Micro and nanostructuration of polymers

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 :	**N. SINTES**
Statut du responsable :	**MCF**

REQUIREMENTS

Basic concepts in Polymer Science and rheology

PROGRAMM

The course presents the basic mechanisms that lead to the formation of micro or nanostructures in polymer blends and in bulk or aqueous copolymer systems.

- The first part is devoted to the elementary mechanisms driving the formation of micro and nanostructures in heterogeneous polymer systems. More precisely, thermally or chemically driven phase separation in polymer mixtures (spinodal decompositions) or the mechanisms controlling the more elaborated structures spontaneously formed in copolymer systems are investigated.
- A second part will allow to travel in the scale of structuring: from immiscible polymer blends, compatibilized or not, to nanometric and organized heterogeneous systems that can only be obtained by increasing the fraction of block copolymer within the material. Throughout the course, examples will be developed progressively from "micro" to "nano"; examples of commercial materials or from advanced research.
- The third part concerns self assembly of amphiphilic copolymers (polymersomes and micelles) : the effect of the composition and the chemical microstructure and the experimental conditions, such as pH, temperature, ionic strength, concentration…) on the size and morphology of the resulting nanoobjects will be studied.

SPECIFIC SKILLS

At the end of the course, the student should be able to design a heterogeneous polymer system to a specific specification. This includes:

- knowing how to select the appropriate polymers and predict the morphology required to obtain the properties
- be able to propose processes for micro and nanostructuring organic materials (prediction and exploitation of phase diagrams, physical mixing modes, interface management).
- kwowing understanding and predicting autoassociation of amphiphilic copolymers in water according to molecular characteristics of copolymers and experimental conditions