COURSE DATA

DATA SUBJECT

Code: 46992
Name: Current Topics in Advanced Materials
Cycle: Master's Degree
ECTS Credits: 2
Academic year: 2025-26

STUDY (S)

Degree	Center	Acad. year	Period
2278 - Master in Advanced Materials	Facultat de Química	1	Second quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
2278 - Master in Advanced Materials	Temas actuales en materiales avanzados	COMPULSORY

COORDINATION

CORONADO MIRALLES EUGENIO

SUMMARY

Classes for this subject, along with those for module MA4, will be taught intensively over three weeks in May each year at a different university. Instruction will be provided in English.

This course presents the state-of-the-art in the field of advanced materials through lectures given by specialists in the field, including renowned researchers and industry figures, organized as a European School on Advanced Materials (ESAM). Students will have the opportunity to give a brief oral presentation followed by a discussion on a preliminary and specific result of their research.

This school is essential for the cohesion of the interuniversity program and for the creation of a scientific and technological community in the field of advanced materials.

The topics of the talks will include:
1. Graphene and other 2D materials.
2. Materials for energy.
3. Smart materials with advanced functionalities.

The theoretical foundations related to these topics will have been previously taught in the classes of modules 1, 2, 3, and 4, thus ensuring students' prior knowledge of the terms and concepts explained. The lectures in this module will place special emphasis on the state of the art in advanced materials research, addressing the latest trends, advances, and challenges in the field. In this way, the master's program

curriculum is constantly updated, ensuring that students have access to current and relevant knowledge in the field, preparing them to face the latest scientific and technological challenges in the field of advanced materials.

PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

There are no specified enrollment restrictions with other subjects of the curriculum.

OTHER REQUIREMENTS

Previous knowledge of chemistry, physics or materials science as taught in the degrees indicated in the recommended entry profile to the master's degree is required. Previous knowledge of materials science as taught in the Introduction Module (MA1) is required.

COMPETENCES / LEARNING OUTCOMES

2278 - Master in Advanced Materials

Capacity for learning, responsibility and decision-making: Act autonomously in learning, make informed decisions in different contexts, issue judgements based on experimentation and analysis and transfer knowledge to new situations.

Categorise the use of advanced materials for environmental remediation: water, soil and air treatment. Also consider concepts such as biodegradation.

Communication: Be able to communicate effectively, both orally and in writing, adapting to the characteristics of the situation and audience.

Creative and entrepreneurial skills: Propose creative and innovative solutions to complex situations or problems within the field of knowledge to respond to diverse professional and social needs.

Critically analyse, evaluate and synthesise new ideas to solve problems in complex or unfamiliar environments within broader contexts in the different areas of impact and application of materials.

Critical thinking, ethical commitment and professional responsibility: Demonstrate critical and self-critical reasoning in the field of the degree, considering aspects such as professional ethics, moral value and the social implications of the different

Emotional intelligence: Understand and regulate one's own emotions and those of others to interact and participate effectively and constructively in social and professional life.

Evaluate the lifetime of advanced materials by applying the concept of circular economy to starting products, preparation processes, usage and recycling.

Gender perspective: Know and understand, within the area of the degree, inequalities based on sex and gender in society; integrate different needs and preferences based on sex and gender into the design of

solutions and problem-solving.

Have the knowledge and skills necessary to pursue future doctoral studies in the field of materials.

Identify and classify 2D materials and their derivatives.

Predict and rationalise properties related to spin-polarised transport in devices.

Predict and rationalise the physical properties of 2D materials.

Relate the type of advanced material to the best methods of production, manufacturing and processing of the final device.

Social commitment and sustainability: Contribute to the design, development and implementation of solutions that respond to social demands, considering the Sustainable Development Goals as a reference.

Students from one area of knowledge (e.g. physics) should be capable of communicating and interacting scientifically with peers from other areas of knowledge (e.g. chemistry) in the analysis and resolution of common problems.

Teamwork and leadership: Collaborate effectively in work teams, taking on responsibilities and leadership roles and contributing to collective improvement and development.

Understand the main applications of materials in quantum technologies and neuromorphic computing.

