ANX-PR/CL/001-01

LEARNING GUIDE

SUBJECT

43000612 - Nanocompuestos Y Materiales HÍbridos Nanoestructurados

DEGREE PROGRAMME

04AN - Master Universitario En Ingenieria De Materiales

ACADEMIC YEAR & SEMESTER

2023/24 - Semester 2

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Learning guide

1. Description

1.1. Subject details

Name of the subject	43000612 - Nanocompuestos y Materiales Híbridos Nanoestructurados
No of credits	3 ECTS
Type	Optional
Academic year ot the programme	First year
Semester of tuition	Semester 2
Tuition period	February-June
Tuition languages	English
Degree programme	04AN - Master Universitario en Ingenieria de Materiales
Centre	04 - Escuela Tecnica Superior De Ingenieros De Caminos, Canales Y Puertos
Academic year	2023-24

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
Fco. Javier Llorca Martinez (Subject coordinator)		javier.llorca@upm.es	- -
Alvaro Ridruejo Rodriguez		alvaro.ridruejo@upm.es	Sin horario.

* The tutoring schedule is indicative and subject to possible changes. Please check tutoring times with the faculty member in charge.

2.3. External faculty

Name and surname	Email	Institution
Juan José Vilatela	juanjose.vilatela@imdea.org	IMDEA Materials Institute

3. Prior knowledge recommended to take the subject

3.1. Recommended (passed) subjects

- Microstructural Characterization

- Properties Of Materials

3.2. Other recommended learning outcomes

- Undergraduate level Materials Science degree

4. Skills and learning outcomes *

4.1. Skills to be learned

CE1 - Capacidad para aplicar los fundamentos científicos del comportamiento físico y químico de los materiales para relacionar causalmente sus propiedades fundamentales físicas y químicas con su comportamiento macroscópico y el de los productos con ellos realizados / Ability to apply the scientific foundations of the physical and chemical behavior of materials to correlate their fundamental physical and chemical properties with their macroscopic behavior and that of the products made with them.

CE2 - Uso de equipos y técnicas experimentales de caracterización de materiales (micro y macroestructura, comportamientos mecánico, eléctrico, y óptico) para identificar y analizar los diversos tipos de materiales / Use of equipment and experimental techniques for the characterization of materials (micro and macrostructure, mechanical, electrical, and optical behavior) to identify and analyze the various types of materials.

CE3 - Capacidad de diseñar, modelizar, evaluar, seleccionar, fabricar y utilizar materiales con propiedades específicas (estructurales y funcionales) para satisfa

CE4 - Autonomía para adquirir, analizar, actualizar y aplicar nuevos conocimientos, modelos y técnicas experimentales y numéricas en relación con la composición y estructura de los materiales, su caracterización física

y química, sus procesos de fabricación, su utilización y aplicación científica y tecnológica, y su reciclado, reutilización y eliminación / Autonomy to acquire, analyze, update and apply new knowledge, models and experimental and numerical techniques related to the composition and structure of materials, their physical and chemical characterization, their manufacturing processes, their use and scientific and technological application, and their recycling, reuse and disposal

CE5 - Capacidad para planificar, explotar y gestionar técnicamente la selección, fabricación, procesado, utilización, reciclado, reutilización y eliminación de materiales, de forma respetuosa con el medio ambiente, de conformidad con la legislación nacional e internacional, y promoviendo el desarrollo sostenible y el bienestar de la sociedad / Ability to technically plan, exploit and manage the selection, manufacturing, processing, use, recycling, reuse and disposal of materials, in an environmentally friendly manner, in accordance with national and international legislation, and promoting sustainable development and well-being of the society

CG1 - Uso de la lengua inglesa: Los alumnos son capaces de transmitir conocimientos y expresar ideas y argumentos de manera clara, rigurosa y convincente, tanto de forma oral como escrita, adaptándose a las características de la situación y de la audiencia / Use of the English Language: Students are able to transmit knowledge and express ideas and arguments in a clear, rigorous and convincing manner, both orally and in writing, adapting to the characteristics of the situation and the audience .

CG9 - Que los estudiantes sepan comunicar sus conclusiones y los conocimientos y razones últimas que las sustentan a públicos especializados y no especializados de un modo claro y sin ambigüedades

4.2. Learning outcomes

RA1 - Saber comunicar conocimientos, procedimientos, resultados o técnicas relacionadas con el comportamiento y el uso de materiales

RA11 - knowledge of the basic fabrication methods, structure and properties of nanomaterials and other forms of nanostructured hybrids

* The Learning Guides should reflect the Skills and Learning Outcomes in the same way as indicated in the Degree Verification Memory. For this reason, they have not been translated into English and appear in Spanish.

