# 220059 - Materials Chemistry

<table>
<thead>
<tr>
<th>Coordinating unit:</th>
<th>205 - ESEIAAT - Terrassa School of Industrial, Aerospace and Audiovisual Engineering</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teaching unit:</td>
<td>713 - EQ - Department of Chemical Engineering</td>
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<tr>
<td>Academic year:</td>
<td>2019</td>
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<tr>
<td>Degree:</td>
<td>BACHELOR'S DEGREE IN AEROSPACE VEHICLE ENGINEERING (Syllabus 2010). (Teaching unit Optional)</td>
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<td>BACHELOR'S DEGREE IN INDUSTRIAL TECHNOLOGY ENGINEERING (Syllabus 2010). (Teaching unit Optional)</td>
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<td></td>
<td>BACHELOR'S DEGREE IN AEROSPACE TECHNOLOGY ENGINEERING (Syllabus 2010). (Teaching unit Optional)</td>
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<td></td>
<td>BACHELOR'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2009). (Teaching unit Optional)</td>
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<tr>
<td>ECTS credits:</td>
<td>3</td>
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<tr>
<td>Teaching languages:</td>
<td>English</td>
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## Teaching staff

<table>
<thead>
<tr>
<th>Coordinator:</th>
<th>José María Dagá Monmany</th>
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<tr>
<td>Others:</td>
<td>José María Dagá Monmany</td>
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<tr>
<td></td>
<td>José María Gibert Vives</td>
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## Requirements

It is useful to carry a laptop or similar to most classes. En the lectures, there will be special emphasis on library resources, and we must protect them and consult them. The library resources are essential for research work.

## Teaching methodology

The course is divided into parts:

**Theory classes**

Self-study for doing exercises and activities.

In the theory classes, teachers will introduce the theoretical basis of the concepts, methods and results and illustrate them with examples appropriate to facilitate their understanding.

In the practical classes (in the classroom), teachers guide students in applying theoretical concepts to solve problems, always using critical reasoning. We propose that students solve exercises in and outside the classroom, to promote contact and use the basic tools needed to solve problems.

Students, independently, need to work on the materials provided by teachers and the outcomes of the sessions of exercises/problems, in order to fix and assimilate the concepts.

The teachers provide the curriculum and monitoring of activities (by ATENEA).

## Learning objectives of the subject

The main objective is to develop contents of materials and solid state chemistry knowledge not discussed before in extent in the previous chemistry courses. So we will elaborate structural, reactivity, synthetic and analytical questions, covering also property and application concerns.

We will pay special attention to frontier research and development of new products in materials chemistry. Materials products with market definitive implementation could also be studied, taking into account possible alternatives. This objective will be specially achieved by a directed research work, developed individually by the student, or in a two team.
# Study load

<table>
<thead>
<tr>
<th>Total learning time: 75h</th>
<th>Hours large group:</th>
<th>30h</th>
<th>40.00%</th>
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</thead>
<tbody>
<tr>
<td>Self study:</td>
<td></td>
<td>45h</td>
<td>60.00%</td>
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## Content

| - Solid state chemistry (inorganic examples) | Learning time: 37h  
Theory classes: 12h  
Self study: 25h |
|---------------------------------------------|-------------------------------------------------|

**Description:**
Inorganic polymers, fibres, inorganic solids, semiconductors, superconductors, ceramics, glasses, pigments, coatings, hydrogen storage systems, thin films by chemical vapour deposition (CVD), imaging agents for magnetic resonance, catalysts, surface science and connections with chemical process technology.

**Related activities:**
These inorganic examples will be developed explaining first the fundamental theory, afterwards discussing case studies in seminars, then solving numerical problems in practical classes, and finally pointing at bibliographic sources for further information (for research work).

| - Organic polymers | Learning time: 13h  
Theory classes: 6h  
Self study: 7h |
|-------------------|-------------------------------------------------|

**Description:**
Specialty and high performance polymers, liquid crystalline polymers, elastomers, synthetic and natural fibres.

**Related activities:**
These examples of organic polymers will be developed explaining first the fundamental theory, afterwards discussing case studies in seminars, then solving numerical problems, and finally pointing at bibliographic sources for further information (for research work).

| - Biomaterials and biomedical polymers | Learning time: 12h 30m  
Theory classes: 6h  
Self study: 6h 30m |
|---------------------------------------|-------------------------------------------------|

**Description:**
Biocomposites, biomimetics, natural and modified fibres (natural and artificial nanomaterials; biomaterials from renewable resources; biomineralization).

**Related activities:**
These examples of biomaterials and biomedical polymers will be developed explaining first the fundamental theory, afterwards discussing case studies in seminars, then solving numerical problems, and finally pointing at bibliographic sources for further information (for research work).
The final grade depends on the following assessment criteria:

\[ F = 0.25 \text{AEP} + 0.5 \text{AEF} + 0.25 \text{RWP} \]

- F: final evaluation
- AEP: evaluation exam partial
- AEF: evaluation exam final
- RW: Research Work Project

Any student who cannot attend any of the written tests or that wants to improve the obtained grade, will have the opportunity by taking an additional global written exam that will take place the date fixed in the calendar of final exams. The grade obtained in this test will range between 0 and 10, and will replace that of the previous tests only in case it is higher.

**Qualification system**

**Heterogeneous catalysis and physical techniques in materials chemistry characterization**

**Learning time:** 12h 30m
- Theory classes: 6h
- Self study: 6h 30m

**Description:**
Physical techniques to characterise materials. Case studies covering the following techniques:

- X-ray diffraction (XRD)
- Scanning Electron Microscopy (SEM)
- Raman and infrared spectroscopy
- Nuclear Magnetic Resonance
- Colorimetry

**Related activities:**
These examples of heterogeneous catalysts and physical techniques will be develop explaining first the fundamental theory, afterwards discussing case studies in seminars, then solving numerical problems, and finally pointing at bibliographic sources for further information (for research work).

**Qualification system**

The final grade depends on the following assessment criteria:

\[ F = 0.25 \text{AEP} + 0.5 \text{AEF} + 0.25 \text{RWP} \]

- F: final evaluation
- AEP: evaluation exam partial
- AEF: evaluation exam final
- RW: Research Work Project

Any student who cannot attend any of the written tests or that wants to improve the obtained grade, will have the opportunity by taking an additional global written exam that will take place the date fixed in the calendar of final exams. The grade obtained in this test will range between 0 and 10, and will replace that of the previous tests only in case it is higher.

**Regulations for carrying out activities**

Because the contents of the partial exam are included in the final exam, passing the final exam implies having passed also the partial exam. In any case, the best average of the exams will remain.
220059 - Materials Chemistry

Bibliography

Basic:


Others resources:

Course notes available in Atena platform.