Macromolecular Design of "Smart" Polymeric Systems:
Responsive Nanocarriers and Injectable Hydrogels

ABSTRACT: Macromolecular engineering is an integrated chemical process aiming to design polymeric materials for specific advanced applications. In order to achieve this goal, tailor-made segmented block copolymers with specific macromolecular architecture and topology, chemical composition/functionality and low molecular polydispersity and heterogeneity have to be synthesized and thoroughly characterized. The establishment of structure-property relationships of the spontaneously macromolecular self-assemblies in specific environments (e.g. solution, interfaces, bulk) is the following step, that will allow a rational retro design of the macromolecular characteristics of copolymer as to finally obtain nanostructured polymeric materials with tailor-made macroscopic properties, suitable for a specific function. For the successful upshot of the above procedure special synthetic tools, the so-called controlled/"living" polymerization methods, has to be applied.

A special class of polymeric materials are constituted of the so-called "smart" macromolecules which self-assemble reversibly, through association mechanisms by various non-covalent interactions, e.g. hydrophobic, ionic, H-bonding etc., and which are able to response to external stimuli namely temperature, pH, ionic strength, light, magnetic field etc.,

The aim of this seminar is to highlight the recent achievements of the Polymer Lab, dealing with the design of "smart" polymeric systems which form two types of stimuli responsive self-assemblies, namely micellar nanoparticles and physically crosslinked networks. The first type can be used as nano/micro multi-carriers for the controlled drug delivery potential applications while the second one can be used as injectable hydrogels for tissue engineering and therapeutic agents sustainable delivery potential applications.