

Research topic proposal for Erasmus Students in Chemistry (Master Level)

## "Development of 2<sup>nd</sup> Generation ThermoPlastic Elastomers"

The aim of the project is to develop thermoplastic elastomers (TPEs) with adjustable thermomechanical properties. TPEs are materials that combine the properties of common thermoplastic polymers such as ease of processing with those of elastomeric materials. In addition, the main advantages of TPEs are their recyclability, their rigidity as well as their ability to be stretched up to high strains and, after unloading, to recover their original shape. Currently, the most used TPEs are based on diblock copolymers consisting in a rubbery block giving the material elastic properties and a rigid block, generally a semi-crystalline polymer, conferring the rigidity and the processability. Nevertheless, the variety of microstructures that can be achieved with this type of materials remains limited, mainly due to the fact that the blocks used consist in homopolymers. Thus, the only parameter that can be adjusted regarding the microstructure is the size of the blocks of the copolymer. This represent a severe limit in view of obtaining a material with tailored properties.

As schematized on the figure below, it is envisaged in this project to adopt a new approach allowing to easily tune the thermomechanical properties of TPEs over a wide range. More precisely diblock copolymers which can be independently crosslinked will be synthesized. Consequently, the variation of the crosslinking degree will allow to adjust the properties of each block and thus to control the stretchability of the elastomeric block on the one hand and, on the other hand, the rigidity of the transition temperature of the hard block. Moreover the reversible character of the processes involved will allow to elaborate materials with evolutional properties.



The objectives of the student during this project, which combines both the chemistry and physics aspects of the polymer science, are:

- To synthesize the polymers
- To carry out the structural characterization of the materials by means of WAXS and SAXS techniques
- To determine the thermomechanical properties of the materials as a function of the crosslinking degree (DSC and tensile tests)
- To study the reversibility of the crosslinking reaction.

## Placement: UMET Laboratory – Building C6

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