UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Fundamentals of Polymers

2425-3-E2702Q110

Aims

The course aims to provide a basic preparation on polyme science for the Bachelor's Degree Course in Chemical Sciences and Technologies that allows the student to orient himself in relation to other disciplines and prepare to approach the world of work, in which polymers play a important role. Many internships, both industrial and internal to the Departments, are carried out in strong connection with this field, and can benefit from more systematic knowledge on polymers.

Knowledge and understanding
At the end of the course the student will have acquired knowledge on:

- stereochemistry and chemical structure of polymers
- main methods of synthesis
- property-structure relationships in amorphous and semicrystalline polymers.

*Applying knowledge and understanding
At the end of the course the student will be able to describe the main properties of polymers for scientific and application uses in various industrial sectors.

Making judgments
The student will be able to orient himself in the field of polymeric materials both in terms of chemical structure and properties.

Communication skills
The student will be able to express the topics explored during the course with language properties suitable for polymer science.

Learning skills
The student will be able to apply the knowledge acquired during the course to the contexts of the productive industrial world and will be able to understand the topics dealt with in the scientific and patent literature in the field

of polymers.

Contents

The course focuses on the basic aspects of polymer science in terms of macromolecule architecture, main synthesis methods and property-structure relationships. The various classes of polymers will be described, providing a large number of examples and highlighting the specific applications in the industrial field.

Detailed program

- Properties of macromolecules in solution and in bulk, compared with the properties of analogous molecules of low molecular mass.
- How polymer chains are synthesized: general principles.
- Various classes of polymers and their chemical structure, including cross-linked polymers, copolymers, blends and polymeric composites.
- Main properties and transitions of amorphous and semicrystalline polymers. Polymers treatment methods: solubility, hygroscopicity, heat treatments.
- Basic property-structure relationships of polymers for scientific and applicative uses in the pharmaceutical, cosmetic, biomedical, adhesives, surfactants, resins, fibers, transport fields.
- Polymers for advanced applications.
- Degradability and recycling, including polymers from renewable sources, biodegradable and biocompatible.

Prerequisites

Fundamental knowledge of chemistry, in particular organic chemistry.

Teaching form

Lectures in Italian.
18 two-hour lectures, in person, Delivered Didactics.

Textbook and teaching resource

- Notes provided by the professor (power point presentations to support teaching activities).
- Polymers, Walton, D. J., Lorimer, J. P. (2001). Oxford Chemistry Primers, Oxford University Press.
- Fondamenti di Scienza dei Polimeri, AIM, Pacini Editore, Pisa.
- Polymer Chemistry Koltzenburg, S.; Maskos, M.; Nuyken, O. ; Hughes, K., Translator; Springer: Berlin, Germany, 2017.

Semester

3rd year, 2nd semester

Assessment method

INTERVIEW ON TOPICS COVERED IN CLASS

The oral exam consists of the evaluation of the knowledge acquired by the student in the field of polymer science, with particular attention to the structure and properties of polymers. The autonomy of analysis and judgment, and the ability of exposure will be evaluated using the following criteria:
18-20/30: preparation on a small number of topics covered during the course, with limited capacity for discussion and analysis; not always correct presentation skills and vocabulary, with limited capacity for critical processing.
21-23/30: partial preparation on the subjects covered during the course, limited ability to self-analysis; use of correct vocabulary although not entirely accurate and clear; uncertain presentation skills.
24-27/30: preparation on a wide range of topics covered during the course, ability to develop self-argument and critical analysis; Ability to apply general knowledge to the specific context of polymer science and link topics studied to concrete cases; use of correct vocabulary and competence in the use of scientific language.
28-30/30L: complete and comprehensive preparation on all the subjects covered during the course; autonomy of analysis and critical judgment of the topics addressed in class; ability to link the topics studied to concrete cases and different scientific contexts; Full mastery of scientific vocabulary and rigorous presentation skills, clear and articulate; excellent ability to argue and reflect.

Office hours

By appointment. (silvia.bracco@unimib.it)

Sustainable Development Goals

INDUSTRY, INNOVATION AND INFRASTRUCTURE | RESPONSIBLE CONSUMPTION AND PRODUCTION