Materials Science

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European credits ECTS: 6

Teaching Language: English

Supporting files: Spanish and English

	Number of course slots (1h)	Number of course slots (1h)
Magisterial	40	
Seminars	7	
Practical		10 (lab.) + 3 (comp.)

Description

- To provide the students with the theoretical-practical knowledge that allows them to understand the relationship between the structure and the properties of the different materials, taking into account the influence of the processing.
- Specifically, to show the different types of materials, understand their general behavior, their characteristic properties and their potentialities, and recognize the effects of the environment and the conditions of service on their behavior. This understanding is necessary to be able to select the ideal material to participate in the design of reliable and economical components, systems and processes that use the wide spectrum of materials currently available.

Outline

Part 1:

Introduction

- Historical perspective. Classification of materials.
- Advanced materials. New material requirements

Structure of the polymers

- Monomer, polymer, polymerization reactions, degree of polymerization. Copolymers.
- Thermoplastic and thermostable.
- Polymeric crystals. Solid state.

Structures of metals and ceramics

Imperfections in solids

- Impurities in solids.
- Point defects in polymers. Linear defects. Interfacial defects.
- Optical and electronic microscopy.

Diffusion

- Factors that influence diffusion.

- Diffusion and processing.
- Diffusion in ionic and polymeric materials.

Mechanical properties

- Concepts of stress and strain. Elastic deformation.
- Mechanical behavior of metals, ceramics and polymers.
- Hardness and other mechanical properties.

Part 2

Deformation and strengthening mechanisms

- Deformation mechanisms for metals. Mechanisms of strengthening in metals.
- Recovery, recrystallization and grain growth.
- Deformation mechanisms for ceramic materials.
- Mechanisms of deformation and for strengthening of polymers.

Failure

- Fundamentals of fracture.
- Ductile fracture. Brittle fracture.
- Fracture toughness testing. Fatigue and creep

Phase diagrams

- Equilibrium phase diagrams. Binary isomorphous systems. Binary eutectic systems.
- Equilibrium diagrams having intermediate phases or compounds. Eutectoid and peritectic reactions.

Steel phase diagram and phase transformations

- Iron-carbon system phase diagram. Phase transformations in metals. Microstructural changes in steel. Precipitation hardening.

Part 3

Types and applications of materials

- Metal alloys. Processing of metals.
- Types of ceramics and their processing.
- Types of polymers and their processing.

Composites

- Particle-reinforced. Fiber-reinforced.
- Structural composites.

Corrosion and degradation of materials

- Corrosion rates. Prediction of corrosion rates. Corrosion prevention.
- Oxidation. Degradation of polymers.

Electrical properties

- Semiconductivity. Semiconductor devices.
- Electrical conduction in ionic ceramics and in polymers. Dielectric behavior.
- Ferroelectricity and piezoelectricity.

Computer practical contents

- Phase diagrams (computer practices).

Experimental practical contents

- Scanning electron microscopy (laboratory practices).
- Hardness (laboratory practices).
- Stress-strain test (laboratory practices).