

PR1100 Introduction to Materials

Professor: Jean-Hubert Schmitt

Language of instruction: French – **Number of hours:** 36 – **ECTS:** 3

Prerequisites: You can not be enrolled in this course PR1100 if you followed the course MG1400 current semester 7

Period: S6 Elective 01 February to March IN16DE1, SEP6DE1
S8 Elective 08 February to March IN28IE1, SEP8IE1

Course Objectives

- ✧ Give an overview of material-related problems and their key role in all sectors of the economy
- ✧ Show the multidisciplinary approach required to solve these problems
- ✧ Study the main classes of materials and explain their functional and structural properties
- ✧ Establish the relationships between the processing, structure, and properties of materials

On completion of the course, students should be able to

- ✧ select the suitable material for a given application
- ✧ understand the relationships between the processing, the structure and the properties of materials
- ✧ implement simple physical models to describe the behavior of materials

Course Contents

Introduction: presentation of problems and issues of materials in various domains

The main classes of materials: definition from the nature of chemical bonding, resulting properties and use, material selection

- ✧ Structures and phase transformations of materials
- ✧ Order and disorder: from crystal to amorphous
- ✧ Defects (0D to 3D)
- ✧ Thermodynamic equilibria: from Gibbs energy to phase diagrams
- ✧ Kinetics of phase transformation: phase nucleation and growth

Material properties

- ✧ The mechanisms of plastic deformation, modeling at the microscale
- ✧ Damage and fracture of materials
- ✧ Functional properties (thermal and electrical conductivity, ferroelectricity, magnetism, optics)

Invited conferences to illustrate materials problems in specific economic area

Course Organization

Lectures: 21 hr, Tutorials: 12 hr, Exam: 3 hr

Teaching Material and Textbooks

- ✧ Course reader : Génie des matériaux, de J.B. Guillot
- ✧ M. Ashby and D. Jones, Materials Engineering

Resources

Instructors: V. Aubin, B. Dkhil, H. Duval, J.-H. Schmitt

Evaluation

3-hr written exam with documents and calculator