


5.0 credits	30.0 h + 30.0 h	1q
-------------	-----------------	----

Teacher(s) :	Jacques Pascal ;
Language :	Anglais
Place of the course	Louvain-la-Neuve
Inline resources:	http://icampus.uclouvain.be/claroline/course/index.php?cid=MAPR2642
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 :	<p>Contribution of the course to the program objectives</p> <p>With respect to the general objectives of the KIMA program, the present course contributes to the development of the following learning outcomes :</p> <p>--</p> <p>AA1 Scientific and technical knowledge (AA1.1, A.A.1.3)</p> <p>--</p> <p>AA2 Engineering competences (AA2.1)</p> <p>--</p> <p>AA3 R& mp;D competences (AA3.1)</p> <p>--</p> <p>AA5 Effective communication(AA5.3)</p> <p>Specific learning outcomes of the course</p> <p>At the end of the course, the students should be able to</p> <p>--</p> <p>AA1.1 To characterise the microstructure of inorganic material using in a combined way microscopy techniques (light & mp; 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.</p> <p>--</p> <p>AA3.1 To understand and analyse the results of the technical and scientific literature in relation with the characterisation techniques (micrography, spectra, diffraxction patterns, ...).</p> <p>--</p> <p>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.</p> <p>--</p> <p>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.</p> <p>--</p> <p>AA1.3 To use statistical elements in order to compare in a quantitative way the experimental results from characterisation procedures.</p> <p>--</p> <p>AA5.3 To summarise the results reached through characterisation techniques.</p> <p><i>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".</i></p>
Evaluation methods :	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 :	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.

<p>Bibliography :</p>	<p>A syllabus is available. Reference books : -- D. Brandon & mp; W.D. Kaplan, 'Microstructural Characterization of Materials', J. Wiley & mp; Sons, 2001 -- "Electrode Dynamics", A.C. Fisher (Oxford Chemistry Primers). Documents will be available on icampus</p>
<p>Other infos :</p>	<p>It is supposed that the concepts of the FYKI orientation at the bachelor level are known.</p>
<p>Faculty or entity in charge:</p>	<p>FYKI</p>

Programmes / formations proposant cette unité d'enseignement (UE)				
Intitulé du programme	Sigle	Credits	Prerequis	Acquis d'apprentissage
Master [120] in Physical Engineering	FYAP2M	5	-	
Master [120] in Chemical and Materials Engineering	KIMA2M	5	-	