



MATÉRIAUX AMORPHES POUR STRUCTURES FONCTIONNELLES INNOVANTES

AMORPHOUS MATERIALS FOR INNOVATIVE FUNCTIONAL STRUCTURES

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| Lecturers : 12.0 | TC : 14.0 | PW : 4.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

Amorphous materials are synthetic or natural materials widely used in a large number of applications. For these materials, the industrial and technological development has often preceded scientific concerns in terms of characterization, structure-property relationship and modelling of the behavior and their life cycle. Currently, the science of glasses is a field rich in developments, with numerous technological impacts in industrial sectors such as the transportation, civil engineering, medical, agri-food... This course offers a deepening of the knowledge on the specificities of these materials and on their applications. External speakers will be present and a visit to a plastic bottle recycling centre will be organised.

Keywords : Glass, vitreous state, oxides, polymers, elastomers, glass transition, semi-crystallinity, rheological behavior, recycling

Programme

- The amorphous state: origins of order and disorder...
- Manufacturing processes.
- Networks and crystallization phenomena.
- Characterization methods: thermal analysis, X-ray, infrared...
- Structure and rheological behavior.
- Functional properties: optics, shape memory, damping, thermal insulation, electrical conduction and innovative applications in various industrial sectors.
- Life cycle, characterization and recyclability of a packaging (example of a soda bottle).

Learning outcomes

- Acquire knowledge on the structure and characterisation techniques of amorphous materials in the objective to better understand their properties.
- Define the characterisation and identification techniques to be used according to the material to be analysed.
- Have notions concerning the recycling of amorphous materials.
- Use acquired knowledge to analyse the issues of their life cycle and make a critical analysis.

Independent study

Objectifs : Control of all the stages of the life of a part made of amorphous material from its manufacturing to its after-use destination.

Méthodes : The autonomous work consists of preparing practical works, writing reports and carrying out a bibliographic project on a problem related to the recyclability of these materials. All these activities are teamwork.

Core texts

Powell, Peter C, *ENGINEERING WITH POLYMERS*, Chapman & Hall, 1992
Jerzy, Zarzycki *GLASSES AND THE VITREOUS STATE*, Cambridge University Press, 1991
Duval, Claude *PRÉSENTATION MATIÈRES PLASTIQUES ET ENVIRONNEMENT - RECYCLAGE, VALORISATION, BIODÉGRADABILITÉ, ÉCO-CONCEPTION*, Dunod, 2009

Assessment

0.5: knowledge (100% final exam: quiz + exercises); 0.5: know-how (50% oral presentation of the project+50% practical work report).