Course guide
240EM112 - 240EM112 - Organic Matrix Composites

Last modified: 02/06/2022

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

Degree: ERASMUS MUNDUS MASTER'S DEGREE IN ADVANCED MATERIALS SCIENCE AND ENGINEERING (Syllabus 2014). (Optional subject).
MASTER'S DEGREE IN MATERIALS SCIENCE AND ENGINEERING (Syllabus 2014). (Optional subject).

Academic year: 2022 **ECTS Credits:** 4.5 **Languages:** Spanish

LECTURER

Coordinating lecturer: M Lluisa Maspoch

Others: Jonathan Cailloux
Violeta García

PRIOR SKILLS

To have knowledge about plastic materials at the level of the subjects Fundamentals of Polymers and Plastics materials and composites (Degree in Materials Engineering.)
For non-graduates of degrees related to Science and Materials Engineering: having completed the subject 240EM013 - Structure and Properties of Polymers.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CEMCEM-03. (ENG) Aplicar mètodes innovadors en la resolució de problemes i aplicacions informàtiques adequades, pel disseny, simulació, optimització i control de processos de producció i transformació de materials

Transversal:
06 URI N2. EFFECTIVE USE OF INFORMATI0N RESOURCES - Level 2. Designing and executing a good strategy for advanced searches using specialized information resources, once the various parts of an academic document have been identified and bibliographical references provided. Choosing suitable information based on its relevance and quality.

TEACHING METHODOLOGY

Subject in process of extinction. There is no teaching, the students that enroll it do so only with the right to an exam.

LEARNING OBJECTIVES OF THE SUBJECT

1. Know the main types of organic matrices, of second phases.
2. Know the properties of the interface and how it can be modified
3. Know the main processing processes of composite materials with fibers.
4. Learn how to design a laminated composite material in order to optimize its useful life in real service conditions.

STUDY LOAD

Type	Hours	Percentage
Hours small group	13,5	12.00
Hours large group	27,0	24.00
Self study	72,0	64.00

Total learning time: 112.5 h

CONTENTS

Subject 1. Introduction

Description:
Definition
Classification
Examples of applications
Natural compounds
The wood

Related activities:
Laboratory work

Full-or-part-time: 6h
Theory classes: 3h
Self study : 3h

Subject 2. Composites with fibers.

Description:
Types of fibers.
Types of polymeric matrix.
Matrix fiber interfaces.
Key factors that determine the properties of a compound.

Related activities:
Laboratory work.

Full-or-part-time: 19h 30m
Theory classes: 6h
Guided activities: 1h 30m
Self study : 12h

Subject 3. Compounds with particles.

Description:
Rigid particles: types of particles, function of each type of particle, effects on mechanical properties and on fracture behavior and crack propagation. Incorporation.
Elastomeric particles: preparation of these compsites, examples and applications. Effect on mechanical properties and on tenacity

Full-or-part-time: 16h 30m
Theory classes: 6h
Self study : 10h 30m

Tema 4. Foams

Description:
Definitions by cell type and size.
Preparation methods.
Examples and applications.
Properties and function of the size of the cells.

Full-or-part-time: 9h
Theory classes: 1h 30m
Guided activities: 1h 30m
Self study : 6h

Subject 5. Nanocomposites.

Description:
Classification and types of nanofillers in polymer matrix.
Methods of preparation of organic matrix nanocomposites.
Relationship structure and properties.
Examples of applications

Full-or-part-time: 3h
Theory classes: 1h 30m
Self study : 1h 30m

Subject 6. Processing of composites

Description:
Manual and projection molding.
SMC and BMC.
Compression molding
Vacuum bag, infusion and RTM.
Autoclave.
Pultrusion and winding of filaments.
RIM, RRIM and SRIM

Related activities:
Guided work.

Full-or-part-time: 9h
Theory classes: 1h 30m
Guided activities: 1h 30m
Self study : 6h

Subject7. Micro and macromechanics of composite materials with long fibers

Description:
Unidirectional mechanical properties of composite materials with long fibers from known properties of fiber and matrix.
Mechanical properties in laminates: estimation of elastic constants in the medium plane.
Mechanical design of laminates.

Related activities:
Group activities

Full-or-part-time: 36h
Theory classes: 6h
Guided activities: 6h
Self study : 24h

Subject 9. Failure analysis in laminates.

Description:
Failure models.
The "Ply discount" model.
Prediction of useful life of laminates.

Full-or-part-time: 13h 30m
Theory classes: 1h 30m
Guided activities: 3h
Self study : 9h

GRADING SYSTEM

Subject in process of extinction. There is only one final test that corresponds to 100% of the final grade of the subject.

BIBLIOGRAPHY

Basic:
- Tecnología de los composites/plásticos reforzados. Barcelona: Hanser, DL 1992. ISBN 8487454046.
- Friedrich, Klaus; Fakirov, Stoyko; Zhang, Zhong. Polymer composites : from nano-to-macro-scale. New York: Springer, 2005. ISBN 0387241760.
- Hull, Derek. Materiales compuestos. Barcelona [etc.]: Reverté, cop. 1987. ISBN 8429148396.
- Composite materials technology : processes and properties. Munich [etc.]: Hanser, cop. 1990. ISBN 3446156844.

Complementary:
- Gibson, Lorna J.; Ashby, Michael F. Cellular solids : structure and properties. 2nd ed. Cambridge: Cambridge University Press, 2001. ISBN 0521499119.
- Composites science and technology [on line]. New York, NY: Elsevier Science Pub Co, [1999?]- [Consultation: 20/05/2020]. Available on: https://www.sciencedirect.com/science/journal/02663538.- Kinloch, A. J.; Young, R. J. Fracture behaviour of polymers. London [etc.]: Chapman & Hall, 1995. ISBN 0412540703.