UCLouvain

lmapr2013

2018

Physical Chemistry for Metals and Ceramics

5 credits	30.0 h + 30.0 h	Q1

Teacher(s)	Jacques Pascal ;
Language :	English
Place of the course	Louvain-la-Neuve
Main themes	Three main themes will be considered : non metallic inorganic solids (ceramics and mineral glasses), physical metallurgy, main processing of the principal industrial metals and alloys (steel, aluminum, ...).
Aims	1 **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, 2.2) AA3 R&D competences (AA3.1) **Specific learning outcomes of the course** At the end of the course, the students should be able to AA1.1. describe the solid state phase transformations in binary metallic systems : AA1.1. to give the general characteristics of the most common engineering metallic materials. AA1.1. to describe the equilibria in ternary systems. AA1.1. to describe the structure of ceramics and inorganic glasses, as well as the point defects. AA1.1. to give the mechanisms of mass and charge transport in ceramics. AA1.3, AA2.1. to analyse the influence of the production processes used for inorganics materials. AA1.3, AA2.1 to choose the mostly adapted category of inorganic materials for a specific application based on requested performances and economical concerns. - - - - *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	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 resolution of an exercise related to the physical chemistry of metals and ceramics. A specific exam will deal with the practicals. It consists in the recognition of the microstructure of specific samples and solving specific problems.
Teaching methods	The course is organised around 12/13 lectures, 4 exercise sessions and 6 laboratories.
Content	1. Phase equilibria : reminder of binary systems ; ternary equilibria ; 2. Diffusion in solids. 3. Ceramics and glasses : crystal structure, amorphous state, mineral glasses, crystalline defects, transport of mass and electrical conductivity, phase equilibria in processes 4. Physical metallurgy ' types of transformations, kinetics of transformations, TTT diagrams, application to different metals and alloys (steels, aluminum, ...) 5. Steelmaking processes 6. Extrative metallurgy of aluminum.
Inline resources	https://moodleucl.uclouvain.be/course/view.php?id=8186
Bibliography	Un syllabus est disponible via SICI. Le professeur déposera également des versions actualisées du syllabus sur le site web icampus du cours. Pour les chapitres I et II, le livre de référence est : 'Phase transformations in metals and alloys' (D.A. Porter & K.E. Easterling, Taylor & Francis, ISBN:0-7487-5741-4. Pour les chapitres III à VI, le cours s'inspire principalement du livre «Physical Ceramics : Principles for Ceramic Science and Engineering » (Y-M Chiang, D. Birnie, W.D. Kingery) Wiley (ISBN 0-471-59873-9).
Other infos	It is highly recommended to have knowledge in chemistry and physical chemistry at the bachelor level. Particularly, the courses LMAPR 1805 : Introduction à la science des matériaux, LMAPR 1310 : Thermodynamique ' équilibres de phase et LMAPR 1231 : Procédés de chimie inorganique.

Faculty or entity in charge	FYKI

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Aims
Master [120] in Chemistry and Bioindustries	BIRC2M	5		
Master [120] in Chemical and Materials Engineering	KIMA2M	5		
Master [120] in Biomedical Engineering	GBIO2M	5		