Universidad Zaragoza

Academic Year/course: 2023/24

66112 - Preparation of Nanostructured Materials

Syllabus Information

Academic year: 2023/24
Subject: 66112 - Preparation of Nanostructured Materials
Faculty / School: 100 - Facultad de Ciencias
Degree: 539 - Master's in Nanostructured Materials for Nanotechnology Applications
ECTS: 6.0
Year: 1
Semester: First semester
Subject type: Compulsory
Module:

1. General information

The main aim of this module is to instruct the student in the different methods available to obtain nanostructured materials, i.e. the first stage in the production of nanodevices with properties that are of interest in fields as diverse as physics, chemistry, biochemistry and medicine. , in this module, different nanostructured materials production techniques will be examined, linking the most appropriate technique in each case to the material we wish to handle and the architecture and end properties of the nanodevice we intend to produce.

These approaches and objectives are aligned with the achievement of SDG 9. Industry, innovation and infrastructures of the Agenda 2030. More specifically, they will create action to enhance research, foster innovation and upgrade industrial technologies.

2. Learning results

- Possess a critical view of the different chemical and physical methods for the preparation of nanostructured materials, identifying the pros and cons of each method.
- Classify the nanostructure production methods, identifying the most appropriate in each case in accordance with the starting materials and the intended end properties.
- Use specific equipment to prepare nanostructured materials.
- Apply the vocabulary appropriate to this discipline, being able to assess, judge and contrast results obtained for the nanostructure production processes with other students.
- Identify the main applications of nanolithographic processes.
- Plan, design and perform experiments that allow value added nanomaterials to be produced, assessing the problems, risks and results.

3. Syllabus

Preparation methods for thin film, single and multi-layer molecules: chemical vapour deposition (CVD), physical vapour deposition (PVD), liquid phase deposition (cast films, spin coating, spray coating, ink printing, dip-coating, layer-by-layer, Langmuir-Blodgett, liquid phase epitaxy, electroplating), solid phase deposition (powder deposition, screen printing).

Fabrication of micro and nanostructure in the Clean Room by: Optical lithography, Nanoimprint lithography, Electron beam lithography, Ion beam lithography and the Scanning Probe Lithographies.

4. Academic activities

- **Lectures (4 ECTS)**. Lecture notes and a set of problems (and their corresponding solutions) will be available for the students. The lecturers will provide the students with notes, handouts or summaries of class content prior to the beginning of the class (preferably via Moodle) along with the recommended reading for more in-depth understanding of the topic. Other learning tasks taking place during lectures are open forum on the basic concepts and their application, comparison with real developments, problem-solving and practical case studies.
- **Laboratory Sessions (2 ECTS)**. Four laboratory practice sessions through which the student will face real-life problems in the preparation of nanostructured materials. Thanks to the work with their colleagues in practical groups, the students will develop group work skills.
- **Assignments**. At the end of every topic, each student will complete individually the Q&As that the lecturers give them

over the course.

- **Autonomous work**. Students are expected to spend about 95 hours to study theory, solve problems, prepare lab sessions and assignments and take exams.

5. Assessment system

For students choosing **Continuous Assessment** (attendance to at least 80% of this module lectures is required)

1.- Written exam (33% of the final result for the module). This written exam consists of: a) Theory questions; b) Problem solving and exercises where the student will have to show knowledge about production of nanomaterials, nanostructures and nanolithographic techniques.

2.- An individual monographic project (33% of the final result for the module) related to some of the topics included in the module descriptors. Specifically for the report, a score of 1 to 10 is given for: i) structure (logical division of content); ii) quality of scientific and technical content (presentation of state of art, correct use of formulae, use of consistent arguments, and correct presentation of most important conclusions); iii) good use of bibliography (number and quality of sources consulted); iv) presentation (well written, correct and fluent use of English, care taken over style).

3.- Practical Assessment (33% of the final result for the module) where the knowledge, abilities and skills of the students in the laboratory are evaluated. Lectures may also ask the students to write reports on their laboratory results.

For students that did not pass the ongoing assessment or wish to increase their mark **Global Assessment** comprising a written test (50%), a practical test (25%) and a dissertation + oral presentation of a monographic piece of work (25%) before a board of three lecturers from the subject area.

A minimum qualification of 4 out of 10 is needed in each of the three parts to pass the subject. In any case, the average over the three sections must be at least 5 out of 10 to pass the subject.