5. Brief description of the subject and syllabus

5.1. Brief description of the subject

The main objective of this subject is to gain knowledge of the basic fabrication methods, structure and properties of nanomaterials and other forms of nanostructured hybrids. The course focuses predominantly on different processing methods and strategies to assemble nanoparticles into macroscopic structures. It relates assembly methods to resulting bulk properties, particularly mechanical, electrical and thermal.

5.2. Syllabus

1. Introduction

2. Nanocarbons

3. Other inorganic and organic nanomaterials

4. Industrial production and safety considerations

5. Assembly routes

6. Nanocomposites with fillers

7. Hierarchical composites with macroscopic reinforcing fibres

8. Sheets of randomly dispersed nanoparticles

9. Macroscopic fibres of nanocarbons

10. Nanostructured composites for energy management

11. Applications, forecasts and perspectives for industrial implementation

6. Schedule

6.1. Subject schedule*

Week	Classroom activities	Laboratory activities	Distant / On-line	Assessment activities
1	**Introduction** Duration: 02:00 Lecture			
2	**Nanocarbons** Duration: 02:00 Lecture			
3	**Other inorganic and organic nanomaterials** Duration: 02:00 Lecture			
4	**Industrial production** Duration: 02:00 Lecture			
5	**Assembly routes** Duration: 02:00 Lecture			
6	**Nanocomposites with fillers** Duration: 00:00 Lecture			
7				**Continuous evaluation exam** Written test Continuous assessment Presential Duration: 02:00
8	**Hierarchical composites** Duration: 02:00 Lecture			
9	**Sheets of randomly dispersed nanoparticles** Duration: 02:00 Lecture			
10	**Macroscopic fibres of nano carbons** Duration: 02:00 Lecture			**report of laboratory practice** Individual work Continuous assessment Presential Duration: 02:00
11	**Macroscopic fibres of nano carbons** Duration: 02:00 Lecture			
12		**Laboratory practice in IMDEA Materiales** Duration: 04:00 Laboratory assignments		

13	**Nanostructured composites** Duration: 02:00 Lecture			
14	**Applications, forecast and perspectives of industrial implementation** Duration: 02:00 Lecture			
15				**Continuous evaluation exam** Written test Continuous assessment Presential Duration: 02:00
16				
17				**Ordinary exam** Written test Final examination Not Presential Duration: 02:00

Depending on the programme study plan, total values will be calculated according to the ECTS credit unit as 26/27 hours of student face-to-face contact and independent study time.

* The schedule is based on an a priori planning of the subject; it might be modified during the academic year, especially considering the COVID19 evolution.

7. Activities and assessment criteria

7.1. Assessment activities

7.1.1. Assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
7	Continuous evaluation exam	Written test	Face-to-face	02:00	40%	5 / 10	CG9 CG1 CE1 CE2 CE3 CE4 CE5
10	report of laboratory practice	Individual work	Face-to-face	02:00	20%	5 / 10	CG9 CG1 CE1 CE3 CE4 CE5
15	Continuous evaluation exam	Written test	Face-to-face	02:00	40%	5 / 10	CG1 CE1 CE2 CE3 CE4 CE5

7.1.2. Global examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
17	Ordinary exam	Written test	No Presential	02:00	100%	5 / 10	CG9 CG1 CE1 CE2 CE3 CE4 CE5

7.1.3. Referred (re-sit) examination

No se ha definido la evaluación extraordinaria.

7.2. Assessment criteria

Continuous evaluation will e carried out with two exams and the report of the laboratory practice. The students have to pass (>5/10) the two exams and the laboratory report.

Ordinary exam: The students have to pass (>5/10)

Extraordinary exam: The students have to pass (>5/10)

8. Teaching resources

8.1. Teaching resources for the subject

Name	Type	Notes
M. Ashby- Materials: Engineering, Science, Processing and Design 2018	Bibliography	
Dieter Vollath - Nanomaterials: An Introduction to Synthesis, Properties and Applications, 2nd Edition 2013	Bibliography	
Nanocarbon-Inorganic Hybrids. Next Generation Composites for Sustainable Energy Applications Edited by: Dominik Eder and Robert Schlögl, De Gruyter 2014	Bibliography	