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Ph-D position in physics and chemistry of materials

New designs for vitrimer materials and composites

Introduction: Vitrimers, invented in 2011 at ESPCI-Paris by the group of Leibler, are chemically crosslinked polymers characterized by the presence of exchangeable links, a feature that allows to change topology while keeping the integrity of the network. Vitrimers show unusual combination of properties: they are both insoluble and processable, and flow in the same way as glass at high temperature (they were given the name "vitrimers" with reference to this characteristics). This makes them fundamentally recognized as a third and new class of polymeric materials, alongside thermoplastics and thermosets, and on a practical level as a new means of controlling and resolving problems of (re)processing, chemical strength and thermal resistance of materials and composites.

Project Background: This Ph-D project is part of a collaboration between three institutions: the Laboratory of Polymer Materials Engineering (University of Lyon), the Soft Matter and Chemistry Laboratory (ESPCI-Paris) and the CTI-IPC platforms (Technical Center for Plastics and Composite), Alençon / Oyonax, France). The goal is to take full advantage of this tripartite collaboration to implement breakthrough concepts based on vitrimers.

Mission: The research program is inspired by several key concepts of materials science, already at work in metallurgy, civil engineering or in the glass industries and which, thanks to vitrimers could become also relevant in the field of polymer materials.

The doctoral student based at ESPCI-Paris will have to design original experiments to highlight new properties and to relate the original functionalities to the particular structure of vitrimers. Investigations will involve design, formulation and extrusion of reactive systems, rheology, molecular spectroscopy, (thermo)mechanical testing, microscopy, X-ray scattering techniques. Collaboration with the CTI platforms will ensure the relevance of the means implemented in terms of scale up and suitability to industrial needs, whereas Prof Drockenmuller and his group at University of Lyon will provide us with innovative chemistry. Short stays in Lyon and CTI will be organized during the course of this project whenever particular experiments will require it.

Profile: Candidate holding a master's degree and having a very good training in physicochemistry or materials science together with a basic knowledge of polymer chemistry. Knowledge in diffraction and modeling techniques applied to the formulation and study of materials will be also highly appreciated

Location : Laboratoire Matière Molle et Chimie
Ecole Supérieure de Physique et Chimie Industrielles
10 rue Vauquelin 75005 Paris

Doctoral School: ED 397 Physique et Chimie des Matériaux
Duration: 36 months. preferred start date: november 2018
Application: Send CV, motivation & recommendation letters to: francois.tournilhac@espci.fr