Understand the main technological applications of 2D materials and their derivatives, and be able to place them within the general context of materials science.

Understand the state of the art in 2D materials.

Understand the state of the art in energy materials.

Understand the state of the art in materials for electrocatalysis.

Understand the structure property relationship in different advanced stimuli-responsive materials and distinguish their fields of application.

DESCRIPTION OF CONTENTS

The talk topics will include:

1. Graphene and other 2D materials.

2. Materials for energy.

3. Smart materials with advanced functionalities.

These talks will be divided into three types, depending on their level of specificity and the speaker's profile:

- General lectures (50 min + 10 min debate): These talks will cover essential aspects of Advanced Materials. They will be given by internationally renowned researchers who are experts in the topic of the talk, most of whom are leaders of established research groups, some of whom are recipients of an ERC Advanced or Consolidator grant.

- Specialized lectures (25 min + 5 min discussion): These talks will showcase some of the most relevant scientific advances achieved by the most representative European research groups in the field of Advanced Materials. The speakers will often be leaders of emerging research groups, some of whom will be recipients of an ERC Starting grant or other prestigious international recognition.

- Oral presentations (5 min + 2 min discussion): To encourage debate and communication among all participants, students will present short presentations on a research topic in the field of advanced materials. In addition to the Master's in Advanced Materials students, students from related doctoral programs will also participate in this school and may also give a short oral presentation on the results of their doctoral thesis, including those that, although incomplete, could stimulate discussion.

Representatives from European companies with a certain level of relevance in the field of advanced materials will also be invited to give lectures.

The full program of the most recent ESAM organized can be found at www.icmol.es/esam

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Theory	25,00
Classroom practices	5,40
Total hours	**30,40**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Individual or group project	19,60
Total hours	**19,60**

TEACHING METHODOLOGY

The main training activities will be attending conferences and specialized seminars given by European researchers in the field of advanced materials organized in the form of the European School on Advanced Materials (ESAM).

During this school, which will also be attended by other master's and doctoral students who are training in the field of advanced materials, a discussion forum will be established between this young generation of scientists, consolidated research groups of international prestige and professionals from companies in the field of advanced materials.

In the same way, the students must make a short oral communication with their subsequent discussion on a preliminary and concrete result of their investigation chosen by the student. For this you must prepare an

abstract and the content of the oral communication. The fundamental objective of this activity is for the students to be able to communicate scientific results and debate them with an audience made up of other master's students, young doctoral researchers and researchers and professors who are experts in advanced materials.

In this activity, the student has 5 minutes to present and then debate with the audience a preliminary and concrete result of their investigation. In this communication, the aim is to make the students demonstrate their level of competence in communication and discussion with an audience made up of other master's students, young doctoral researchers and researchers and professors who are experts in advanced materials.

By attending this school, one of the objectives of the Master's is to be achieved: Promote mobility and interaction between Master's students and contact with other universities, research centers and/or companies active in the area.

EVALUATION

SE3- Active participation in face-to-face activities: 80%
SE4- Presentation and discussion of an oral communication: 20%

SE3- Active participation in face-to-face activities: the evaluation of this subject will consider the active participation of the students in the lectures of the European School on Advanced Materials (ESAM). Aspects such as the frequency and quality of student interventions and contributions, the relevance of their comments and their ability to formulate relevant questions will be taken into account.

SE4- Presentation and discussion of an oral communication: Both the summary (abstract) of the talk and the oral presentation made by the students on a preliminary and concrete result of their research will be evaluated at the student's choice. The content of the communication will not be valued so much as its ability to present it in a clear and structured way, and, above all, its ability to interact with a multidisciplinary audience made up of master's students, doctoral students and professors.

The assessment will consider fundamental aspects such as the student's ability to synthesize and communicate complex technical information in a well-structured, clear and comprehensible manner, using technical terminology and precision in the transmission of concepts and results. Likewise, their ability to respond to questions or comments from the audience in a well-founded and rigorous manner will be taken into account.

The evaluation will be carried out by the teaching staff of the assistant master at the school.

Attendance at training activities is mandatory. In order to pass the module, it will be necessary to have attended all the talks, except in duly justified cases.

REFERENCES