

60030 - Material science

Syllabus Information

Academic year: 2023/24

Subject: 60030 - Material science

Faculty / School: 100 - Facultad de Ciencias

Degree: 538 - Master's in Physics and Physical Technologies
589 - Master's in Physics and Physical Technologies

ECTS: 5.0

Year: 1

Semester: First semester

Subject type: Optional

Module:

1. General information

The main objective of the subject "Materials Science" is the study of the relationship between the microstructure and the properties of materials, and how these properties can be modified by means of an adequate control of the manufacturing processes. This subject is multidisciplinary in nature, encompassing aspects of applied physics, chemistry and engineering.

This approach is aligned with the following two Sustainable Development Goals (SDGs) of the United Nations 2030 Agenda (<https://www.un.org/sustainabledevelopment/en/>), Goal 7; (Affordable and Clean Energy), and Goal 9 (Industry, Innovation and Infrastructure), and is related to other complementary subjects in the Master, such as "Nanoscience and Nanotechnology" and "Advanced Topics in Physics".

2. Learning results

To pass this subject, the student must be able to:

- Compare the main materials for structural and functional use.
- Know how to modify and characterize the microstructure of a material.
- Relate the properties of a material to its microstructure.
- Characterize materials according to their properties.
- Select materials for specific applications.

3. Syllabus

a) Content of theory and problems:

Microstructure and classification of materials.

The structure of the materials.

Glass defects.

Diffusion.

Phase equilibrium diagrams.

Phase transformations.

Metals: heat treatments, functional properties, applications.

Ceramics: preparation, microstructure, structural and functional ceramics, applications.

Polymers: molecular structure, classification of polymers, applications.

Composite materials: types and applications.

Surface characterization techniques.

b) Content of the laboratory practices:

Microscopic techniques.

Phase transformations.

Material selection (CES Selector).

Surface analysis techniques: XPS, AES, nanoindentation and confocal microscopy.

4. Academic activities

- Theory/problem classes (3 hours per week).
- Practical classes (4 sessions of 3.5 hours each).
- Personal (or group) study for the solving of the exercises proposed in class and the preparation of work presentations.

5. Assessment system

Continuous assessment:

- Presentations of works, as well as practical exercises to be developed by the students: 50% of the final grade will be weighted.
- Final exam: multiple-choice exam, whose grade will be weighted by 50% of the final grade.

Single Comprehensive Test:

Students who wish to do so will be entitled to take a single final exam. The exam will be a multiple-choice test, and the grade obtained will represent 100% of the final grade of the subject.