

ChE-614

Electron & energy transfer in organic & hybrid systems

Marchioro Arianna, Nüesch Frank

Cursus	Sem.	Type
Chemistry and Chemical Engineering		Opt.

Language of teaching	English
Credits	2
Session	
Exam	Oral presentation
Workload	60h
Hours	32
Courses	24
Exercises	8
Number of positions	

Frequency

Every year

Remark

Next course January 2025

Summary

Electron and energy transfer processes are fundamental to numerous biological processes. In synthetic molecular and hybrid systems and devices, they are key to the functionality and efficiency of various devices. Advances in understanding and manipulating these processes continue to drive innovation

Content**A. Interaction of light with molecules**

- Generation of excited molecular states by light absorption: - Transition dipole moment and selection rules
- Generation of excited states by chemical processes
- Electron-phonon coupling: Huang Rys factor
- Fundamental aspects of absorption, fluorescence, intersystem crossing and internal conversion
- Spectroscopic methods

B. Energy transfer

- Radiative and non-radiative processes (Dexter and Förster transfer)
- Excitons in molecular aggregates: Davydov splitting
- Coherent/incoherent energy transfer
- Charge transfer states
- Exciton-exciton annihilation and fusion

C. Electron transfer

- Marcus theory
- Experimental methods: Flash photolysis and transient absorption

D. Biological systems and Applications

- Photosynthesis and chemiluminescence
- Dye sensitized solar cells
- Perovskite solar cells
- Organic solar cells and photodetectors
- OLEDs
- Organic up-converter Devices

Note

13-17.01.2025

Keywords

Organic conjugated molecules, conjugated polymers, molecular orbitals, absorption, fluorescence, phosphorescence, electron transfer, energy transfer, photosynthesis, chemiluminescence, solar cells.

Assessment methods

Presentation of the problems in front of the class. Attendance is mandatory for all students and will last for about 6h. On Thursday the student have a full day (8h) to prepare for a problem to be presented in class on Friday.

Resources

Bibliography

Gilbert, J. Baggott, Essentials of Molecular Photochemistry, Blackwell Sci. Publ., Oxford, 1991.
P. W. Atkins, R. S. Friedmann, Molecular Quantum Mechanics, Oxford University Press, Oxford, 1997.
A. Köhler and H. Bässler Electronic Processes in Organic Semiconductors, Wiley-VCH, Weinheim, 2015

Ressources en bibliothèque

- [Gilbert, J. Baggott, Essentials of Molecular Photochemistry](#)
- [W. Atkins, R. S. Friedmann, Molecular Quantum Mechanics](#)
- [Anna Köhler, Heinz Bässler, Electronic Processes in Organic Semiconductors](#)

Moodle Link

- <https://go.epfl.ch/ChE-614>