

60458 - Advanced structural characterization techniques

Syllabus Information

Academic year: 2024/25

Subject: 60458 - Advanced structural characterization techniques

Faculty / School: 100 - Facultad de Ciencias

Degree: 543 - Master's in Molecular Chemistry and Homogeneous Catalysis

ECTS: 4.0

Year: 1

Semester: Second semester

Subject type: Optional

Module:

1. General information

This subject studies specific techniques for the characterization of materials that are considered complementary to the basic structural characterization techniques of organic or organometallic compounds. Students are expected to acquire sufficient knowledge to be able to approach the structural, morphological and functional characterization of new composites and materials, using the most appropriate techniques, selected in a reasoned manner.

In this subject, the student will receive the necessary information on specific advanced instrumental techniques that are currently being used to understand the structure of molecules and materials from the nanoscopic to the macroscopic scale.

2. Learning results

To know and apply advanced concepts related to spectroscopic and instrumental techniques of great utility in the characterization (structural, thermal, optical, magnetic, electrical) of organic, inorganic and organometallic compounds and materials.

To know the basis of different instrumental techniques for structural characterization and assessment of properties (thermal, optical, magnetic, electrical) of molecules and materials.

To know the field of application of each technique and its different modalities, as well as their interrelation and complementarity.

To be able to select techniques, design experiments and assess characterization methods in each case, depending on the problem to be solved.

To know the type of molecule or material that can be studied with the techniques learned and how to prepare the sample appropriate to each case.

The knowledge acquired in this subject will allow the student to approach the structural characterization and assessment of the properties of the molecules and materials prepared, using advanced instrumental techniques specific to the problem to be solved. The student will be able to select the most appropriate technique or techniques for the material to be studied, from its molecular and/or supramolecular structure and dimensions (from the nanoscale to the macroscale) to its most characteristic properties (thermal, optical, magnetic, electrical).

3. Syllabus

The contents are divided into the following modules:

1. Structural characterization techniques: nuclear magnetic resonance (NMR) of solid state and soft matter; surface characterization techniques such as X-ray photoelectron spectroscopy (XPS); X-ray absorption spectroscopy; electronic and vibrational circular dichroism.

2- Morphological and compositional characterization techniques: Advanced microscopies: electron microscopies (TEM, SEM), proximity microscopies (AFM, STM).

3- Thermal characterization techniques: differential scanning calorimetry (DSC); thermogravimetric analysis (TGA).

4- Magnetic characterization techniques: electron paramagnetic resonance (EPR); magnetic properties.

4. Academic activities

Expository-participative classes (2.6 ECTS)

Problem solving, development of seminars, case studies (1 ECTS) Practice in teams (0.4 ECTS)

Tutorials in small groups or personalized

5. Assessment system

The continuous assessment of this subject is based on the following activities with the weighting shown below:

1- Regular class work based on problem solving and theoretical-practical questions (20 %).

2- Completion of supervised practical work individually or in groups (25 %).

3- A written test to be taken during the global assessment period consisting of the solving of problems as well as theoretical and theoretical-practical questions (55 %).

The subject will be considered as passed if the weighted average of the three grades according to the indicated percentages is equal to or higher than 5.

Students who do not opt for continuous assessment or who do not pass the subject by this procedure may take a global test, which will account for 100% of the final grade, both in the first and in the second call

This exam will consist of a written test on all the contents covered in the subject.

Students who wish to improve their continuous assessment grade may also take the global test in the first call, keeping the best of the grades obtained.

6. Sustainable Development Goals

4 - Quality Education

9 - Industry, Innovation and Infrastructure