

Composites Processing

ECTS	Course (h)
3	18

Mention du master transmettant la fiche UE :	Chimie et Sciences des Matériaux
Composante de gestion de l'UE :	Faculté des Sciences – Département de Chimie
Responsable de l'UE :	P. CASSAGNAU
Statut du responsable :	PR

REQUIREMENTS

I. Polymers Composites

Physical chemistry of polymers, rheology, mechanics of materials, knowledge in polymer processing.

II. Metal Matrix Composites (MMC)

Master level knowledge in metals, alloys and ceramics, and in their thermal and mechanical behaviour:

- Verre, métaux, semi-conducteur et céramiques (VMSC2, CHM2025L+)
- Mécanique pour les matériaux (CHM3030L+),
- Thermodynamique des Matériaux (CHM3027L+)
- Matériaux (CHM3095L+)
- Métallurgie (CHM1205M+)
- Verres, Ciments et Céramiques. Cristallines (CHM1209M+)

PROGRAMM

The general objective of this course is to present Polymer and Metal Matrix Composites (MMC) as structural materials, from the point of view of their synthesis, their implementation and/or shape and their reactivity.

Polymers Composites

- To provide the skills necessary for the development, characterization and implementation of polymer matrix composites (thermoplastics and thermosets)
- Industrial composites, Synthesis of polymer networks (permanent or reversible networks).
- Notions of interface and fiber/polymer interphase
- Structural transformations (sol-gel transition, vitrification, phase diagrams). Chemo-rheology and characterization of networks (swelling, rubber elasticity...), model networks. Influence of fillers.
- Mass transfers and heat exchanges in processing. Flow in processing machines. -Permeabilities in porous reinforcements. Study and in-situ control of the implementation processes (RTM, RIM, SMC, etc...)

Metal Matrix Composites (MMC)

- Overview of the main MMC currently used in industry and their main industrial applications (Course 1).
- Concise presentation of the different ways of MMC synthesis at an industrial (Course 2).
- Focus on Reactivity drawbacks observed during the implementation or the use of the MMC (properties evolution, aging, damaging) and their understanding based on Phase diagrams (Course 3)
- Presentation of cutting-edge and new ways of synthesis (MMC in-situ synthesis), current research on mechanical properties evolution (bimodal MMC) and the interest for "new" reinforcements (Carbides type and other) (Course 4).

Keywords: Fibrous reinforcements, Particle reinforcements, Polymer matrix, Metal matrix, - Implementation Thermodynamics, Reactivity, In-situ synthesis

SKILLS

- Ability to integrate several disciplines (Chemistry and Physics of polymers)
- Knowledge of the main industrial MMC
- Understanding the MMC interest and specific properties.
- Knowledge of the MMC ways of synthesis
- Understanding the MMC properties evolution during their synthesis and uses.