



Máster en Materiales Nanoestructurados para Aplicaciones Nanotecnológicas 66106 - Case studies of industrial applications

Course 2014 - 2015

Curso: 1, Semestre: 1, Créditos: 6.0

Basic information

Teachers

- **Francisco Balas Nieto** fbalas@unizar.es
- **Gerardo Fabián Goya Rossetti** goya@unizar.es
- **Miguel Ángel Urbiztondo Castro** urbiz@unizar.es
- **María Pilar Lobera González** plobera@unizar.es
- **Jesús Marcos Santamaría Ramiro** jqcatal@unizar.es

Recommendations to attend this course

Recommendations for taking this subject

The "*Case studies of Industrial Applications*" module is obligatory and is equivalent to 6 ECTS credits or 150 student work hours. The course is given in the first term of the academic year. As with the other modules in this Master's, this module is taught and assessed completely in English.

The objective of this module is that the students analyse and understand how Nanotechnology has real applications in our everyday lives. In order to achieve this objective, various speakers from the industrial sector will show how their companies make use of Nanotechnology in their production lines and end products. In addition, through this module students should become aware of the potential risk of nanomaterials on health, environment and sustainability and how to prevent or limit these effects.

As the whole course is taught in English, students need to have an upper-intermediate level in the language: minimum level B1 in the European Common Framework Language Reference, but preferably level B2. Level B1 is reached when the student is able to understand the main points of clear, standard-language texts when covering known matters - whether in terms of work, study or leisure; when able to cope in most situations which the student encounters during a trip to places where the language is spoken; when able to write simple, coherent texts on familiar topics or those in which the student has an interest; and when able to describe experiences, happenings, wishes and ambitions as well as briefly justify opinions or explain plans. B2 is achieved when the student is able to understand the main ideas of complex texts that deal with both specific and abstract topics, even if these are technical - though within the field of specialisation; when able to communicate with native speakers with the degree of fluency and ease such that the communication takes place without effort on either side; and when able to write clear, detailed texts on diverse subjects as well as defend a point of view on general topics - giving the pros and cons of the different options.

Additional information about this master (grants, events, etc.) can be found on the web site:
www.unizar.es/nanomat

Course Schedule and Deadlines

Dates and key points for the subject

This module is taught in the first term in parallel with modules 2 and 3, thus the start date is the end of October.

The course is given in the afternoon and the calendar for classes and exam dates will be published prior to the beginning of each academic year in the web site of the Faculty of Science (<https://ciencias.unizar.es/web/horarios.do>).

Home

Learning outcomes that define this course

The student, in order to pass the course, will have to show her/his competence in the following skills:

- 1:** Identify the differential characteristics that the application of the nanoscale can give particular commercial products.
- 2:** Identify the difficulties existing for the advances achieved in the laboratory to be put into practice.
- 3:** List and describe products on the market (textile, motor, pharmaceutical, technological, construction, etc.) based on nanostructured materials.
- 4:** Recognise the design factors in high tech products and the characteristics which make them successful commercially.
- 5:** Recognize possible effects of nanomaterials on health, environment and sustainability and how these effects can be eliminated or minimized.

Introduction

Brief presentation of the course

In this module, different speakers from the industrial world in areas from electronic to biomedical applications will explain to the students how their companies harness nanomaterials to provide a value added to their products. This allows our students to become aware of the real, scientific, financial, social, marketing, etc. difficulties involved in launching a nanodevice or a particular application of nanostructured materials onto the market.

Competences

General aims of the course

The expected results of the course respond to the following general aims

Through the talks given in this module, the students will become familiar with real cases of practical applications and get to know highly specialised experts, allowing them to become aware of the potential applications of Nanotechnology and also of the difficulties of getting a product into the marketplace. Likewise, they will develop the ability to communicate and interact with professionals from different disciplines. It will let them see, at first hand, important companies that might in the future be interested in contracting well-trained and highly specialised people in areas connected to Nanoscience and Nanotechnology.

Context/Importance of the course for the master degree

Context and position of the subject in the qualification:

In this subject, it is intended that the student be able to apply the knowledge gained about Nanoscience, understanding the market possibilities, the competitive advantages of technological innovation, the real difficulties when launching a new product or setting up a company, and, definitively, broadening the horizon regarding nanotech applications. In addition, this is the beginning of leaning towards a greater degree of specialisation, once the different applications of nanomaterials have been explored.

