

Introduction to Polymer Technology (E721043)

Course size (nominal values; actual values may depend on programme)

Credits	3.0	Study time	90 h	Contact hrs	36.0 h
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Course offerings and teaching methods in academic year 2018-2019

A (semester 1)	Dutch	seminar: coached	9.0 h
		exercises	
		lecture	24.0 h
		excursion	3.0 h

Lecturers in academic year 2018-2019

Van Steenberge, Paul	TW11	lecturer-in-charge
Delva, Laurens	TW11	co-lecturer

Offered in the following programmes in 2018-2019

Master of Science in Chemical Engineering Technology	crdts	offering
	3	A

Teaching languages

Dutch

Keywords

Polymers, Synthetic materials, Composites, Additives

Position of the course

Study of the production and chemical-technological aspects of commercial polymers, composites and additives.

Contents

PART A: Thermoplastics

Introduction:

- classification according to mechanism
- classification according to reactor/reactor configuration
- classification according to commercial importance
- mathematical description polymerization kinetics: basic techniques
- experimental characterization: basic techniques

Coordination polymerization

- reaction kinetics
- reactor choice
- production process for polyethylene and polypropylene

Radical polymerization

- reaction kinetics of free radical polymerization: homo- and copolymerization
- selection of initiators and reactors
- production process of polystyrene, polymethacrylates and polyacrylates
- extension to controlled radical polymerization: functional polymeric materials
- extension to suspension polymerization
- extension to emulsion polymerization

Polycondensation

- reaction kinetics
- reactor choice
- production process for polyamides, polystyrenes and polycarbonates

PART B: Thermosets

Phenolic resins, amino resins, thermoset polyester, epoxy resins, polyurethanes, polyurea and polydicyclopentadiene

- Production and structure of prepolymers
- Curing mechanisms
- Properties
- Applications

Choice of monomers, chemical-technological production of prepolymers and their curing mechanisms and the influence on the final properties of the product.

PART C: Additives

The chemistry, mechanism and function of different additives and their influence on the properties of polymers and composites

Stabilizers

- antioxidants, heat stabilizers
- light stabilizers

Fillers, fibers and coupling agents

Nucleating agents

Fire retardants

Initial competences

Final competences as envisaged in the courses "Advanced Chemistry II" (partim: Organic chemistry) and "Polymers".

Final competences

- 1 Knowledge: Concepts: Defining micro-, meso- and macroscale phenomena relevant for the production of polymers
- 2 Knowledge: Concepts: Defining polymerization mechanisms, -techniques and -reactors for the production of polymers
- 3 Knowledge: Concepts: Defining characteristics of the microstructure of polymers and additives
- 4 Knowledge: Relations: Describing the relation between the microstructure of polymers and additives and the process conditions and properties
- 5 Knowledge: Insights: Predicting the effect of process conditions on the microstructure of polymers
- 6 Knowledge: Models: Schulz-Flory distribution, Stockmayer distribution, particle size distribution, method of moments
- 7 Skills: Methods: Solving typical design problems for the production of polymers
- 8 Skills: Methods: Simplifying complex polymerization schemes using the method of moments
- 9 Skills: Methods: Critically approaching polymer technology in an industrial environment

Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

Conditions for exam contract

This course unit cannot be taken via an exam contract

Teaching methods

Excursion, lecture, practicum, seminar: coached exercises

Learning materials and price

Syllabus and hand-outs (electronically available, partly in English)

References

Principles of Polymerization, G. Odian, Wiley, 2004 ISBN 0-471-27400-3

Handbook of Thermoset Plastics (Third Edition), H. Dodiuk, S. H. Goodman, 2014, ISBN 978-1-4557-3107-7

Additives for Plastics Handbook, J. Murphy, Elsevier Science, 2001, ISBN 978-1-85617-370-4

Course content-related study coaching

Appointments can be made with the lecturers for additional information with respect to the course and feedback on the evaluation

Evaluation methods

end-of-term evaluation and continuous assessment

Examination methods in case of periodic evaluation during the first examination period

Oral examination

Examination methods in case of periodic evaluation during the second examination period

Oral examination

Examination methods in case of permanent evaluation

Participation, report

Possibilities of retake in case of permanent evaluation

examination during the second examination period is not possible

Extra information on the examination methods

closed-book examination, written preparation with oral explanation, participation in and report on study visit

Calculation of the examination mark

Exam (90%)

Study visit (10%)