Materials Science

Code: 102438
ECTS Credits: 6

2024/2025

Degree	Type	Year
2500897 Chemical Engineering	OB	3

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Teachers

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Teaching groups languages

You can view this information at the end of this document.

Prerequisites

This subject requires prior knowledge of chemistry and physics obtained during the first- and second-year degree in Chemical Engineering.

Objectives and Contextualisation

This subject approaches the students to the world of materials science. The internal structure of materials is correlated with their physical properties and finally with their applications. Special emphasis is laid on the assessment of mechanical properties, thermal treatments and the most characteristic transformation processes for each family of materials. Students should be able to properly apply the theory to problem solving, to make a critical analysis of the results, and to prepare and present cutting-edge topics in materials science in dedicated seminars.

Competences

- Apply relevant knowledge of the basic sciences, such as mathematics, chemistry, physics and biology, and the principles of economics, biochemistry, statistics and material science, to comprehend, describe and resolve typical chemical engineering problems.
- Apply scientific method to systems in which chemical, physical or biological transformations are produced both on a microscopic and macroscopic scale.
- Develop personal attitude.
- Develop personal work habits.
- Develop thinking habits.

Learning Outcomes

1. Apply scientific method to the design of functional materials.
2. Apply the essential principles of crystallography to the interpretation of the phenomena of plastic deformation and diffusion.
3. Apply the existing relation between bond and structure in materials to the control of their electrical, magnetic and optical behaviour.
4. Control and modify the microstructures of metals and their alloys by means of phase reactions and thermal treatments, and relate them with the mechanical properties observed.
5. Develop independent learning strategies.
6. Develop scientific thinking.
7. Develop systemic thinking.
8. Distinguish the different types of ceramic materials by the applications for which they are used.
9. Generate innovative and competitive proposals in professional activity.
10. Identify the type and properties of the different polymers obtained and evaluate the effects that they produce, their physical and chemical properties, and the variation in their most typical parameters.
11. Identify the type of compound material in accordance with the dispersed phase present and calculate their mechanical properties.
12. Recognise the effect the fact that a material is nanostructured has on mechanical, optical and electromagnetic properties.

Content

1. Structure of solids. Crystalline structure of metals and ceramics. Structure of polymers

2. Composite materials and nanomaterials

3. Imperfections and diffusion in solids

4. Mechanical properties of the solids. Deformation and hardening mechanisms

5. Phase Diagrams. Phase Transformations

6. Synthesis, manufacture and processing of materials

7. Selection of materials

8. Electrical, magnetic and optical properties

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes

Type: Supervised			
Mentoring	5	0.2	
Type: Autonomous			
Bibliographic search	18	0.72	5
Problem solving	45	1.8	1, 2, 3, 4, 8, 10, 11, 12
Study of thoretical concepts	70	2.8	1, 2, 3, 4, 8, 10, 11, 12

This subject will no longer be face-to-face in the 2024-25 academic year, given that it is being discontinued due to the implementation of a new degree study plan. Therefore, the methodology to be followed is the self-work of the students and the required tutorials with the teaching staff responsible for monitoring the contents of the subject.

The self-work load encompasses the study of the fundamental concepts given, resolution of exercises, bibliographic search, preparation and presentation of a topic in the field of materials science.

The material will be available on the Virtual Campus.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Midterm exams or final exam	70%	11	0.44	1, 2, 3, 4, 8, 9, 10, 11, 12
Oral presentation	15%	0.5	0.02	5, 6, 7, 9
Written assignments	15%	0.5	0.02	1, 2, 3, 4, 5, 8, 10, 11, 12

The evaluation of the subject is online except for midterm and final exams, and will be performed in a continuous manner. In the event of the assessment activities a student has performed accounting for less than 2/3 of the subject's final mark, their work will be classified as "not assessable" on their transcript.

The final mark (NF) of the subject will be obtained from the following assessable activities:

70%: Mark of the two midterm exams [(P1 + P2) / 2] and / or of the final exam (F)

1st midterm exam (P1): topics 1 to 3 (35%).

2nd midterm exam (P2): topics 4 to 7 (35%).

(The date of the exam revision session will be notified through Campus Virtual in due time)

15%: Mark of the oral presentation (T), to be done by the end of the semester. The student can request keeping the mark obtained in previous courses.

15%: Mark of the assignments (PP); the delivery date will be notified through the Campus Virtual. The student can request keeping the mark obtained in previous courses.

Calculation of the final mark (NF) considering the midterm exams:

NF = 0.7 · [(P1 + P2) / 2] + 0.15 · T + 0.15 · PP

Calculation of the final mark (NF) considering the final exam (F):

NF = 0.7 · F + 0.15 · T + 0.15 · PP

* The final exam will consist of two separate exams corresponding to the contents of P1 and P2.

* A mark of 4.5 out of 10 points is required in the midterm exams for further averaging.

* If one of the midterm exams is scored less than 4.5 out of 10, student's knowledge will be reassessed (final exam). Recall that to be reassessed, the student must previously have submitted a minimum of two-thirds of the course-assessment items.

* If the mark obtained following reassessment is less than 5 (out of 10 points), the mark will not be weighted with the rest of assessable activities (T andPP).

* Students retaking the subject may, if they wish, do the final exam only and omit the midterm exams. They must, though, perform the oral presentation (T) and deliver the assignments (PP).

Bibliography

- Ciencia e ingeniería de materiales; W.D. Callister & David G. Rethwisch, 2a ed., Wiley, 2018.

https://csuc-uab.primo.exlibrisgroup.com/permalink/34CSUC_UAB/1c3utr0/cdi_proquest_ebookcentral_EBC6798

- Introducción a la ciencia de materiales para ingenieros; J.F. Shackelford (traducción y revisión técnica, Alfredo Güemes Gordo, Nuria Martín Piris), 7a ed., Prentice Hall, Madrid, 2010.

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- Materiales: Estructura, propiedades y aplicaciones; J.A. de Saja *et al*., Thompson, Madrid, 2005.

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Software

VESTA programme (free programme that allows visualizing 3D structures)

Wolfram Demonstration project: https://demonstrations.wolfram.com/

Language list

Information on the teaching languages can be checked on the CONTENTS section of the guide.