After completing the course, the student will be competent in the following skills:

- 1: Assess the importance of the nanotech product market.
- 2: Appreciate the potential of Nanotechnology as a horizontal discipline capable of incorporation into numerous production processes.
- 3: Appreciate the potential of Nanotechnology as a horizontal discipline capable of incorporation into numerous production processes.
- 4: Understand the potential risk of nanomaterials.
- 5: Recognise the difficulties and the scientific, financial, social, marketing, etc. challenges involved in launching a nanodevice or a particular application of nanostructured materials onto the market.
- 6: Communicate and interact with professionals from different disciplines.

Relevance of the skills acquired in the course

The results of the learning process for this subject are important because:

Through this module students will become much more aware of the reality of the discipline they are studying. Herein, students receive a description of the market prior to the insertion of a nanotech product, identifying the opportunity, designing the product or process, technological and commercial implementation. In other words, they see how science and industry have been able to apply the knowledge, tools, and resources studied in the previous modules to real problems. It is hoped the study of all these cases (10 case studies are expected to be studied from different areas: pharmaceutical industry, motor, textile, cosmetics, biotechnology, sensor manufacturing) will allow them to set themselves new challenges and develop innovative ideas.

Evaluation

Assessment tasks

The student will prove that he/she has achieved the expected learning results by means of the following assessment tasks:

1:

ONGOING ASSESSMENT

For students choosing continuous assessment:

- (a) Each student will set out a case study for which a written report must be presented. This describes the implementation process for a product in the market, evaluating not just the scientific difficulties and limitations but also the technological, financial and social concerns for this implementation, and the contribution of new ideas. The report must be a maximum of 20 pages long (times new roman 12 and including the figures or schemes that accompany the text). The originality of the topic chosen, the review of the state of the art in the area (including patents) and the identification of the niche market will be assessed. At the same time, the technological viability of the proposed idea will be assessed and the consideration given to the main factors here, including cost estimation, availability of raw materials, viability of proposed processes, etc. Lastly, this work will be publicly presented before three examiners. The presentation will last a maximum of 15 minutes and will be followed by a debate with the tribunal. The final mark encompasses the quality of the written report (40%) and its defence (40%) before a tribunal of three lecturers from the subject.
- (b) The remaining 20% for this module is scored between 1 and 10 and is on questions regarding the content of the talks given during the classes and/or the nanosafety section of this module.

- 2:**
- Hybrid students coming to other sittings or wishing to increase their mark** must also present a report where they describe the implementation process for a product in the market, evaluating not just the scientific difficulties and limitations but also the technological, financial and social concerns for this implementation, and the contribution of new ideas. The report must be a maximum of 25 pages long and be in English. The originality and viability of the topic chosen will be assessed along with the scientific and technological ideas that support it. Lastly, this work will be publicly presented before a tribunal consisting of three lecturers from the subject. The presentation will last a maximum of 15 minutes and will be followed by a debate with the tribunal. The final mark will value the written report (35%) and its defence (35%). The remaining 30% for this module for the hybrid students consists in writing a report that reviews the applications of nanoscience and nanotechnology in various sectors in industry and nanosafety implications. The report will make mention of specific applications and real products on the market, patent review, etc. The report will be a minimum of 20 and a maximum of 25 pages long. Special value is placed on sufficient detail of the various applications being obtained and the different industrial sectors being perfectly represented in the applications described.

Activities and resources

Course methodology

The learning process that has been designed for this course is based on the following activities:

The learning process created for this subject is based on:

Provide students with real cases of application of nanotech devices in the market through guest talks from specialists at the highest level in their fields. Through critical analysis of these case studies, the students appreciate the advantages, limitations and difficulties in the use of nanotechnology in the chemical, textile, motor, construction, etc. industries.

Outline of the Programme

The programme offered to the students to help them achieve the learning results includes the following activities :

- 1:** Guest speakers: talks lasting - depending on the topic - one to three 50 minute sessions.
- 2:** Lectures for the nanosafety section will be presented, analysed and discussed by the lecturer through participatory master classes lasting 50 minutes.
- 3:** The module coordinator will tutor and supervise the "case study" for which each student will prepare a report.

Course planning

Calendar of actual sessions and presentation of works

This calendar will be published at the beginning of each academic year in the web site of the Faculty of Science (<https://ciencias.unizar.es/web/horarios.do>). Additional information could be found at www.unizar.es/nanomat. All classes will be in the afternoon.

Bibliographic references of the recommended readings