UCLouvain

lmapr2672

2026

Materials for Extreme Environments

5.00 credits	30.0 h + 30.0 h	Q2

This biannual learning is being organized in 2026-2027

Teacher(s)	Erauw Jean-Pierre ;Jacques Pascal ;
Language :	English > French-friendly
Place of the course	Louvain-la-Neuve
Main themes	Metallic and ceramic powders: production and characterization; shaping of the semi-finished green product ; sintering process ;properties of sintered products.

Learning outcomes	**At the end of this learning unit, the student is able to :**
	Within the engineering degree program in chemistry and materials science, the course involves simultaneously four axes covering both disciplinary and transversal learning outcomes. At the end of the course, students will be able to :
	• (Learning Outcome 1.1)
	  • Explain the physical and physico-chemical phenomena underlying the processes of shaping of massive bodies from metal or ceramics powders via dry, wet, or plastic methods.
	  • Describe the interactions between the critical parameters for the manufacturing of a homogeneous, high density green part.
	  • Describe the driving forces and mechanisms of material transport that govern the different stages of sintering of an aggregate of solid particles.
	  • Describe the influence of residual porosity on the mechanical behavior of sintered materials.
	  • Describe and classify the different surface treatment processes.
	• (L.O. 1.2 and 3.2)
	  • By reclaiming the achievements of the bachelor program in mathematical concepts and in the use of computational tools, develop a mathematical model to simulate a physical phenomenon.
	• (L.O. 3.1)
	  • Draw a state of the art in a specific technological domain based on a set of technical and scientific references.
	• (L.O. 4.2)
	  • Conduct a project group.
	• (L.O. 5.3)
	  • Present and defend an oral report effectively and critically.
	• (L.O. 6.3)

Evaluation methods	Students are assessed individually in writing and orally. The exam questions are formulated to verify the acquired disciplinary learning outcomes mentioned above. The exam focuses on the response to questions relating to the understanding of the theory. The achievement of transversal learning outcomes is evaluated via an oral assessment on the project. Each student orally presents the work of the group. The content of the project is summarized in a report and is discussed. Depending on the evolutionof the sanitary situation, the organisation of the exam could be modified (online exam, ...).
Teaching methods	The course consists of a dozen of lectures and a dozen of exercise sessions or small projects. These ones are related to the concept considered during the lectures.
Content	Following a general introduction, various extreme environments will be considered, along with their consequences on the durability and properties of the materials used. General introduction: Examples and characteristics of extreme environments; required properties; physical and chemical characteristics. Materials for extreme mechanical environments; Materials for extreme thermal environments; Materials for extreme corrosion and hydrogen environments; Materials for extreme radiation environments; Materials for specific properties (erosion/abrasion, controlled thermal expansion, etc.) and coupled effects.

	Practical work is organised in the form of a group project. The aim of this project is to help develop the skills listed in point 1 above. In order to enable groups to apply their knowledge and expertise to real-life industrial problems, project topics are proposed by companies.
Bibliography	Slides and syllabus are available.
Other infos	The science of inorganic materials is covered at EPL through a series of consecutive courses in the FYKI and KIMA programmes. This course is therefore the last in the series. For non-UCL students, a minimum background of approximately 15 ECTS credits in the field of basic materials science, particularly inorganic materials (development/ thermodynamics, microstructures and properties, especially mechanical properties), is required in order to get the most out of this course.
Faculty or entity in charge	FYKI

Programmes containing this learning unit (UE)

Program title	Acronym	Credits	Prerequisite	Learning outcomes
Master [120] in Chemical and Materials Engineering	KIMA2M	5		