DEGREE CURRICULUM

MATERIALS SCIENCE

Coordination: Jordi Casanovas

Academic year 2013-14

MATERIALS SCIENCE 2013-14

Subject's general information

Subject name	Materials Science
Code	102113
Semester	2n Q Avaluació Continuada
Typology	Obligatòria
ECTS credits	6
Groups	2 Grups Grans, 4 Grups Mitjans
Theoretical credits	0
Practical credits	0
Coordination	Jordi Casanovas
Department	Química
Important information on data processing	Consult this link for more information.
Language	Català
Office and hour of attention	Jordi Casanovas Dj. 16h-18h / Despatx 2.14 (EPS) Josep Monné Dj. 17-18h i Dv. 18-19h / Despatx 2.14 (EPS)

MATERIALS SCIENCE 2013-14

Jordi Casanovas Salas (grups matí)
Josep Monne Esquerda (grups tarda)

Subject's extra information

Continuous work of students throughout the semester, reading basic references and solving exercises. Visit the Virtual Campus frequently, since there will be uploading useful material: backup of the theoretical presentations, collections of exercises, instructions for the practices ... Take advantage of office hours / tutoring with teachers.

Learning objectives

see competences

Competences

Degree-specific competences

- Knowledge and use of the principles of the resistance of materials.

  Goals

  - Knowing the mechanical behavior -in particular the mechanical strength- of metals, ceramics and polymers.
  - Knowing how to evaluate the main mechanical properties

- Knowledge of the principles of science, technology and the chemistry of materials. Understanding of the relationship between microstructure, synthesis or processing and properties of materials.

  Goals

  - Knowing the main characteristics of metals (and metal alloys), ceramics, polymers, semiconductors and composite materials
  - Improve the knowledge of their crystal and non-crystalline structures, as well as of their structural defects and atomic diffusion phenomenon.
  - Understand the physical and chemical properties (mechanical, electrical, magnetic, thermal, optical, corrosion) of different types of materials available to an engineer. Learn to evaluate some parametres to characterize the properties.
  - Understanding the relationship between internal structure and material properties

Degree-transversal competences

- Ability to work under pressure and/or in situations where there is a lack of information.

  Goals

  - Learn to find and choose, in a limited time, the necessary information to solve a problem of Materials Science.

- Ability to resolve problems and elaborate and defend arguments inside their field of study

  Goals

  - Learning to think, solve and explain correctly a problem of Materials Science.

Subject contents

MATERIALS SCIENCE 2013-14

1. Introduction

1.1. Definition of Materials Science and Materials Engineering

1.2. Structure and Properties.

1.3. Classification of materials.

1.4. Current needs of society.

2. Crystal structure and non-crystalline structure

2.1. Introduction

2.2. Common crystal structures

- 2.2.1. Metals
- 2.2.2. Ceramics
- 2.2.3. Semiconductors

2.3. Structural characteristics of polymers

2.4. Composites

3. Imperfections and diffusion phenomena

3.1. Deviations from the ideal crystal structure

- 3.1.1. Punctual defects
- 3.1.2. Linear defects: dislocations
- 3.1.3. Surface defects
- 3.1.4. Volume defects

3.2. Diffusion phenomena

- 3.2.1. General considerations
- 3.2.2. Mechanisms for diffusion
- 3.2.3. Factors affecting the diffusion
- 3.2.4. Applications

4. Mechanical properties

4.1. Laboratory tests: relation stress - strain

4.2. Elastic deformation and plastic deformation

- 4.2.1. Elastic deformation. Modulus of elasticity
- 4.2.2. Plastic deformation

4.2.3. Hardness

4.3. Mechanical and thermomechanical properties of polymers

4.4. Reinforcement techniques

4.5. Fracture and Fatigue

5. Electrical properties

5.1. Introduction

5.2. Band Theory

5.3. Metallic conductivity

5.4. Semiconductors

5.4.1. Intrinsic semiconductors

5.4.2. Extrinsic

semiconductors

5.5. Conductivity in ceramics, polymers and composites

6. Magnetic properties

6.1. General concepts

6.2. Non-cooperative magnetic behavior: diamagnetism and paramagnetism

6.3. Cooperative magnetic behavior: ferro-, antiferro-and ferrimagnetism

6.4. Influence of temperature

6.5. Magnetic hysteresis cycle

6.6. Magnetically hard and soft materials

6.7. Superconductors

7. Optical and thermal properties

7.1. Thermal properties: heat capacity, thermal expansion, thermal conductivity

7.2. Thermal properties of polymers

7.3. Optical properties

7.4. Applications of optical phenomena: luminescence, photodegradation, laser and fiber optics

8. Corrosion of Materials

8.1. Introduction

8.2. Atmospheric attack: oxidation

8.3. Electrochemical attack

8.3.1. Ion concentration batteries

8.3.2. Galvanic batteries

8.3.3. Gaseous reduction

8.4. Methods to prevent corrosion

Evaluation

Without translate-

Activitat d'Avaluació 1 (AA1). Prova escrita, Temes 1-4, Percentatge de la Qualificació Final: 25%

Activitat d'Avaluació 2 (AA2). Prova escrita, Temes 1-8, Percentatge de la Qualificació Final: 50%

Activitats Pràctiques. Percentatge de la Qualificació Final: 10%

Altres Activitats. Tests. Percentatge de la Qualificació Final: 15%

Activitat de Recuperació. Permet recuperar el 75% de la qualificació final (Equivalent a AA1+AA2)

Bibliography

Recommended bibliography

- J.C.Anderson, K.D. Leaver, R.D. Rawlings y J.M. Alexander, "*Ciencia de losMateriales"*, 2ª ed., Ed.Limusa, México, 1998
- D.R.Askeland, "*Ciencia e Ingeniería de los Materiales"*, InternationalThomson Editores, México, 1998
- W.D.Callister Jr., "*Introducción a la Ciencia e Ingeniería de los Materiales"*, 3ª ed., Ed.Reverté S.A.,Barcelona, 1995
- J.Casanovas y C. Alemán, *"Introducción a la Ciencia de los Materiales"*, CálamoProducciones Editoriales,Colección Manuales Básicos, Barcelona, 2002
- J.F.Shackelford, "*Introducción a la Ciencia de Materiales para Ingenieros"*, 4ª ed., PrenticeHall Iberia, Madrid, 1998
- W.F. Smith, "*Fundamentos de la Ciencia e Ingeniería deMateriales"*, 3ª ed., McGraw-Hill, Madrid, 1998

Other didactic material s'aniràpenjant al Campus Virtual: http://cv.udl.cat