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Ph-D position in physics and chemistry of materials

### Formulation of self-healing vitrimer membranes

#### 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.

The goal of this project is to design new vitrimers with adequate functionality to ensure efficient transport properties and self-healing. Such materials are heavily needed to develop clean processes in chemical engineering, energy and food industries. The Ph-D student will develop and study new vitrimer formulation compliant with current membrane processes and provided with extended functionality.

#### Description of the research Unit

The Soft Matter and Chemistry Laboratory, MMC, established in 2001 by Ludwik Leibler at ESPCI Paris, is involved in research combining fundamental and applied aspects. The activity covers chemistry, colloid and polymer physics and materials science. Including ten staff people (researchers, teachers, technical and administrative), the laboratory hosts PhD students and postdoctoral fellows from different continents and backgrounds. The laboratory maintains numerous collaborations with industrial partners in sectors as diverse as chemicals, oil exploration, automotive, biomedical devices, pharmaceuticals, coatings, cosmetics and water treatment.

**Ph-D Supervisor:** Dr. François Tournilhac

**Profile:** We will look for a candidate holding (or enrolled in) a Master's degree in Chemistry or Physicochemistry. In addition to basic knowledge of organic chemistry, methods of synthesis and analysis of polymers, a background in rheology, mechanics, microscopy, spectroscopy, diffraction and modeling applied to the formulation and study of materials will be highly appreciated.

#### Applicants should meet eligibility conditions:

<https://www.upto.paris/Eligibility-conditions.html>

Duration: 36 months. Start date: march to september 2019

**Online application:** <https://www.upto.paris/Preparing-the-application.html> **Deadline 17 sept 2018**