Techniques of Spectroscopies and Microscopies

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:** UE4
- **Course language:** English
- **Duration (hours):** 12
- **ECTS:** 1
- **Teacher(s):** Régis BARILLE

Assessment:

- [x] Continuous assessment
- [ ] Final exam

Teaching methods:

[x] Lecture course	12 hours	[ ] Case study
[ ] Tutorial course	hours	[ ] Project
[ ] Practical work	hours	

COURSE DESCRİPTİON

X and electron microscopy sciences
- Spectroscopies with electron microscopes: EELS et EDX
- Spectroscopy of X absorption in synchrotron: XANES et EXAFS
- Electron spectroscopy for surface characterization: XPS

Near-field Microscopies
- AFM: contact mode (c-AFM), non- contact (nc-AFM), intermittent contact (t-AFM), lateral forces (lf-AFM), spécific interactions, force spectroscopy.
- SNOM: Optical near-field, operating principle, type of set-up, experimental set-up
- STM: topographic mode (I-V constant or constant tip-sample distance) and tunnel-effect spectroscopy (STS).

Raman Spectroscopy
- Relation of molecular-structures - macroscopic phenomena (physical origin of the refractive index, absorption, diffusion).
- Application of Raman spectroscopy in microscopy.
- Main sources of light (white source, LED, Laser diode): materials and temporal and spectral characteristics.
- Principles of Raman and Resonance Raman spectroscopy.
- Extension on non-linear spectroscopy (second harmonic generation, emission with biphotonic absorption).

OBJECTİVES

The objective of this module is first to complete the knowledge of the student on the microscopy techniques already approached during the first year of the master's degree. Advanced microscopy techniques such as X microscopy (STXM, tomography), and near field microscopy (AFM, STM, SNOM) in the aim to acquire information (dimensions, shape, composition, structuring) at the nanometric scale will be discussed without going deeply into the physics of these techniques, but simply as characterization tools for a student chemist. The goal is to answer the question: What is the useful technique to get important information to know? With the same objective, Raman spectroscopy will be described as a tool for characterizations and applications.