Coatings Technology and Surface Treatments

Academic Year: (2022 / 2023) **Review date: 08-04-2022**

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

Coordinating teacher: VELASCO LOPEZ, FRANCISCO JAVIER

Type: Electives ECTS Credits : 3.0

Year : 1 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Not required to have completed any particular subject.
Being an optative subject, the student is studying the subjects of Topic 1 (Advanced Materials), to support his knowledge about coatings and surface treatments.

OBJECTIVES

COMPETENCES
CB6, Acquire and understand concepts that provide the foundation or opportunity to be original on 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 wide (or multidisciplinary) contexts 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 to 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 both specialized and wide public in a clear and unambiguous manner.
CB10, Students will acquire learning skills that allow them to continue studying in an autonomous and self-paced way.
CG1, Understand the challenges associated to Materials Science and Engineering in an industrial and research environment.
CG2, Know the adequate disciplines to work in a materials¿ lab and optimize getting 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 optimization, 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 development of new materials and be aware of their potential advantages with respect to more traditional materials.
CE2, Be able to design new ways of optimizing the properties of different materials for specific applications, through the modification of their structure and composition.
CE4, Acquire ability to optimize a processing technology for specific applications and problems.
CE5, Know in detail the most used in research characterization techniques for materials and acquire the skills to autonomously use the associated instrumentation.
CE6, Interpret, discuss and elaborate conclusions from experimental data obtained from complex characterization techniques, usual in Materials Science and Engineering.
CE7, Know and understand the environmental effect of materials during their life cycle, developing new materials and processing techniques base don sustainability criteria.
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 characterization.

SKILLS
- Know technologic advantages and limitations of different coating procedures and surface treatments.
- Evaluate the effect of porosity in coatings and propose strategies to control it depending on its application.
- Identify environmental risks in coatings and surface treatment technologies.

- Know environmental issues in coatings and surface treatment technologies.

DESCRIPTION OF CONTENTS: PROGRAMME

SPECIFIC CONTENTS FOR COATING TECHNOLOGY AND SURFACE TREATMENTS:

- Importance of degreasing and pickling processes. Pretreatment processes of surfaces: optimizing coating systems.
- Metallic coatings: influence on properties. Main technologies: plating, hot dipping, electroless coatings.
- Ceramic coating technologies: PVD, CVD. Wear basics and importance of ceramic coatings. Thermal spraying and thermal barrier coatings.
- Organic coatings and their functionality.
- Environmental issues of coating technology
- Adhesion of polymer materials.
- Surface thermal treatments.

PROGRAMME

Introduction to coatings and surface treatments.
Surface preparation of metals and polymers: adhesion and performance.
Metallic coatings: hot dipping, plating, electroless (autocatalytic) coatings, anodizing.
Diffusion Surface treatments
Thermal spraying. Application to thermal barrier coatings.
Organic coatings
Wear and ceramic coatings.
Selection procedures and optimizing of coatings.

LEARNING ACTIVITIES AND METHODOLOGY

LEARNING ACTIVITIES

AF1, Theoretical-practical classes.
AF2, Lab practices
AF3, Tutorials
AF4, Work in groups
AF5, Individual work from the student
AF6, Visits to companies or research labs related to the subject, our from Universidad Carlos III de Madrid

METHODOLOGIES

MD1, Explanations in class, so the professor develops main concepts of the subject, practical examples or problems
MD3, Practical resolution of examples, problems or exercise, by the student (alone or in groups)
MD4, Explanation and discussion in class, under professor supervision, of issues related to the subject
MD5, Obtaining experimental results in the lab, using research equipments and techniques, under professor supervision
MD6, Elaborating Works and reports, alone or in groups

ASSESSMENT SYSTEM

Participate in classes and labs, demonstrated critical analysis on considered matter (SE1) 5
Carry out and/or exhibition of works, exercises or reports, made alone or in groups, during the course (SE2) 20
Carry out lab practices, elaborate, present and discuss reports or questions, related to used techniques and obtained experimental results. (SE3) 35
Final exam of the subject, to be done individually, written or oral (SE4) 40

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

BASIC BIBLIOGRAPHY

- Amy Forsgren Corrosion control through organic coatings, CRC/Taylor & Francis, 2006
- B.G Mellor Surface coatings for protection against wear, Woodhead - CRC Press, 2006
- Jose¿ Antonio Pue¿rtolas Tecnologi¿a de superficies en materiales, Síntesis, 2010
- Jose¿ Mari¿a Albella Marti¿n La¿minas delgadas y recubrimientos : preparacio¿n, propiedades y aplicaciones, CSIC, 2003

- Klaus Erich Schneider Thermal spraying for power generation components, Wiley, 2006
- Stan Grainger Engineering coatings : design and application, Abington Cambridge, 1998

ADDITIONAL BIBLIOGRAPHY

- John B Wachtman Ceramic films and coatings, Noyes, 1993
- R Lambourne, T.A Strivens Paint and surface coatings : theory and practice, Woodhead, 1999