



DE LA MATIÈRE AUX MATÉRIAUX : STRUCTURE ET PROPRIÉTÉS

FROM MATTER TO MATERIALS: STRUCTURE AND PROPERTIES

Lecturers: Bruno BERTHEL

| Lecturers : 8.0 | TC : 32.0 | PW : 0.0 | Autonomy : 6 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

This module introduces a basis grounding on the materials currently used, on their structures and properties as well as the characterization methods. In particular, the approach used will underline the relation between the properties (mechanical and physical) and the structure of the material at a relevant scale (from nano to macroscopic). This knowledge will enable the student to propose well-considered selection of materials in relation to the elaboration and manufacturing processes for a given application. Practical work (IDM tc2) completes this teaching.

Keywords : Mechanical behaviour of materials (elasticity, plasticity, fracture, fatigue, creep), crystallography, heat treatment, metallic alloys, glasses, polymers, composites, solid state physics, electrical conductivity.

Programme

General introduction to materials engineering (2h Lec.). | Chapter 1: Materials: mechanical properties, structure (10h TC and 2h Aut.) : mechanical behavior on the macroscopic scale ; Interatomic bonds, structure and defects ; relation between mechanical properties and structure/defects. | Chapter 2: Families of materials: elaboration, modification of properties (2h lec., 14h TC and 2h Aut.) : Metals and metal alloys ; Polymers; Ceramics and inorganic glasses; Composites. | Chapter 3: Physical properties of materials (4h lec., 8h TC and 2h Aut.) : From Drude's model to Sommerfeld's free electron theory ; Nearly free electron model ; Electrical, thermal conductivity and magnetic properties of materials.

Learning outcomes

- To know the main families of materials and their specificity
- To know the materials processes and manufacture
- Be able to use the mechanical constitutive laws of materials (elasticity, plasticity, fracture)
- Know the physical properties of materials

Independent study

Objectifs : Acquisition and oral restitution of knowledge, situational exercises and problem-solving.

Méthodes : Personal and group work:
- Chapters 1 and 2: reading documents and doing exercises.
- Chapter 3: preparing an exercise and presentation during a tutorial

Core texts

J.-P. Baïlon et J.-M. Dorlot., *DES MATÉRIAUX*, Presses internationales polytechnique Montréal, 2002
M. Ashby et D. Jones. *MATÉRIAUX (TOMES 1 ET 2)*, Edition Dunod, 2008
C. Kittel *PHYSIQUE DE L'ÉTAT SOLIDE*, Edition Dunod, 2007

Assessment

Final mark = 100% Knowledge
Knowledge mark = 90% final exam + 10% continuous assessment