



Secteur des Sciences  
et Technologies

Invitation à la soutenance publique de thèse de

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Master of Science in Polymer Science

Pour l'obtention du grade de Docteur en sciences de l'ingénieur et  
technologie

« Synthesis and thermo-rheological properties of thermoplastic  
elastomers based on hydrogen-bonded hard segments »

qui se déroulera  
**le jeudi 13 juin 2019 à 14h**  
**Auditoire SUD 05**  
**Place Croix du Sud**  
**1348 Louvain-la-Neuve**

Jury members :

Prof. Evelyne Van Ruymbeke (UCLouvain), supervisor

Dr. Carel Fitié (DSM BV, Netherlands), co-supervisor

Prof. Jacques Devaux (UCLouvain), chairperson

Prof. Jean-François Gohy (UCLouvain), secretary

Prof. Charles-André Fustin (UCLouvain)

Dr. Wilco Appel (DSM BV, Netherlands)

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Prof. Pavlik Lettinga (Forschungszentrum Jülich, Germany)



 **UCLouvain**

Polyesteramide (PEA) segmented copolymers represents an interesting class of thermoplastic elastomers (TPEs), containing of two different segments termed as hard segment (HS) and soft segment (SS). Chemically, SSs are polyether units having low  $T_g$ , which provides flexibility to the polymer chain, whereas HSs are short amide units, which can self-associate via hydrogen bonding and form a physical crosslinked network. The thermodynamic incompatibility between the SS and HS results in a two-phase morphology and sets the interesting properties of these copolymers. For example, they show the physical property of rubbers at room temperature, such as softness, flexibility and resilience, while at high temperature, the HS domains melt, making the segmented copolymers processable like thermoplastics. Thus, this temperature dependence of the HS domains allows the transition from a processible melt to a solid, rubber-like object, and vice versa. This last one can be tuned by playing with the chemical chain composition, type of the HSs (monodisperse or polydisperse) and the extent of phase separation, which strongly affects the copolymer properties and make them suitable for different applications in automotive, electric and consumer product industries.

This thesis aims to synthesize well-defined amide-based PEAs of equal molar mass, but containing different HS concentrations (0, 5, 10, 15 and 20wt%) and to study their properties in order to understand in depth the role of HS density on morphology, thermal and viscoelastic properties. Parallel to this, it also aims to study the effect of polymer chain architecture, by synthesizing and studying PEAs with same HS density but with a dumbbell architecture. The structure-property relationship is established based on various experimental techniques like small-angle and wide-angle X ray scattering, DSC, FTIR, FSC and shear rheology. The results show that the final properties of the samples like high-temperature stability, temperature independent plateau modulus, or improved low-temperature flexibility are strongly dependent on their microstructure, which is largely influenced by the chemical composition, HS density, SS entanglements, thermal history, cooling conditions (fast or slow) and external parameters like time and temperature. Hence, the systematic study offers many possibilities for engineering these materials to meet the required behavior.