MSE-486

Organic electronic materials - synthesis, applications, properties

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Cursus	Sem.	Type
Chimiste	MA2, MA4	Opt.
Materials Science and Engineering	MA2, MA4	Opt.

Language of teaching	English
Credits	3
Session	Summer
Semester	Spring
Exam	Written
Workload	90h
Weeks	14
Hours	**3 weekly**
Lecture	2 weekly
Exercises	1 weekly
Number of positions	

Summary

This course will introduce students to the structural requirements of charge transport in organic materials as well as synthetic methods for their preparation.

Content

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1. **Introduction, Motivation, and Overview**
    1. Research in Materials Related to Energy Conversion and Storage
    2. Basics of Supramolecular Chemistry
2. **Charge Transport in Organic Molecules and Materials**
    1. Chemical Bonding in Organic Molecules
    2. Electron Delocalization in Molecules with pi-Conjugated Systems
    3. Charge Generation and Transport in Molecules and Bulk Materials
3. **Synthesis and Properties of Organic Electronic Materials**
    1. General Strategies
    2. Oligo(phenylene)s and Poly(phenylene)s
    3. Oligo(thiophene)s and Poly(thiophene)s
    4. Poly(phenylene vinylene)s
    5. Other Low Molecular Weight Organic Semiconductors
4. **Fabrication and Characterization of Organic Electronic Devices**
    1. Organic Field-Effect Transistors (OFET)
    2. Organic Light-Emitting Diodes (OLED)
    3. Organic Solar Cells (OSC)

Keywords

aromaticity, pi-conjugation, conjugated electron systems, electron delocalization, charge carrier generation and transport, solitons, polarons, bipolarons, polymer and oligomer semiconductors, organic field-effect transistors, organic light-emitting diodes, organic solar cells

Learning Prerequisites

Required courses

MSE 211 Organic and macromolecular chemistry (for materials science students)
or similar basic organic chemistry courses (students from other disciplines)

Recommended courses

Organic semiconductors (Frank Nüesch), in parallel
MSE 488 Supramolecular aspects of polymer materials

Important concepts to start the course

notion of the covalent bond
notion of chemical structures
notion of basic physics (atoms, electrons, electromagnetic radiation)

Learning Outcomes

By the end of the course, the student must be able to:

- Describe electronic structure of aromatic compounds, electron delocalisation
- Draw molecular orbital diagrams of pi-conjugated systems
- Discriminate charge generation mechanisms and species (solitons, polarons, bipolarons)
- Apply synthesis methods appropriate for pi-conjugated molecules
- Categorize different classes of organic electronic materials
- Elaborate functioning of organic solar cells, field-effect transistors, light-emmitting diodes

Transversal skills

- Access and evaluate appropriate sources of information.
- Assess one's own level of skill acquisition, and plan their on-going learning goals.
- Communicate effectively with professionals from other disciplines.

Teaching methods

ex cathedra, slides and blackboard, interactive exercises

Expected student activities

attendance to lectures
active participation in lectures (questions, feedback)
solving the exercise sheets (at home)
active participation in exercises (demonstrating solutions on blackboard)
complementing course work with organic and polymer chemistry textbook (at home)

Assessment methods

written examination

Resources

Ressources en bibliothèque

- Organic Chemistry / Clayden
- Atkins' Physical Chemistry / Atkins
- Organic electronics II : more materials and applications
- Electronic Processes in Organic Semiconductors, An Introduction / Köhler