

## 60385 - Characterization of geological materials: techniques and applications

### Syllabus Information

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**Academic year:** 2023/24

**Subject:** 60385 - Characterization of geological materials: techniques and applications

**Faculty / School:** 100 - Facultad de Ciencias

**Degree:** 624 - Master's in Geology: Techniques and Applications

**ECTS:** 3.0

**Year:** 1

**Semester:** Second semester

**Subject type:** Optional

**Module:**

### 1. General information

Chemical, textural and physical characterization is basic in the research lines of petrology, geochemistry, crystallography and mineralogy, as well as in the economic, industrial and environmental fields. The objective of the subject is to provide a broad overview of characterization techniques and their applicability to specific problems so that the student is able to select the most appropriate ones and analyse, interpret and draw coherent conclusions from the results obtained.

These approaches and objectives are aligned with the following Sustainable Development Goals (SDGs) of the United Nations Agenda 2030 (<https://www.un.org/sustainabledevelopment/es/>), so that the acquisition of the learning results of the subject provides training and competence to contribute to some extent to their achievement: Goal 4: Quality Education.

### 2. Learning results

Upon completion of the subject, the student will be able to:

- Know the fundamentals, requirements and applicability of the most common chemical and textural characterization techniques in geology.
- Select the appropriate technique to obtain the type of information required by the problem.
- Apply quality criteria (precision and reproducibility of the technique) to validate and analyse the results obtained from each technique.
- Apply the above knowledge to the interpretation of the results obtained, integrating the results of the application of various techniques.
- Draw geological conclusions from the results, that are consistent with the problem posed and, if necessary, interpret the causes of anomalous results.

### 3. Syllabus

#### Block I

- Physical characterization techniques: isotropy/anisotropy characterization, textural characterization and porosimetric characterization.
- Natural variability, sampling scale and scale of analysis.

#### Block II

- Electron microscopy (SEM and TEM). Electronic microprobe.

#### Block III

- Spectroscopic techniques (infrared, Raman, X-ray absorption, nuclear magnetic resonance, Mossbauer).
- Thermal analysis (differential thermal analysis, differential scanning calorimetry, thermogravimetric analysis, dilatometry). -quantification by X-Ray diffraction
- Imaging techniques (atomic force microscopy, tunnelling microscopy, confocal microscopy).
- Synchrotron: basics and applications.

### 4. Academic activities

**Participative lectures: 18 h.** Sessions in which the teacher will explain the subject's syllabus.

**Special laboratory practices: 8 h.** The laboratory practices will consist of two sessions in which observations and analysis of real samples will be conducted by electron microscopy.

**Special field practices: 4 h.** A visit to a large analytical equipment, either from the University of Zaragoza or from another research centre will be conducted.

**Study or personal work: 20 h.**

**Assessment tests: 2 h.**

## **5. Assessment system**

Classroom development of the subject: continuous assessment.

There will be three written tests, one for each of the content blocks included in the syllabus. These tests will be based on the knowledge acquired during the development of the theoretical part of the subject and the laboratory practices (SEM and TEM) and will eliminate subject matter for the official calls, provided a grade equal to or higher than 5 is obtained. Each of the tests represents 20%, 40% and 40%, respectively, of the grade.

Global assessment test.

Students who have not passed the subject by continuous assessment or who have not opted for this type of evaluation will have to take a single theoretical-practical test of all the contents of the subject, whose assessment will represent 100% of the grade.