Chimie Lille
ÉCOLE NATIONALE SUPÉRIEURE DE CHIMIE

UMET

COURSES

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University of Lille, France

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Fatigue, environmental effects

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METALLURGY & METALLIC ALLOYS
(40 h – 30h – 3 ECTS)

MICROSTRUCTURE INVESTIGATION TECHNIQUES
(40 h – 30h – 3 ECTS)

DAMAGE MECHANISM AND RELIABILITY OF MATERIALS
(56h – 40h – 4 ECTS)

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METALLURGY AND METALLIC ALLOYS

Lecture Contacts

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Simulation, modelling
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Metallurgy, microscopies
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SPECIFICITIES (1/2)

- **Main aims:** Students learn the basic knowledge of metallurgy to allow understanding what is a metallic alloy and the link between its microstructure and its properties.
- **Learning outcomes:**
  - Read phase diagram, know defects in micrsostructure, know phase transformation mechanisms.
  - Optimization of microstructure by heat treatment, design of new alloys

SPECIFICITIES (2/2)

- **Prerequisites**
- Thermodynamics
- Crystallography and crystallochemistry
- Matter structure

- **Total student workload: 70hours**
  - Contact hours: 40 hours
  - Personal work hours: 30 hours

CONTENT OF THE LECTURE

- From the liquid to the solid: solidification curves and phase diagrams
- Defects
- Transformation kinetics in metals and metallic alloys in solid state
- Steels
- High performance metallic alloys

PRESENT SITUATION

- Draft has been submitted
- Oral presentation will given next meeting
- Final paper will be sent end of december

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Chimie Lille
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MICROSTRUCTURE INVESTIGATION TECHNICS

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Rose Noëlle VANNIER

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Fuel cell, oxide materials for energy

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SPECIFICITIES (1/2)

- **Main aims:** teach the modern techniques for the characterisation of solid materials. The purpose of the course in not to make students specialists of each technique but to give them a necessary “toolkit”.

- **Learning outcomes:**
- Technology of characterisation tool
- Specificity of each technique (bulk or surface)
- Be able to face an analytical problem dealing with the characterisation of materials

SPECIFICITIES (2/2)

- **Prerequisites**
- Thermodynamics
- Crystallography and crystallochemistry
- Matter structure
- crystallography
- The students should be able (i) to understand the methods for calculation and data processing (ii) to analyze spectra according to well-known law (e.g. Bragg's law)

- **Total student workload: 70 hours**
  - Contact hours: 40 hours
  - Personal work hours: 30 hours

PRESENT SITUATION

- Draft has been submitted
- Oral presentation will given next meeting
- Final paper will be sent end of december

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DAMAGE AND RELIABILITY OF MATERIALS

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SPECIFICITIES (1/2)

- **Main aims:** understanding the damage mechanisms of structural materials that result from mechanical loading and from environmental.
- **Learning outcomes:**
  - know the main mechanical tests to characterize the fracture resistance of materials and the main methods for corrosion resistance assessment.
  - learn the mechanisms of damage: corrosion, the ductile to brittle transition, the coupling effect between stress and environment.

SPECIFICITIES (2/2)

- **Prerequisites**
  - Metallurgy
  - Plasticity
  - Analytical chemistry
  - The students should be able to mix concepts from different areas as metallurgy, mechanics, analytical chemistry and possess general knowledge of how large infrastructure works, e.g. power plant

- **Total student workload: 96 hours**
  - Contact hours: 56 hours
  - Personal work hours: 40 hours

CONTENT OF THE LECTURE

- Mechanical testing
- Degradation by corrosion
- Effect of temperature on fracture mode
- Fatigue failure
- Environmentally assisted fracture
- wear

PRESENT SITUATION

- **Draft has been submitted**
- **Oral presentation will follow by J.-B. Vogt**
- **Final paper will be sent end of december**