Nanomaterials Applied Technology

Academic Year: (2019 / 2020) **Review date: 20/10/2019 13:56:42**

Department assigned to the subject: Materials Science and Engineering and Chemical Engineering Department

Coordinating teacher: RABANAL JIMENEZ, MARIA EUGENIA

Type: Compulsory ECTS Credits : 3.0

Year : 1 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Fundamentals of Chemistry
Fundamentals of Physic
Fundamentals of Materials Science and Engineering

OBJECTIVES

COMPETENCES
CB6- Acquire and understand concepts that provide the foundation or opportunity to be original in the development and/or application of ideas, often in a research context.
CB7, Students will be able to apply the acquired knowledge and skills on problem resolution in new or hardly known environments in the context of broad (or multidisciplinary) settings related to the area under study
CB8, Students will be able to integrate knowledge to face the complexity of making assessments based on limited or incomplete information but considering the ethical and social responsibilities associated with the application of their knowledge and assessments.
CB9, Students will be able to communicate their conclusions and the knowledge and reasons that support them to specialised and the wide public in a clear and unambiguous manner
CB10, Students will acquire learning skills that allow them to continue studying in an independent and self-paced way.

CG1, Understand the challenges associated with Materials Science and Engineering in an industrial and research environment
CG2 ¿ Know the disciplines appropriated for working in a laboratory of materials and for optimising the obtaining of results
CG3, Develop team working skills in a research environment
CG4, Develop skills to apply the acquired knowledge to the research and development of new materials or in technologies for their processing in strategic sectors.
CG5, Combine the interest on innovation and process optimisation, with the need of doing so in an environmentally friendly manner.
CG6, Acquire the required skills to defend a research project and its results.
CG7, Develop creative strategies for decision making to solve problems associated with materials, their design, processing and behaviour.

CE1, Discover the latest tendencies in the development of new materials and be aware of their potential advantages concerning more traditional materials
CE2, Be able to design new ways of optimising the properties of different materials for specific applications, through the modification of their structure and composition.
CE3, Know processing systems and advanced synthesis that allow obtaining materials with improved properties.
CE4 Acquire the ability of contributing to the optimization of processing technology for applications and specific problems.
CE5 Be able to develop creative strategies and decision-making facing problems related to materials, manufacturing and behavior.
CE6, Know the techniques of characterization of materials and personally experiencing its handling in the laboratory.

CE7 Be able to interpret and discuss data obtained using techniques of complex characterisation.
CE8 Know the environmental impact of materials during the entire their life cycle, and how to minimise it
CE9, Consolidate specific research skills in Materials Science and Engineering
CE10 Acquire knowledge and useful scientific and technical skills to solve specific problems associated with the work in a research laboratory in the field of material development and characterisation

LEARNING OUTCOMES
Successfully overcoming this matter ensures that the student can:
To know and master the techniques and manufacturing processes of nanomaterials.
- Know the principles of the different techniques structural, morphological and functional characterisation of nanomaterials.
- Justify the relationship between the structure and morphology at the nanoscale with presenting the material properties at the nanoscale and possible applications of new technologies.
- Know the technological advantages and limitations of different variants of technology powder or generation of coatings and surface treatments.
Evaluate the effect of porosity in coatings and sintered materials and propose strategies to control depending on the application requirements.
Identify environmental and health risks related to the use of nanomaterials and other technologies.
Knowing the environmental implications (energy consumption, cost of raw materials, products and waste generation) of the different variants of technology powder or generation of coatings and surface treatments.

DESCRIPTION OF CONTENTS: PROGRAMME

All subjects in this area allow students to meet industrial processes by which they can obtain materials with advanced properties. During the development of the subjects we discussed how materials can be processed according to their nature and properties that are intended to achieve. In all subjects of the matter described in detail the various industrial processes involved and reasons how these affect the characteristics and final properties of the products obtained. Furthermore, the aspects of recycling of the different types of materials are discussed.

Specific topics of technology applied to nanomaterials:
- Science of materials at the nanoscale. Perspectives of nanotechnology and nanomaterials. Classification. Collection methods. Properties. Characterization techniques.
- Carbon nanotubes: structure and properties. Fullerenes and their properties. Graphene.
- Semiconductors and inorganic nanostructures. metal nanostructures. Nanoparticles.
- Nanoporous polymers. Multifunctional polymeric nanocomposites.
- Nanotechnology and biomaterials.
- Design of nanomaterials: multifunctional nanoarchitectures. Applications.
- Environmental and health associated with the use of nanomaterials risks. Possible solutions.

LEARNING ACTIVITIES AND METHODOLOGY

RAINING ACTIVITIES
AF1, theoretical and practical classes
AF2, Lab
AF3, Tutoring
AF4, Workgroups
AF5, Individual work of student
AF6, visits to companies in the sector laboratories or centres different from the Carlos III University of Madrid Research

TEACHING METHODS
MD1, Exhibitions in class with teacher support and audiovisual media, in which the main concepts of matter are developed, and examples of solving exercises or case studies are given
MD3, Resolution by the student (individually or in groups) case studies, problems or exercises posed by the teacher
MD4, Exhibition and class discussion under the moderation of teacher issues related to the content of matter
MD5, obtaining experimental results in the laboratory. handling equipment and research techniques

under the guidance of Professor
MD6, Development of papers and reports individually or in group

ASSESSMENT SYSTEM

% end-of-term-examination/test:	60
% of continuous assessment (assigments, laboratory, practicals…):	40

Participation in theory and laboratories and critical thinking skills demonstrated on the issues raised classes (SE1) 0-5

Making and / or exhibition of works , exercises or individual memories or collectively made throughout the course (SE2) 25-40

Performing laboratory practice , preparation, presentation and discussion of reports or detailed questionnaires on the techniques used and the experimental results . (SE3) 0-25

Final evaluation of the course made individually, in writing way (type test) or orally (SE4): 40-60

BASIC BIBLIOGRAPHY

- C.N.R. Rao, A. Muller, A.K. Cheetham Nanomaterials Chemistry:New developments and New Directions, Wiley-VCH, 2007

- M.R. Wiesner; J-I. Bottero Environmental Nanotechnology: applications and Impacts of Nanomaterials, Mc_Graw Hill, 2000

- Vollath Nanomaterials: an introduction to synthesis, properties and applications, Wiley-VCH, 2008