

Dynamic Covalent Self-Assembly of Nanostructured Polymers

PhD position (36 months)

Project

Block copolymers are fundamental building blocks in material science, widely used for their ability to self-assemble into periodic nanostructures (spheres, cylinders, lamellae). However, synthesizing these architectures requires complex and costly living polymerization techniques. We aim to explore an alternative using dynamic covalent materials. By introducing exchangeable bonds into linear and branched polymers, we aim to allow the material to "find" its own optimal topology, effectively self-synthesizing ordered block-like structures from random precursors driven by thermodynamic forces.

As a PhD candidate, you will study the fundamentals of this new class of materials in the bulk state. Your goal is to correlate the chemical dynamics of the exchangeable bonds with the physical self-assembly of the polymer chains. After successfully understanding and synthesizing these self-assembling materials, you will explore how they can be processed into nanostructures for energy-relevant applications (e.g., electronic, optical, or filtration applications).

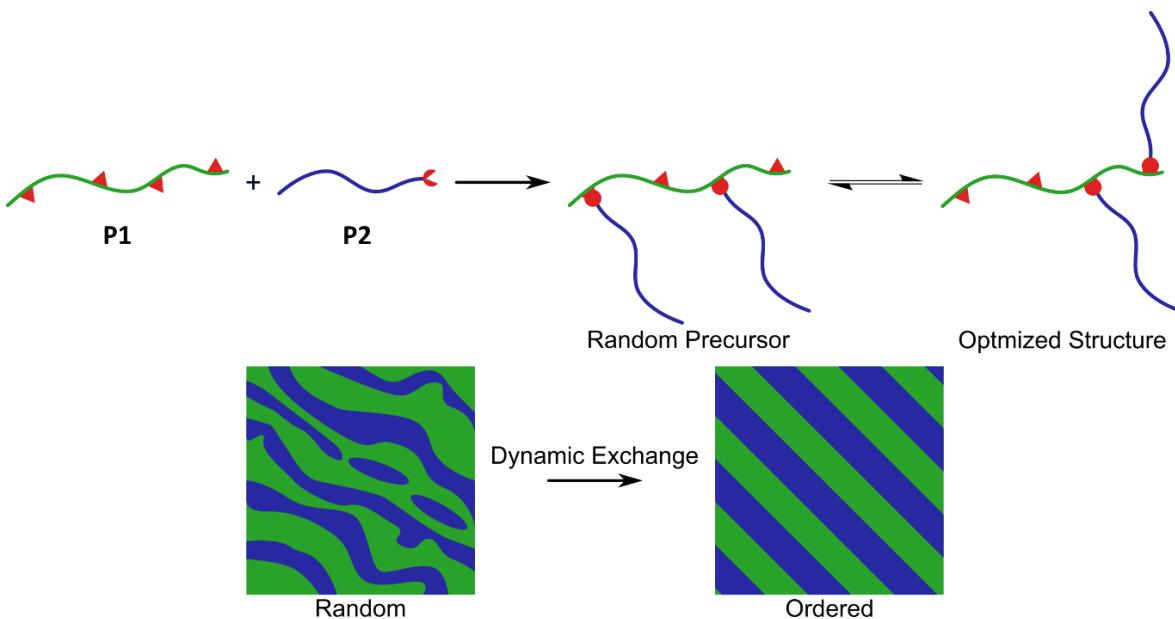


Figure: Concept of the project. Using dynamic covalent chemistry to allow random graft copolymers to reorganize their topology into ordered block-like sequences and well-defined nanostructured material.

Key Responsibilities

- **Synthesis:** Design and synthesize functional monomers and polymers equipped with dynamic covalent units.
- **Material Preparation:** Design dynamic polymer formulations. Study and optimize annealing protocols to trigger topological reorganization.
- **Characterization:** Map the resulting nanostructures and phase behavior using a full suite of physico-chemical tools, including Small Angle X-ray Scattering (SAXS), Atomic Force Microscopy (AFM), and Transmission Electron Microscopy (TEM).

Candidate Profile

- Master's or engineering degree in Polymer Chemistry, Materials Science, Organic Chemistry, or Physical Chemistry.
- Strong background in the synthesis and characterization of polymers.
- Experience in the self-assembly of block copolymers is a plus.
- Interest in understanding new applications and concepts of dynamic polymers.
- Eager to learn, discuss new ideas, and integrate into a fast-paced new team.

Conditions

- **Start Date:** September/October 2026 (flexible).
- **Duration:** 36 Months (Fully Funded).
- **Salary:** ~1700 €/month
- **Location:** IMP Laboratory, Université Claude Bernard Lyon 1.
- **Contact:** georges.formon@unifr.ch

Position open until the vacancy is filled.