Microstructural design and characterization of inorganic materials

Lecturer
Stephane GODET (Coordinator)

Course mnemonic
CHIM-H412

ECTS credits
6 credits

Language(s) of instruction
English

Course period
First term

Course content

In the characterization part:

- Interactions electromagnetic wave-matter: IF, UV spectrocopy, X-ray Diffraction, XPS
- Interactions electrons-matter: SEM, TEM, Auger
- Interactions ions-matter: SIMS, RBS

In the physical metallurgy part:

- Thermodynamics of phase diagrams,
- Diffusion in crystalline solids,
- Thermodynamics of interfaces,
- Solid state transformations, phase transformation in steels
- Phenomenological theory of martensite crystallography,
- Aluminium and titanium alloys

Objectives (and/or specific learning outcomes)

The goal of this courses is two-fold. First it motivates how interactions of particules or waves with matter can be used in different charactrization tools. Second, it also motivates how thermodynamics and kinetics concept can be used to optimize the microstructure of metals. At the end of this course, the students should be able to:

- propose specific characterization tools in a specific applications
- to analyse the specific drawbacks and strong points of the various techniques
- in particular, they shoud be able to compare them in a quantitative and critical manner
- propose thermal and thermomechanical treatments designed to produce optimized microtrctures
- compare the different phase transformations mechanisms
- Show how those global concepts can be applied to specific alloys

Teaching method and learning activities

The theoritical aspects are introduced in an oral course while these concepts are applied in a project carried out by groups of 3-4 students

Contribution to the teaching profile

This teaching unit contributes to the following competences:

- In-depth knowledge and understanding of exact sciences with the specificity of their application to engineering
- In-depth knowledge and understanding of integrated structural design methods in the framework of a global design strategy
- Conceive, plan and execute a research project, based on an analysis of its objectives, existing knowledge and the relevant literature, with attention to innovation and valorization in industry and society
- Correctly report on research or design results in the form of a technical report or in the form of a scientific paper
- Present and defend results in a scientifically sound way, using contemporary communication tools, for a national as well as for an international professional or lay audience
- Collaborate in a (multidisciplinary) team
- A creative, problem-solving, result-driven and evidence-based attitude, aiming at innovation and applicability in industry and society
- The flexibility and adaptability to work in an international and/or intercultural context
- An attitude of life-long learning as needed for the future development of his/her career
- An integrated insight in chemical process and materials' technology

References, bibliography and recommended reading

Phase Transformations in Metals and Alloys, Second Edition (Paperback) by David A. Porter (Author), Kenneth E. Easterling (Author) ISBN-10: 0748757414

Other information

Contact(s)

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Evaluation method(s)

Other

Evaluation method(s) (additional information)

oral examination consisting in

1. 're-explaining' selected slides of the course part based on 'microstructural design''

2. Proposing characterizaton strategies in a given context for the part on 'materials characterization'

Determination of the mark (including the weighting of partial marks)

oral exam 60%

project (including individual grade+group grade): 40%

If the grade of the oral exam is 7 or below, the total grade is the grade of the oral exam

Main language(s) of evaluation

English

Programmes

Programmes proposing this course at the Brussels School of Engineering

MA-IRMA | Master of Science in Chemical and Materials Engineering | finalité Professional/unit 1