UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Synthesis and Special Organic Techniques in Material Chemistry

2425-2-F5401Q071

Aims

The course aims to provide an overview of the synthesis and structure of semiconductor organic materials O1 – Knowledge and understanding The student is required to show sufficient knowledge, understanding and mastery of organic chemistry in: 1) predict the optical and electronic characteristics of a polyunsaturated organic compound starting from its structure 2) conduct a reasonable retrosynthetic analysis in order to identify a possible and effective synthetic strategy. 3) possess an adequate mastery of the reactivity of the main functional groups in organic chemistry and their use in the preparation of polyunsaturated molecules and polymers. 4) Metal-catalyzed coupling reactions. 5) prepare the main polymeric and oligomeric materials for use in the field of conductive, semiconductor and electroluminescent materials.
6) describe the main photophysical and photochemical processes involved in the absorption of electromagnetic radiation (UV-Vis light) O2 – Applying knowledge and understanding The student, during the learning assessment mode, is required to demonstrate an adequate ability in applying the knowledge and understanding of the concepts acquired in: 1) to identify the functional structural and electronic parameters of polyinsatire structures based on the nature and connectivity of the elementary constituent elements. 2) apply the concepts of retrosynthesis in the simplification of the synthesis strategy of nonlinear organic systems, identifying the best disconnections, the corresponding syntons generated by the disconnection and the corresponding synthetic equivalents. 3) handle the reactivity of the main organic functional groups.4) handle the main coupling strategies of unsaturated units (aromatic and heteroaromatic systems) catalyzed by transition metals O3 – Making judgements To be able to conduct a reasoned retrosynthetic analysis of organic systems with application in materials science. O4 – Communication skills To be able to illustrate and identify the organic semiconductors of greatest interest for materials science, to illustrate with language properties the retrosynthetic and synthesis approaches useful for their preparation. O5 – Skills Ability to learn To be able to apply the knowledge acquired in the field of retrosynthesis and synthesis to organic systems with electrical, optical and optoelectronic properties of interest for printable electronics, photonics and (bio)sensors

Contents

The course provides an overview on the preparation of organic materials with specific optical and electronic properties exploitable in the field of photonics, organic semiconductors and on the synthesis of principal polymers with application as organic conductors or electroluminescent devices. An overview provides on organic photochemistry supporting the organic synthesis promoted by light.

Detailed program

Synthesis of polyunsaturated molecules and polymers, also heteroaromatic based. The following will be examined: the synthesis of "Push-Pull" molecular structures containing polyenel, polyincine, oligoaryl or heteroaryl and mixed aryl and/or heteroaryl-enic and/or inic molecular structures containing both organic and organometallic electronacceptor and electrodonor groups at the extremes; the synthesis of semiconductors that can be used in field-effect devices or organic conductors or/and electroluminescent materials with particular emphasis on conjugated polyunsaturated structures such as: polyenes, polyarenes, polyheteroarenes. Polymers for energetics: Thiophene-based polymers and Donor-Acceptor polymers. Concepts and applications of organic photochemistry.

Prerequisites

For an optimum understanding of the topic treated, a consolidated organic chemistry background is required together with basic knowledge on the optical and electronic properties of polyconjugated organic molecules and polymers.

Teaching form

24 two-hour lectures, in person, Delivered Didactics

Textbook and teaching resource

Full recording of classroom lectures. Annotated slides Reference articles from the most recent literature

Semester

first semester

Assessment method

Oral examination is the assessment method employed to check the level of understanding of the concepts taught during the course. Questions will ask to the student regarding the entire topic treated during the course. The final mark proposed to the student is in thirtieths, and a final minimum mark of 18/30 is necessary to pass the

examination.

Evaluation Scale:

18-19: Knowledge of a limited number of topics from the course syllabus, with restricted ability in discussion and analysis, which, in the case of an oral exam, emerge only with the help and questions from the instructor; expository skills and vocabulary are not always accurate, with limited critical thinking ability.
20-23: Knowledge of some topics from the course syllabus, independent analytical skills only on purely practical and procedural issues, use of correct but not entirely precise and clear vocabulary, and an occasionally uncertain expository ability.
24-27: Knowledge of a broad range of topics covered in the course syllabus, ability to conduct argumentation and critical analysis independently, ability to apply knowledge to different contexts and connect topics to real cases, use of correct vocabulary and proficiency in disciplinary language.
28-30/30L: Comprehensive and thorough knowledge of the exam topics, independent ability to discuss and critically analyze themes, capacity for reflection and self-reflection, as well as for connecting topics to real cases and various contexts, excellent critical and independent thinking skills, full command of disciplinary vocabulary, and a structured, rigorous expository ability, with strong argumentative, reflective, and interdisciplinary connections skills.

Office hours

upon request, on appointment

Sustainable Development Goals

GOOD HEALTH AND WELL-BEING | QUALITY EDUCATION | AFFORDABLE AND CLEAN ENERGY | SUSTAINABLE CITIES AND COMMUNITIES | CLIMATE ACTION