Universidad Zaragoza

Academic Year: 2025/26

60829 - Materials for industrial applications

Teaching Plan Information

Academic year: 2025/26
Subject: 60829 - Materials for industrial applications
Faculty / School: 110 - Escuela de Ingeniería y Arquitectura
Degree: 532 - Master's in Industrial Engineering
ECTS: 6.0
Year: 2
Semester: Second semester
Subject type: Optional
Module:

1. General information

This subject aims to provide a scientific education on the materials available for industrial engineering applications, to update the knowledge of new materials and processes that are under research and development.

Also, to teach students how to use procedures to select the most suitable materials for a specific application, based on operational requirements, taking into account the size and geometry of the piece or material element, as well as its cost. It introduces concepts related to environmental impact and ecological design in the selection of materials.

The subject also offers training in concepts related to the environmental treatment of materials following two lines: life cycle analysis and circular economy.

2. Learning results

It is important for an engineer to possess extensive scientific and technical knowledge of commercial materials or materials in research and development for product manufacturing. It is also important to know how to proceed in their most suitable selection for each application, through the knowledge of the relationships that exist between the material and its processing and its functional and structural properties. This selection requires operational and economic knowledge, as well as understanding their impact on the environment.

- To know the different types of materials currently used in various sectors of industrial engineering, such as the transportation industry (automotive and aeronautics), energy, chemistry, telecommunications, building, mechanics, etc., as well as the advances in new materials and the manufacturing processes that are necessary to produce them.
- To know how to search, analyse and understand the scientific and/or commercial information about the most suitable materials for the different applications in the field of industrial engineering, as well as the trends in research and development in its different fields.
- To understand the impact that the manufacturing and use of industrial materials has on the environment, and to know some of the most relevant techniques for its evaluation. To understand the importance of materials in a circular economy.
- To be able to choose the most suitable material or materials for the specific application under study, taking into account the service conditions and its environmental impact. To be able to prepare reports with the most relevant results in a theoretical/experimental study related to materials in the field of industrial engineering.

3. Syllabus

- Materials for structural applications and their properties: building, energy, transportation, aeronautics, mechanics. Steels, advanced high-strength steels and superalloys, light alloys, superplastic materials, non-metallic materials.
- Advanced materials for structural and functional applications and their properties: shape memory alloys, high entropy alloys, amorphous alloys, special alloys, functional polymers, advanced composites, technical ceramics and glasses.
- Material selection procedures. General method. Use of the CES program. Basic examples of formless selection. Examples of shape selection.
- The materials and their impacts on th environmental. Recyclability and energy content. Life cycle analysis. Materials in the context of circular economy.

4. Academic activities

- Theory Classes (25 hours), with students ‘active participation.
- Problem and case solving classes: (10 hours) The problems and cases to be addressed will be indicated beforehand and each student should have worked on them in advance.
- Group work presentation classes (work groups of 2 people) (10 hours). The subject topics will be covered in depth through presentations based on scientific articles.
- Laboratory practices (12 hours). Material selection practice, practice of the manufacturing as well as of the structural

and mechanical characterization of a high-strength steel including the creation of a poster.
- Final assessment test (3 hours).
- Personal study (55 hours), mandatory readings for classes and subject assignments (35 hours).

5. Assessment system

A progressive and continuous evaluation process is preferably chosen, in order to assess the student's learning in a comprehensive way (knowledge, skills and abilities). In order to assess the acquisition of skills by the students, the evaluation system is as follows:

- Written exercises (30% of the final grade).
- Presentations, debates and directed work (50% of the final grade).
- Laboratory practices (20% of the final grade).

The student must achieve, at least, a grade of 4 out of 10 in each of the assessable activities so they can be considered for the final grade. To pass the subject, the final grade obtained must be equal to or higher than 5 out of 10. Those students who, having followed the course continuously, had not passed some of the tests, must perform in the global test, and must obtain, a minimum grade of 4 out of 10, so that in the global calculation get al least a 5 out of 10.

Those students who do not participate in the continuous assessment, or have not passed it, must take the global test at the end of the term. It will consist of a part on the theoretical contents of the subject (80% of the final grade), and another practical part on the conceptual and procedural aspects of the laboratory practices (20% of the final grade). To pass the global test the student must achieve a minimum grade of 4 out of 10 in both parts, and the final weighted grade must be at least 5 out of 10.

On the other hand, the second call for evaluation will be carried out through a global test carried out in the period established for this purpose in the academic calendar.

6. Sustainable Development Goals

7 - Affordable and Clean Energy
9 - Industry, Innovation and Infrastructure
12 - Responsible Consumption and Production