

# PhD Position

## Borinic Vitrimers

<b>Research unit</b>	Molecular, Macromolecular Chemistry and Materials, UMR 7167 ( <a href="http://www.mmc.espci.fr/">http://www.mmc.espci.fr/</a> )
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<b>Home institution</b>	ESPCI Paris - PSL ( <a href="http://www.espci.fr/en/">http://www.espci.fr/en/</a> )
<b>Type of position</b>	PhD position
<b>Supervisors</b>	Renaud Nicolay ( <a href="mailto:renaud.nicolay@espci.psl.eu">renaud.nicolay@espci.psl.eu</a> ) Amandine Guérinot ( <a href="mailto:amandine.guerinot@espci.psl.eu">amandine.guerinot@espci.psl.eu</a> )
<b>Collaboration</b>	Institut des Sciences Moléculaires (ISM) of Bordeaux University
<b>Salary</b>	1675 € / month
<b>Funding Program</b>	ANR 2019
<b>Start date</b>	September-October 2020

Candidates are asked to submit their CV and provide contact information for references to [renaud.nicolay@espci.psl.eu](mailto:renaud.nicolay@espci.psl.eu) and [amandine.guerinot@espci.psl.eu](mailto:amandine.guerinot@espci.psl.eu)

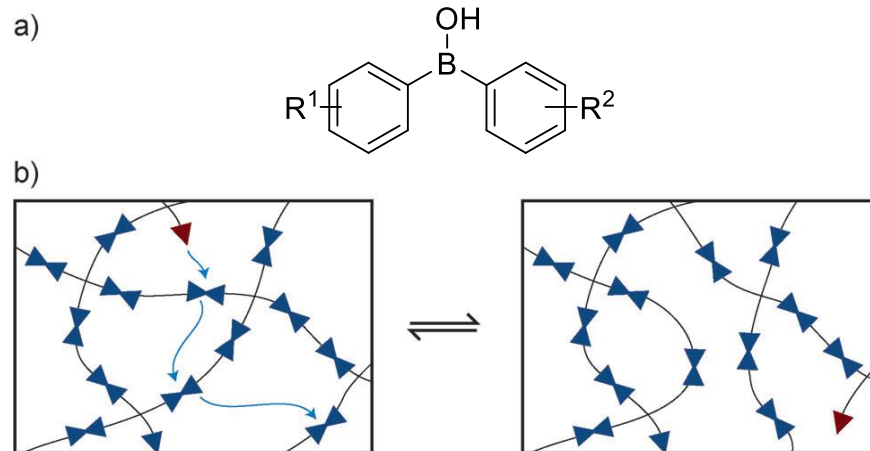
### Description of the laboratory:

The Molecular, Macromolecular Chemistry and Materials (C3M) is a CNRS mixed research unit at the ESPCI Paris, a *grande école* internationally recognized for its scientific excellence in training and research. The C3M laboratory works in close collaboration with industrial partners on research topics linked to the development of new fundamental concepts and applications. Its main areas of research include the development of synthetic methods to access architecturally complex molecules; the design and study of structured polymeric and hybrid materials; the design and study of stimuli-responsive functional systems; supramolecular chemistry; and the dynamic and mechanical study of polymeric-colloid formulations and composites.

### Project description:

A novel class of materials, coined vitrimers, has recently been discovered in the laboratory.<sup>1,2</sup> Vitrimers are unique polymeric networks capable of reorganizing themselves without altering their crosslinking density.<sup>3</sup> As a consequence, vitrimers are reshapeable at will and can be repaired and recycled under the action of heat. This property means that they can undergo transformations using methods that cannot be envisaged either for thermosetting resins or for conventional plastic materials.

The aim of this PhD is to design organo- and hydrosoluble vitrimers relying on borinic acid chemistry and to study them in bulk and in solution. Therefore, the targeted vitrimers will rely on a new exchange chemistry. In addition, new synthetic routes to prepare vitrimers will be explored.



**Figure 1.** a) A diarylborinic acid; b) General scheme of dynamic bonds undergoing an associative exchange reaction in a vitrimer network.

**Required background:**

The candidate should hold a master degree in molecular or polymer chemistry, and have keen interest in polymer characterization (chemical, physico-chemical and mechanical).

**Keywords:**

Vitrimers, borinic acid chemistry, monomer design and synthesis, polymerization, macromolecular engineering, physico-chemical and mechanical characterizations.

**References:**

- 1 - D. Montarnal, M. Capelot, F. Tournilhac, L. Leibler, *Science* **2011**, 334, 965
- 2 - Röttger, M.; Domenech, T.; van der Weegen, R.; Breuillac, A.; Nicolaÿ, R.; Leibler, L. *Science* **2017**, 356, 62
- 3 - Van Zee, N.; Nicolaÿ, R. *Prog. Polym. Sci.* **2020**, in press <https://doi.org/10.1016/j.progpolymsci.2020.101233>