



# Course guide

## 295589 - 295PB018 - Polymer Processing and Coating Technologies

Last modified: 27/06/2024

**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:** 2024    **ECTS Credits:** 6.0    **Languages:** English

### LECTURER

**Coordinating lecturer:** Armelin Diggroc, Elaine Aparecida

**Others:** Borràs Cristòfol, Núria  
Castrejon Comas, Victor

### PRIOR SKILLS

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

### REQUIREMENTS

Degree in Chemical Engineering, Materials Science, or equivalent.

### 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:** 12h

Theory classes: 12h



### 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:** 8h

Theory classes: 8h

### Coatings technology

**Description:**

- 4.1. Fundamentals in coatings technology, coatings classification, manufacturing and quality control.
- 4.2. Paints formulation: Binders, solvents, fillers and additives.
- 4.3. Main physical parameters and their relationship with the coating properties
- 4.4. Anticorrosive, architectural coatings and varnishes
- 4.5. Industrial applications

**Specific objectives:**

Understand the chemical and physicochemical principles of the copolymerization methods that are used in the synthesis of copolymers through the different possible mechanisms, and how they apply to the preparation and design of copolymers, both at industrial and laboratory levels, from the properties that are required for these 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:** 10h

Theory classes: 10h

## GRADING SYSTEM

Partial exam 1 (EP1): 20% [Block 1]

Partial exam 2 (EP2): 20% [Block 2]

Partial exam 3 (EP3): 20% [Block 3]

Final Exam (FE): 40% [Block 4]

FINAL SCORES:  $0.2*EP1+0.2*EP2+0.2*EP3+0.4*FE$  [ $\geq 5.0$ ]

## EXAMINATION RULES.

All exams 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, etc.)

Approval in the subject is conditioned to the obtaining of a minimum of 3.0 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 involved in this subject.



## BIBLIOGRAPHY

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### 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

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### Hyperlink:

- Nom recurs. <https://atenea.upc.edu/>

### Other resources:

Classroom material available at ATENEA platform