



MAPR2641 Complements of crystallography and applications of X-rays to materials

[22.5h+15h exercises] 3 credits

This course is taught in the 2nd semester

Teacher(s): Jean-Paul Declercq, Pascal Jacques
Language: French
Level: Second cycle

Aims

This course aims at giving to the students thorough concepts of crystallography of solid materials as well as a knowledge of the possibilities of analysis of these materials by X-rays diffraction methods

Main themes

X-ray detection, films, gas detectors, solid detectors, position sensitive detectors. X-ray diffraction by crystals, diffracted intensities: atomic formfactors, structure factors, Friedel's law, anomalous dispersion, temperature factor. Diffraction and symmetry, Laue groups. Relationship between electron density and structure factors. Diffraction by polycrystalline samples. Photographic and diffractometric methods. Calculation of the intensities of a powder sample. Qualitative chemical analysis, phases analysis. Indexation of powder diffractograms. Quantitative analysis. Other applications of the diffraction by polycrystalline samples. Width of the diffraction lines, dimensions of the particles. Phase diagrams. Surstructures. Texture, preferential orientations and pole figures. Measurement of residual stress. Diffraction by single crystals. Laue method. Photographic and diffractometric methods. Introduction to three-dimensional structure determination from diffraction data. X-ray scattering by non crystalline materials. Analysis of the radial distribution. Introduction to small angle X-ray scattering. Absorption of the x-rays and introduction to the EXAFS spectroscopy.

Content and teaching methods

This course supplements the basic concepts of crystallography taught in the introduction to the materials characterization. It analyses in a quantitative and thorough way the phenomenon of X-rays diffraction by crystals with regard to the directions of diffraction as well as to the diffracted intensities.

This detailed analysis must make it possible to easily approach the numerous applications of diffraction in the fields of polycrystalline materials and of single-crystals, as well as some applications related to non-crystalline materials.

Other information (prerequisite, evaluation (assessment methods), course materials recommended readings, ...)

None

Other credits in programs

FSA3DA	Diplôme d'études approfondies en sciences appliquées	(3 credits)
MATR22	Deuxième année du programme conduisant au grade d'ingénieur civil en science des matériaux	(3 credits)