CG2
Assessment Tasks (Exams, Continuous Assessment...)	0,15	E7, E8, CG2
TOTAL	5	

* These features should not be modified without the approval of the bodies responsible for academic higher-level structures (field, module and / or system).

COURSE: CHARACTERIZATION OF THE COMPOSITION AND MICROSTRUCTURE OF THE MATERIALS

SUBJECT: Materials characterization and experimentation

MODULE: Specific knowledge module

PROGRAM: Master's degree in Materials Science and Engineering

PAGE 3 OF 4

TEACHING METHODOLOGY

The teaching methodology used in the course is based on lectures and case and problem-solving sessions. Seminars are also scheduled to solve doubts. The student is provided with the complete course documentation with theory and case documents for personal study.

The students prepare presentations in groups or individually on specific issues, which become part of the study material.

ASSESSMENT

ASSESSMENT METHODS *

Assessment methods	Weight	Competences
Final exam	50%	E7, E8, CB6, CB7
Reports and Presentations	20%	E7, E8, CG2
Follow-up activities	25%	E7, E8, CG2
Participation	5%	CG2

LEARNING OUTCOMES

- The student must know the most common spectroscopic, diffraction, microscopy and surface techniques for the characterization of ceramics, metals, polymers and composite materials, as well as their limitations. (E7)
- The student must be able to select the most appropriate analysis technique in the characterization of the composition and microstructure of concrete materials and to relate the structure and properties of the materials with the results obtained. (E8)
- The student must demonstrate sufficient knowledge and ability to interpret an analytical procedure and characterize it by defining the appropriate parameters. (E8)
- The student must demonstrate the knowledge of the properties of ceramic materials in relation to the implications arising from misuse. (CG2)

QUALIFICATION

The evaluation of the course will consider all aspects listed in the evaluation grid with its corresponding weight. The higher weight of the mark rests in the final examination (50%). The reports and Presentations include classroom presentations and specific monographs that students (20%) prepare. Follow-up activities include partial tests or other deliverables (15%). Participation (5%) includes attitude, attendance and initiative shown by the student in the subject.

ASSESSMENT OF THE COMPETENCES (Define calculation expressions for each competency based assessment activities related.)

* These features should not be modified without the approval of the bodies responsible for academic higher-level structures (field, module and / or system).

COURSE: CHARACTERIZATION OF THE COMPOSITION AND MICROSTRUCTURE OF THE MATERIALS

SUBJECT: Materials characterization and experimentation

MODULE: Specific knowledge module

PROGRAM: Master's degree in Materials Science and Engineering

PAGE 4 OF 4

For the evaluation of E7 and E8 competences it will be used as an indicator the final exam, and presentations of work and monitoring activities.

For the assessment of competence CG2 it will be used as an indicator the participation, reports and presentations and follow-up activities marks.

For the assessment of CB6, CB7 competences will be used as an indicator the final exam.

BIBLIOGRAPHY (Recommended and accessible to students.)

1. Leng, Y. "Materials Characterization: Introduction to Microscopic and Spectroscopic Methods", 2nd Ed. 2013
2. Spencer, Michael, Fundamentals of Light Microscopy, Cambridge University Press, 1982.
3. Joseph I Goldstein, Dale E Newbury, Patrick Echlin and David C Joy, "Scanning Electron Microscopy and XRay Microanalysis", 3rd Ed. , 2005.
4. B.D.Cullity, S.R.Stock, "Elements of XRay Diffraction" 3rd. Ed., Prentice Hall, NJ , 2001.
5. 'Encyclopedia of Materials Characterization, Surfaces, Interfaces, Thin Films,' Editors C. Richard Brundle, Charles A. Evans, Jr., Shaun Wilson, Butterworth-Heinemann, Boston London Oxford Singapore Sydney Toronto Wellington.
6. Physical metallurgy and advanced materials' R.E.Smallman and A.H.W. Ngan, Seventh edition, 2007, Elsevier Ltd., USA.

DOCUMENT HISTORY

PREVIOUS CHANGES

September 14, 2016, Carles Colominas i Guardia

CURRENT REVISION

February 26, 2019, Carles Colominas i Guardia