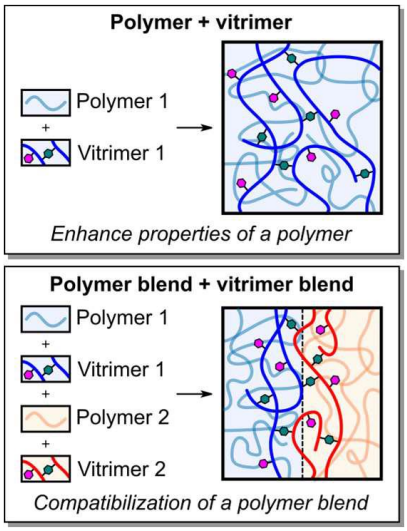
Horizon 2020 – MSCA – ITN 2022

ReBond

A universal platform for recycling plastic waste using dynamic covalent bonds

(https://www.rebondproject.eu/about-us/)

ReBond aims at combining complementary areas of expertise in vitrimer synthesis and multi-scale physical properties of soft composite materials, to decode the relationship between the vitrimer molecular structure and rheological response, to construct a roadmap for designing dynamic systems with desired performance. The superior properties displayed by vitrimers will be exploited to design compatibilizers for unsorted polymer waste streams. Developing, testing and implementing vitrimer-based plastic recycling technologies pose many intriguing questions encompassing synthesis, structure-dynamics interplay, processing, stability and performance. These questions are inherently interdisciplinary, spanning polymer chemistry, physics, and engineering. Our doctoral network, focused on the rheological/mechanical/processing properties of networks containing vitrimers, represents an ideal platform to bring together an international team of experts from both academia and industry to train the next generation of material scientists and promote circular economy.



PhD position

Rheo-Raman and extrusion investigation of compatibilized recycled plastics with vitrimers

Chemical Engineering, Rijksuniversiteit Groningen, The Netherlands.

Chimie Moléculaire, Macromoléculaire, Matériaux, Sciences et Ingénierie de la Matière Molle, École Supérieure de Physique et de Chimie Industrielles de la Ville de Paris, Paris, France ;

This PhD project is part of the European Doctoral Network 'ReBond', which involves eight Universities, five industrial partners and 15 PhD students. By combining the expertise of the different partners in synthesis, advanced characterization, linear and nonlinear dynamics, mechanical properties, modelling, and plastic product development and processing, we shall uncover the underpinning relationships among processing and performance of vitrimer-based recycled plastics and elastomers.

The objectives of the present PhD project are: 1) investigating the structure and dynamics of compatibilized polyolefins via rheo-spectroscopic techniques, and 2) testing the mixing and processability of compatibilized polyolefin blends.

At first, model systems for polypropylene (PP) and polyethylene (PE) vitrimers will be individually investigated, with the aim at studying the effect of molecular parameters (*i.e.*, degree of polymerization, distribution and degree of functionalization) on their rheo-structural properties. PP and PE blends will be then prepared through the use of lab-scale extruders (single and twin screw systems) at various operating conditions (temperature, screw rotational speed, compression factors). Optimizing mixing parameters for the blends will be identified, along with their rheological characterization. A synergistic link between molecular parameters of the vitrimers, their structure, dynamics and processing will be ensured thanks to the joint efforts of the University of Groningen (The Netherlands) and ESPCI (France). The resulting outcome will serve as a strategy to recycle unsorted polyolefin waste streams, for a more sustainable future in the world of plastics.

The proposed PhD research stands as an experimental and multidisciplinary project, encompassing polymer synthesis and characterization, rheology and spectroscopic techniques, and polymer processing. The applicant must have a master's degree in polymer chemistry, material science or chemical engineering. A candidate with strong background in polymer science and rheological properties of polymers is preferred.

Applications should be sent by email (a single pdf file containing a detailed CV, a transcript of marks obtained during the Master, a motivation letter, and the names of two referees) to: rebond-manager@uclouvain.be

Starting dates: between November 2023 and March 2024.

Project duration: 36 Months at UG (The Netherlands) and 12 Months at ESPCI (France)