Introduction to spectroscopy

Composante	Volume horaire
Sciences Fondamentales et Appliquées	**8h**

En bref

Langue(s) d'enseignement: Anglais

Forme d'enseignement : Cours magistral

Ouvert aux étudiants en échange: Oui

Présentation

Description

The course will be delivered in English

Spectroscopic methods probe the structure and the composition of interfaces at the molecular scale to better characterize interfacial phenomena that rules the reactivity of materials. These courses aim at giving students the basics of vibrational spectroscopy and solid-state nuclear magnetic resonance for monitoring interface-controlled processes under static or dynamic conditions. Emphasis is placed on sample preparation as well as the appropriate choice of experimental methods to extract qualitative or quantitative information such as molecular orientation and dynamics at the interfaces.

Objectifs

Program overview:

- Understanding the fundamental principles of solid-state NMR, infrared and Raman spectroscopies.

- Benefits and limitations of these techniques for probing interfacial phenomena

- Qualitative and quantitative analysis of data.

Informations non contractuelles.
Dernière mise à jour le 10 février 2021

Heures d'enseignement

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Programme détaillé

Syllabus

Vibrational spectroscopies

- The basis of infrared spectroscopy : light matter interactions, harmonic oscillator, potential function, normal modes of vibrations, origin of infrared spectrum
- Optical setup to probe interfaces phenomena: transmission, external and internal reflections…
- Adsorption of probe molecules at solid/gas or solid/liquid interfaces.
- Infrared spectroscopy using polarized radiation: orientation and organization of molecules or particles.

Solid-state Nuclear Magnetic Resonance

- The basis of solid state NMR: principles, external and internal interactions (chemical shift, J coupling, dipolar coupling, quadrupolar interaction), relaxation.
- Use of probe molecules for the study by solid state NMR of surfaces and interfaces
- NMR studies of the dynamics of molecules at interfaces
- Coupling of the hyperpolarization technique called dynamic nuclear polarization (DNP) and NMR spectroscopy for studying the surface of materials.

Informations complémentaires

Assessment methods

- Written examination

Compétences visées

Outcomes/Targeted skills

On completion of the course, the student should be able to :

- Have achieved advanced knowledge about the interaction of electromagnetic radiation and matter and their applications in spectroscopy

- Apply formalism for predicting spectroscopic properties.

- Analyse and interpret spectroscopic data collected by the methods discussed in the courses

- Solve problems related to the structure and interfaces.

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- Study molecular interactions by choosing suitable spectroscopic methods and interpreting corresponding data.

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