820465 - ESU - Engineering Surfaces

Coordinating unit: 295 - EEBE - Barcelona East School of Engineering
Teaching unit: 702 - CMEM - Department of Materials Science and Metallurgy
Academic year: 2017
Degree: BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Teaching unit Optional)
BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Teaching unit Optional)
BACHELOR'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2009). (Teaching unit Optional)
BACHELOR'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2009). (Teaching unit Optional)
ECTS credits: 6
Teaching languages: Catalan

Teaching staff
Coordinator: Gemma Fargas Ribas

Opening hours
Timetable: Information in ATENEA

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

<table>
<thead>
<tr>
<th>Study load</th>
<th>Hours large group:</th>
<th>Hours medium group:</th>
<th>Hours small group:</th>
<th>Self study:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total learning time: 150h</td>
<td>60h</td>
<td>0h</td>
<td>0h</td>
<td>90h</td>
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</tbody>
</table>

Study load percentages:
- Hours large group: 40.00%
- Hours medium group: 0.00%
- Hours small group: 0.00%
- Self study: 60.00%
### (ENG) Chapter 1. Introduction

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

**Related activities:**
Presentation of case studies

**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.

**Learning time:** 5h
- Theory classes: 3h
- Laboratory classes: 0h
- 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

**Learning time:** 18h
- Theory classes: 7h
- Laboratory classes: 0h
- Self study: 11h
(ENG) Chapter 3. Surface cleaning:

<table>
<thead>
<tr>
<th>Learning time: 14h</th>
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</thead>
<tbody>
<tr>
<td>Theory classes: 5h</td>
</tr>
<tr>
<td>Laboratory classes: 0h</td>
</tr>
<tr>
<td>Self study: 9h</td>
</tr>
</tbody>
</table>

Description:
- 3.1 Degreasing processes
- 3.2 Removal of organic deposits
- 3.3 Removal of protective layers
- 3.4 Removal of corrosion 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.

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

<table>
<thead>
<tr>
<th>Learning time: 12h</th>
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</thead>
<tbody>
<tr>
<td>Theory classes: 7h</td>
</tr>
<tr>
<td>Laboratory classes: 0h</td>
</tr>
<tr>
<td>Self study: 5h</td>
</tr>
</tbody>
</table>

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

Related activities:
- Presentation of case studies

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

**Learning time:** 21h  
Theory classes: 12h  
Self study: 9h

**Description:**
- 5.1. Carburization  
- 5.2. Nitritration  
- 5.3. Passivation  
- 5.4. Phosphatation  
- 5.5. Ionic implantation

**Related activities:**
Presentation of case studies

**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

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

**Learning time:** 21h  
Theory classes: 11h  
Self study: 10h

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

**Related activities:**
Presentation of case studies

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

**Learning time:** 16h  
Theory classes: 7h  
Self study: 9h

**Description:**
- 7.1. Thermal spray  
- 7.2. Chemical vapor deposition  
- 7.3. Physical vapor deposition

**Related activities:**
Presentation of case studies
### 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

**Learning time:** 16h
- Theory classes: 6h
- Self study: 10h

### Chapter 9. Nanotechnology in surfaces

**Learning time:** 7h
- Theory classes: 2h
- Self study: 5h

**Description:**
- 9.1. Pulsed laser deposition
- 9.2. Lithography

### Qualification 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.

### Regulations for carrying out activities

Autonomous learning evaluation: report and oral presentation
Bibliography

Basic:


Complementary:

