Course guide
295589 - 295PB018 - Polymer Processing and Coating Technologies

Last modified: 02/10/2025

Unit in charge: Barcelona East School of Engineering
Teaching unit: 713 - EQ - Department of Chemical Engineering.

Degree: ERASMUS MUNDUS MASTER'S DEGREE IN ADVANCED MATERIALS SCIENCE AND ENGINEERING (Syllabus 2021). (Optional subject).
MASTER'S DEGREE IN POLYMERS AND BIOPLASTICS (Syllabus 2024). (Compulsory subject).

Academic year: 2025 **ECTS Credits:** 6.0 **Languages:** English

LECTURER

Coordinating lecturer: ELAINE APARECIDA ARMELIN DIGGROC

Others: Primer quadrimestre:
ELAINE APARECIDA ARMELIN DIGGROC - Grup: T1
NÚRIA BORRÀS CRISTÒFOL - Grup: T1

PRIOR SKILLS

Fundamentals in organic and inorganic chemistry and in materials properties acquired during bachelor studies.

REQUIREMENTS

Degree in Chemical Engineering, Physics engineering, Chemistry, Materials Science, or equivalent.

LEARNING RESULTS

Knowledges:
K3. Identify the fundamentals of the processes of synthesis, manufacture, modification, use, recycling and degradation of polymers and biopolymers.
K1. Identify the molecular chemical structure of polymers and biopolymers.
K2. Identify the physical principles that govern the behaviour of polymers and underlie many of the techniques used in polymer analysis.
K4. Apply the necessary criteria for the analysis and characterisation of macromolecular materials and for the selection of technologies required for their production and processing.

Skills:
S5. Select polymers and biopolymers according to their properties and intended use.

Competences:
C3. Apply acquired knowledge and problem-solving skills both in discipline-specific environments and in new or unfamiliar environments in broader (or multidisciplinary) contexts related to the field of study.
C2. Apply appropriate methods of analysis, production and management in the field of polymers and biopolymers.
C4. Make effective use of information resources, managing the acquisition, structuring, analysis and visualisation of data and information within the field of specialisation and critically evaluating the results of this process.

TEACHING METHODOLOGY

MD.1 – Participative lecture;
MD.3 - Case studies;
MD.5 – Cooperative group work.

LEARNING OBJECTIVES OF THE SUBJECT

Know the main families of plastic materials (commodity thermoplastics, engineering thermoplastics, high-performance thermoplastics, elastomers and thermosets).
Know the main techniques and processes for polymer transformation (physical processes)
Know the main additives used in polymer transformation and their properties
Know the different types of organic coatings based on polymers (formulation, fabrication, quality control, main properties and applications to different industrial sectors).

STUDY LOAD

Type	Hours	Percentage
Self study	108,0	72.00
Hours large group	21,0	14.00
Hours small group	21,0	14.00

Total learning time: 150 h

CONTENTS

Polymer transformation in technical plastics and their properties

Description:
1.1. Introduction to polymer transformation
1.2. Fundamentals of plastics modifications with plasticizers, optical and conducting materials
1.3. Plastic properties
1.4. Plastic microbial degradation
1.5. Microbial protection of textiles

Specific objectives:
To understand the methods to transform polymer materials in technical plastics.
To have basic knowledge about the procedures to modify polymers with additives necessary for their applications at the industrial level.
To know the microbial degradation mechanisms and the protection of polymers employed in textile applications.

Related activities:
Resolution of a series of specific exercises, application of the contents of the subject.

Full-or-part-time: 12h
Theory classes: 12h

Polymer additives

Description:
2.1. Plastic reinforcement additives
2.2. Flammability properties and intumescent additives
2.3. Other polymer additives: pigments for coatings, fillers (or extenders), rheological additives

Specific objectives:
To know the most important polymer modifiers (additives, fillers, reinforcing materials) required to offer specific properties to technical plastics and coatings.
To correlate the additives properties with the final properties of the finished plastic materials.

Related activities:
Resolution of practical problems and exercises of a theoretical nature that allow to deepen in the application of the concepts introduced in this subject.

Full-or-part-time: 9h
Theory classes: 9h

Polymer transformation processes

Description:
3.1 Main polymer transformation processes used in textile technology (fiber-spinning).
3.2. Extrusion, injection and thermoforming processes

Specific objectives:
To know the main techniques broadly used in polymer transformation processes and their correlation with the geometry and the end-use application of the desired product.

Related activities:
Resolution of practical problems and exercises of a theoretical nature that allow to deepen in the application of the concepts introduced in this subject.

Full-or-part-time: 11h
Theory classes: 11h

Coatings technology

Description:
4.1. Fundamentals in coatings technology, coatings classification.
4.2. Paints formulation: Binders, solvents, fillers and additives.
4.3. Main physical parameters and their relationship with the coating properties
4.4. Examples of anticorrosive, architectural and intumescent coatings.
4.5. Industrial applications

Specific objectives:
Understand the fundamental principles of coatings formulation, both at industrial and laboratory levels, from the properties that are required for their specific applications.

Related activities:
Resolution of practical problems and exercises of a theoretical nature that allow to deepen in the application of the concepts introduced in this subject.

Full-or-part-time: 10h
Theory classes: 10h

GRADING SYSTEM

Partial exam 1 (EP1, individual evaluation): 30% [Block 1]
Cooperative work (AC1, group and individual marks): 20% [Block 2]
Cooperative work (AC2, group and individual marks): 20% [Block 3]
Cooperative work (AC3, group and individual marks): 30% [Block 4]
FINAL SCORES: 0.3*EP1+0.2*AC1+0.2*AC2+0.3*AC3 [≥ 5.0, refers to text of Additional rules for more information.]

EXAMINATION RULES.

All tests/activities are mandatory and will be realized in-person. Dates will be published in Atenea platform at the beginning of the course. Absences are only justified by dated stamped documents (medical certificate, driver's license exams, and others expressed in UPC rules).
Approval in the subject is conditioned to the obtaining of a minimum of 4.0 points in each block and a NF superior or equal to 5.0.
If not approved, the student will have the opportunity to be re-evaluated in January. The exam will include all the topics of this subject.

BIBLIOGRAPHY

Basic:
- Fried, Joel R. Polymer science and technology. 3rd ed. Upper Saddle River: Prentice Hall, cop. 2014. ISBN 9780137039555.
- Brydson, J. A. Plastics materials. 7th ed. Oxford: Butterworth-Heinemann, 1999. ISBN 0750641320.
- Mark, H. F. Encyclopedia of polymer science and technology. 3rd ed. Hoboken, New Jersey: John Wiley & Sons, cop. 2003. ISBN 0471288241.
- Müller, Bodo; Poth, Ulrich. Coatings formulation : an international book. 2nd rev. ed. Hannover: Vincentz Network, 2011. ISBN 9783866308725.

Complementary:
- Handbook of polymer testing : physical methods. New York: Marcel Dekker, cop. 1999. ISBN 0824701712.
- Sander, Jörg. Anticorrosive coatings : fundamentals and new concepts. Hanover: Vincentz Network, 2010. ISBN 9783866309111.

RESOURCES

Hyperlink:
- Nom recurs. https://atenea.upc.edu/

Other resources:
Classroom material available at ATENEA platform