MATS8AG MECHANICAL AND PHYSICAL PROPERTIES OF POLYMERS

MATS8AG **Mechanical and physical properties of polymers**	**ECTS Credits** : 2 **Duration :** 21 hours	**Semester** : S8

Person(s) in charge:

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Keywords:
polymers, amorphous, semi-crystalline, polymerisation, properties, utilisation, forming

Prerequisites:
Atomic and molecular arrangements: structures and defects, in service mechanical behaviour of materials

Objective:

Have a global overview on polymers, on their properties and utilisations

Programme and Contents:

The main structural and chemical features which influence the properties and the behaviour of polymers are: i) the nature of the monomer, ii) the architecture of the macromolecular chains, iii) the length of the chains and iv) the morphology at different scales. The objectives of this course are:

1. To analyse the functional groupings of polymers, reaction of polymerization and formation of the macromolecular chains,
2. To analyse the relation between macromolecular structures and the physical properties,
3. To understand the mechanisms that contribute to the physical and mechanical properties of polymers and describing the related laws in the context of sustainable development and material recycling
4. To study the relation between the formation and the macroscopic properties of polymers.

A. PHYSICAL & CHEMICAL ANALYSIS OF POLYMERS: - Principles and kinetics of polymerization - Macromolecular structure of polymers - Molecular weight distribution: Number-Average Molecular Weight & Weight-Average Molecular Weight - Physical & chemical characterization methods of polymers

B. PHYSICAL AND MECHANICAL PROPERTIES OF AMORPHOUS AND SEMI-CRYSTALLINE POLYMERS: - Glass transition and crystallization in polymers - Physical methods of micro structural characterization - Methods of mechanical characterization - Microscopic mechanisms of plastic deformation - Viscoelastic behaviour of polymers - Orientations and textures induced by forming processes - Viscosity and flow behaviour of polymers - The different forming processes of polymers

Abilities:

Level	Description of operational verbs
Know	The different types of polymers : heat-hardening and thermoplastic - amorphous - semi-crystalline - various polymerization processes
Understand	The structure of macromolecular chain and parameters governing macroscopic behaviour.
Apply	Various techniques of microstructural characterization and necessary mechanical tests so as to understand well and to predict behaviour of polymer during his forming process and/or in service.
Analyse	Forming processes of polymers and quantify polymer flow in molten state.
Summarise	Understand the existing important link between use properties (mechanical properties) and, microstructure of polymer and forming processes.
Assess	Choice of polymer and process for the fabrication of a specific product.

Assessment:

☑ Written Test	☑ Continuous Control	☑ Oral Report	☐ Project	☐ Written Report