

Structural and chemical characterization: X rays and electrons

ECTS	Course (h)
3	18

Mention du master transmettant la fiche UE :	Chimie et Sciences des Matériaux
Composante de gestion de l'UE :	Faculté des Sciences – Département de Chimie
Responsable de l'UE :	G. SUDRE
Statut du responsable :	MCF

REQUIREMENTS

The following are not prerequisites but will facilitate the understanding and assimilation of the elements developed during the course:

Structure of matter; crystallography; wave optics or electromagnetism; signal processing; atomistics.

PROGRAMM

After introducing the physical basis of elastic interactions of radiation with matter, a theoretical approach of scattering (X-rays or neutrons) will be presented. It will be accompanied by experimental, technological and analytical aspects that will be highlighted by examples.

The formalism adapted to electronic imaging will be developed, in particular introducing essential notions of crystallography. The principles of high resolution techniques as well as the experimental aspects of other techniques (FIB, AFM...) will complete the part of the course focused on structural morphology.

The physical basis of inelastic interactions will introduce the spectroscopic part of the course, which will focus on the development of X-ray and electronic spectroscopy techniques.

SPECIFIC SKILLS

This course provides students with the necessary background to understand the tools used to determine the morphology and/or structure of a material at submicron scales. Without aiming to be exhaustive, different techniques (electron microscopy, X-ray spectroscopy and X-ray scattering) are presented, associating the technologies and theories adapted to the understanding of physical phenomena and the analysis of images or spectra. Here is a list of associated skills:

- explain the main interactions between radiation and matter
- anticipate the type of results obtained according to the technique used
- select the most appropriate technique and conditions to efficiently characterize the materials
- recognize the analysis which have been performed by observing the results
- perform an initial analysis of a spectrum or image and formulate hypotheses on the probable structure of a material.