UCLouvain

lmapr2420

2020

High performance metallic materials

Due to the COVID-19 crisis, the information below is subject to change, in particular that concerning the teaching mode (presential, distance or in a comodal or hybrid format).

5 credits	30.0 h + 30.0 h	Q2

This biannual learning unit is not being organized in 2020-2021 !

Teacher(s)	Jacques Pascal ;Simar Aude ;
Language :	English
Place of the course	Louvain-la-Neuve
Main themes	Advanced and complementary themes with respect to LMAPR 2013 "Physical-chemistry of metals and ceramics" and LMAPR 2481 "Deformation and fracture of materials".
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.1.2) • AA2 Engineering competences (AA2.1) • AA3 R&D competences (AA3.1,AA3.2,AA3.3) • AA4 Project management • AA5 Effective communication efficace • AA6 Ethics and professionalism (AA6.1) **Specific learning outcomes of the course** At the end of the course, the students should be able to • AA1.1 to describe intermetallic solutions and compounds thanks to the Hume-Rothery rules and to describe the order/disorder phase transitions ; • AA1.1 to explain the magnetic properties of metallic materials and to link these properties with the use of such materials (ferromagnetism, permanent magnets, soft magnetic materials, superconductors) ; • AA1.1 to establish in the case of steels and aluminium alloys the link between processing parameters, microstructure evolution and properties. Other metals and alloys will be also considered such as titanium or nickel alloys. • AA1.1 & 1.2 to explain owing to simple physically-based models, the mechanisms responsible for work hardening, creep, wear resistance of advanced metallic alloys as well as coatings. • AA3.1, 3.2, 3.3to compare his/her knowledge with the reality of industrial cases ; • AA3.1, 3.2, 4.2to propose solutions as the output of a working group in order to solve industrial problems, strictly taking into account the limit of time and human resources ; • AA4.2 to organise the different tasks to carry out amongst the members of the group ; • AA5.3, 5.6 to present the chosen methodology and to defend the reached solutions. - - - - *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. Evaluation of the practicals An individual evaluation of the project will be carried out. This evaluation will take into account : • the evaluation by the group supervisor of the work really carried out ; • the individual contribution during the presentation of the project (including the answers to the questions) ; • the part of the exam related to the project
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 projects in groups of 2 to 4 students.
Content	• Solid solutions and intermetallic compounds : Hume - Rothery rules ; order ' disorder transitions ;

	• Metallic magnetic materials : ferromagnetism, permanent magnets ; soft magnetic materials ; • Metallic supraconductors; • Fast quenching, amorphous metallic glasses, quasi-crystals ; • Advanced steels : basics, mechanical properties, phase transformations, hardenability, tempering, annealing and surface treatments, thermomechanical treatments ; • high performance light alloys (Al, Mg, Ti) ; Low melting point alloys ; High temperature alloys ; Superalloys; • Kinetics of microstructure evolution. Practicals are organised as projects for 3-4 students with the aim of contributing to the development of competences of point 1 hereabove. The topics of the projects are proposed by industrial partners.
Inline resources	https://moodleucl.uclouvain.be/course/view.php?id=9255
Bibliography	Un syllabus est disponible.
Other infos	Science of metallic materials at EPL is the topic of successive course of the FYKI and KIMA programs (LMAPR1310 ' Thermodynamics and Phase Equilibria, LMAPR 2805 - Introduction to the Materials Science, LMAPR 2013 ' Physical Chemistry of Metals and Ceramics, LMAPR 2481 ' Deformation and Fracture of Materials. The present course is thus the last one of the series. For non-UCL students, a minimum background of about 15 ECTS in the field of Materials Sciences (particularly the processing, thermodynamics, microstructures and properties of metallic materials) is needed.
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		🔍