Organic Electronics

SCHOOL
Faculty of Science

CAMPUS
Belle-Beille

LEVEL
2nd year Master's degree

OPEN TO EXCHANGE STUDENTS
Yes

SEMESTER
Fall (S1)

- **Degree course:** Light, Molecules, Matter
- **Teaching unit:** UE5
- **Course language:** English
- **Duration (hours):** 60
- **ECTS:** 4
- **Teacher(s):** Philippe BLANCHARD

Assessment:

- [x] Continuous assessment
- [ ] Final exam

Teaching methods:

[x] Lecture course	35	hours	[ ] Case study
[x] Tutorial course	5	hours	[ ] Project
[x] Practical work	20	hours	

COURSE DESCRİPTİON

Introduction to Pi-conjugated systems for Organic Electronics:
- Introduction to Organic Electronics -- Electronic structures and properties of Pi-conjugated systems: From the doped state (conducting) to the neutral state (semiconducting). -- Introduction or reminders to various electrochemical and spectroscopic techniques. -- Determination of HOMO (IP) and LUMO (EA) energy levels of organic materials and construction of energy diagrams of electronic organic devices. -- Characterization of the molecular structure of thin-films.

Conducting polymers:
- Synthesis by electropolymerization and their characterization. -- Structure/property relationship analysis. -- Application to electrochemical and optical sensors, transparent conducting or electrochromic materials.

Organic light-emitting diodes (OLEDs):
- Operating principle. -- Active materials and optimization (from fully organic materials to Perovskites and quantum dots). -- Fabrication methods and characterization of OLEDs. -- Applications.

Organic field-effect transistors (OFETs):
- Operating principle. -- Active materials and optimization.
- Fabrication methods and characterization of OFETs. -- Applications.

Organic solar cells (OSCs):
- Introduction to the different photovoltaic technologies. -- Operating principle of OSCs. -- Active materials and optimization --Fabrication methods and characterization of OSCs (theory and practical courses). -- Transfer on an industrial scale: visit of ARMOR©, world specialist in the chemistry of inks and printing processes (near Nantes).

Dye-sensitized solar cells (DSSCs):
- Operating principle. -- The components of the DSSC and their optimization. -- Fabrication methods and characterization of DSSCs (theory and practical courses). -- Applications for Building Integrated Photovoltaics (BIPV), Dye-Sensitized Photoelectrosynthetic Cells (DSPECs) and dye-sensitized photocatalytic systems.

Perovskite solar cells (PSCs):
- Operating principle. -- Active materials and optimization.
- Fabrication methods and characterization of PSCs. -- Applications.

Polymers for Organic Electronics:
- Reminders on polymers and polymer chemistry: main synthetic approaches. -- Methods of controlled/living polymerization leading to tailor-made polymers, random, block and graft copolymers, functionalized polymers, etc., with predetermined structure and architecture. -- Applications: polymers for organic electronics.

OBJECTİVES

Organic conducting and semiconducting materials based on Pi-conjugated systems or organic/inorganic hybrid materials have become essential components in the field of low-cost flexible electronics. They are used in three key technological areas with very high industrial development potential: organic light-emitting diodes for lighting and displays, organic field-effect transistors and photovoltaic cells.
The main objectives of this course are to present these classes of organic and organic/inorganic hybrid materials, their properties and their characterization methods, establish structure/property relationships and describe the operating principle of electronic components incorporating such materials as well as the laws that govern their efficiencies. The physical methods used for the characterization of the performance of these devices will also be introduced in order to give a global vision of their design, manufacturing and evaluation.
Although this course does not intend to dwell on the synthesis of Pi-conjugated systems, specific attention will be paid to the chemical and electrochemical synthesis of polymers for electronic organics as well as their application in the fields of electrochemical and optical sensors, transparent conducting or electrochromic materials.