

Course guide

820465 - ESU - Engineering Surfaces

Last modified: 02/06/2022

Unit in charge: Barcelona East School of Engineering
Teaching unit: 702 - CEM - Department of Materials Science and Engineering.

Degree: BACHELOR'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Optional subject).

Academic year: 2022 **ECTS Credits:** 6.0 **Languages:** Catalan

LECTURER

Coordinating lecturer: MIQUEL MORALES COMAS

Others: Segon quadrimestre:
GEMMA FARGAS RIBAS - M10
MIGUEL MORALES COMAS - M10

PRIOR SKILLS

Basic knowledge of materials science and chemistry.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Transversal:

1. SELF-DIRECTED LEARNING - Level 3. Applying the knowledge gained in completing a task according to its relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most suitable information sources.

TEACHING METHODOLOGY

Face-to-face expository classes (Theory)
Face-to face directed classes (Problem solving)
Cooperative learning

LEARNING OBJECTIVES OF THE SUBJECT

- 1- Get to Know analytical techniques and characterization of the surface.
- 2- Gaining basic knowledge of surface modification techniques.
- 3- Learning to select surface modification techniques based on applications.

STUDY LOAD

| Type | Hours | Percentage |
|-------------------|-------|------------|
| Self study | 90,0 | 60.00 |
| Hours large group | 60,0 | 40.00 |

Total learning time: 150 h



CONTENTS

(ENG) Chapter 1. Introduction

Description:

- 1.1. Surface engineering goals
- 1.2. Surface description
- 1.3. Surface phenomena: corrosión, wear and fatigue

Specific objectives:

Describe the surface phenomena that limit the useful life of materials and understand the ways that engineering surfaces offers to control and reduce their effects.

Related activities:

Presentation of case studies

Full-or-part-time: 5h

Theory classes: 3h

Self study : 2h

(ENG) Chapter 2. Surface characterization

Description:

- 2.1. Microscopy techniques
- 2.2. Spectroscopy techniques
- 2.3. Measurements and tests

Specific objectives:

Describe the surface characterization techniques at different scales to determine: microstructure, chemical composition and mechanical properties

Full-or-part-time: 18h

Theory classes: 7h

Self study : 11h

(ENG) Chapter 3. Surface cleaning:

Description:

- 3.1 Degreasing processes
- 3.2 Removal of organic deposits
- 3.3 Removal of protective layers
- 3.4 Removal of corrosión and oxidation products

Specific objectives:

To understand the importance of cleaning processes prior to surface modification.

Establish a criterion to select the appropriate cleaning process depending on the initial state of the surface and/or further treatment and/or application.

Full-or-part-time: 14h

Theory classes: 5h

Self study : 9h



(ENG) Chapter 4. Surface modification without changing the material chemically

Description:

- 4.1. Thermal treatments: Quenching and annealing
- 4.2. Mechanical treatments: Shot peening

Specific objectives:

- Understand basic theory of these processes
- Describe the stages on which these processes are carried out at industrial level
- Understand their effect on the surface regarding microstructure and mechanical properties
- Know under which work conditions these processes are useful

Related activities:

- Presentation of case studies

Full-or-part-time: 12h

- Theory classes: 7h
- Self study : 5h

(ENG) Chapter 5. Surface modification by altering surface chemistry

Description:

- 5.1. Carburization
- 5.2. Nitration
- 5.3. Passivation
- 5.4. Phosphatation
- 5.5. Ionic implantation

Specific objectives:

- 1-Understand basic theory of these processes
- 2-Describe the stages on which these processes are carried out at industrial level
- 3-Understand their effect on the surface regarding microstructure and mechanical properties
- 4-Know under which work conditions these processes are useful

Related activities:

- Presentation of case studies

Full-or-part-time: 21h

- Theory classes: 12h
- Self study : 9h

(ENG) Chapter 6. Surface modification by adding a new material onto the surface (coating). Conventional techniques

Description:

- 6.1. Introduction to coatings
- 6.2. Electroplating
- 6.3. Electroless
- 6.4. Galvanized

Related activities:

- Presentation of case studies

Full-or-part-time: 21h

- Theory classes: 11h
- Self study : 10h



(ENG) Chapter 7. Surface modification by adding a new material onto the surface (coating). Advanced techniques

Description:

- 7.1. Thermal spray
- 7.2. Chemical vapor deposition
- 7.3. Physical vapor deposition

Related activities:

Presentation of case studies

Full-or-part-time: 16h

Theory classes: 7h

Self study : 9h

(ENG) Chapter 8. Surface modification by adding a new material onto the surface (coating): Organic coatings

Description:

- 8.1. Technology and functions
- 8.2. Types and selection criteria
- 8.3. Application processes
- 8.4. Pathological processes

Related activities:

Presentation of case studies

Full-or-part-time: 16h

Theory classes: 6h

Self study : 10h

Chapter 9. Nanotechnology in surfaces

Description:

- 9.1. Pulsed laser deposition
- 9.2. Litography

Full-or-part-time: 7h

Theory classes: 2h

Self study : 5h

GRADING SYSTEM

First partial test: 15%

Second partial test: 25%

Third partial test: 35%

Work: 15%

Laboratory: 10%

In this subject a reassessment test will be scheduled

EXAMINATION RULES.

Autonomous learning evaluation: report and oral presentation



BIBLIOGRAPHY

Basic:

- Davis, J. R.. Surface engineering : for corrosion and wear resistance. Materials Park: ASM International, cop. 2001. ISBN 0871707004.
- J. A. Puértolas Ráfales, R. Ríos Jordana, M. Castro Corella, J. M. Casals Bustos. Tecnología de superficies en materiales. Madrid: Síntesis, D.L. 2010. ISBN 9788497566803.
- Vázquez Vaamonde, Alfonso J.; Damborenea González, Juan J. de. Ciencia e ingeniería de la superficie de los materiales metálicos. Madrid: Consejo Superior de Investigaciones Científicas, 2000. ISBN 8400079205.

Complementary:

- Burnell-Gray, J.S.; Datta, P.K. Surface engineering casebook. Abington (Cambridge): Woodhead Publishing, Ltd. Abington Hall, 1996. ISBN 1855732602.
- Adamson, Arthur W. Physical chemistry of surfaces. 6th ed. New York [etc.]: John Wiley & Sons, 1997. ISBN 9780471148739.
- Martin, Peter M. Introduction to surface engineering and functionally engineered materials. Hoboken, N.J: Wiley, 2011. ISBN 9781118171899.