UCLouvain

lmapr2642

2019

Crystallographic and microstructural characterisation of materials

In view of the health context linked to the spread of the coronavirus, the methods of organisation and evaluation of the learning units could be adapted in different situations; these possible new methods have been - or will be - communicated by the teachers to the students.

5 credits	30.0 h + 30.0 h	Q1

Teacher(s)	Idrissi Hosni ;Jacques Pascal ;
Language :	English
Place of the course	Louvain-la-Neuve
Main themes	Study of the methods of characterisation of the microstructure of crystalline materials (metals and ceramics) and, in particular, of the methods based on (scanning and transmission) electron microscopy and diffraction of x rays and electrons. The objective is to show the specificity and complementarity of these methods for the description and quantification of the microstructure of crystalline materials. Overview of electro-analytical techniques, applied to the study of the chemical nature and electrochemical mechanisms of some technologically relevant electrochemical reactions.
Aims	**Contribution of the course to the program objectives** With respect to the general objectives of the KIMA program, the present course contributes to the development of the following learning outcomes : • AA1 Scientific and technical knowledge (AA1.1, A.A.1.3) • AA2 Engineering competences (AA2.1) • AA3 R&D competences (AA3.1) • AA5 Effective communication(AA5.3) **Specific learning outcomes of the course** At the end of the course, the students should be able to 1 • AA1.1 To characterise the microstructure of inorganic material using in a combined way microscopy techniques (light & electron), methods based on x-ray, electron and neutron diffraction as well as microanalysis. To do that, these different methods are described. The objectives are to show the specificity as well as the complementarity of these methods for the description and the quantification of the microstructure of cristalline materials. • AA3.1 To understand and analyse the results of the technical and scientific literature in relation with the characterisation techniques (micrography, spectra, diffrazction patterns, ...). • AA1.3, AA2.1 To evaluate the adequate technique for reaching the needed information to understand the behaviour of inorganic materials. These objectives will be reached through the ex cathedra lectures as well as with the help of short-term projects during which unknown metarials will be characterised following specific procedures. • AA1.1 To carry out electrochemical characterisation in different ways with the help of electro-analytical techniques, with the help of the electrochemical characterisation of a fuel cell. • AA1.3 To use statistical elements in order to compare in a quantitative way the experimental results from characterisation procedures. • AA5.3 To summarise the results reached through characterisation techniques. - - - - *The contribution of this Teaching Unit to the development and command of the skills and learning outcomes of the programme(s) can be accessed at the end of this sheet, in the section entitled "Programmes/courses offering this Teaching Unit".*
Evaluation methods	**Due to the COVID-19 crisis, the information in this section is particularly likely to change.** The students are evaluated individually with a written and oral exam based on the objectives described above. The written exam will concern the scientific and technical knowledge seen during the lectures as well as the projects carried out during the laboratories.
Teaching methods	**Due to the COVID-19 crisis, the information in this section is particularly likely to change.** The course is organised around 12/13 lectures and practicals / projects / laboratories. The scope will be put on the practical use of different characterisation equipments.
Content	Quantitative microscopy ' image analysis. Geometrical and electronic optics. Scanning electron microscopy. Electron probe microanalysis. Reminder of crystallography and diffraction. Transmission electron microscopy.

	Analysis of crystal defects. Analytical microscopy. Crystal texture and measurement. Diffraction of back-scattered electrons. Fuel cells. Electro-analytical techniques : voltamperometry, chronopotentiometry. Statistics.
Inline resources	https://moodleucl.uclouvain.be/course/view.php?id=8184
Bibliography	Un syllabus est disponible. Les ouvrages de référence sont • D. Brandon & W.D. Kaplan, 'Microstructural Characterization of Materials', J. Wiley & Sons, 2001 • "Electrode Dynamics", A.C. Fisher (Oxford Chemistry Primers). Les documents du cours sont disponibles sur Moodle
Other infos	It is supposed that the concepts of the FYKI orientation at the bachelor level are known.
Faculty or entity in charge	FYKI

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Aims
Master [120] in Chemical and Materials Engineering	KIMA2M	5		