PhD position at IMP laboratory, INSA de Lyon, France.

Design of Supramolecular Photoswitches and Engineering of Biomimetic Adaptive Materials

This ambitious PhD project will address the development of photoswitchable supramolecular complexes and their integration into macromolecular materials and nanocomposites to reach stimuli-responsive sacrificial bonds at the nanoscale and light-adaptive mechanical properties at the macroscopic scale. The rationale of this project lies in the design of associative photoswitches exhibiting light-responsive binding capabilities. These associative motifs will be inserted so that geometrical changes that accompany the photoisomerization of the photoswitch can be mechanotransduced to initiate the activation/deactivation of the supramolecular complex or to drastically weaken it. First, efforts will be paid to the investigation of the unexplored interplay between the dynamics of the photoisomerization and supramolecular interactions. The associative photoswitches will be then inserted as chain ends or pendant units into precisely defined macromolecular building blocks. After preliminary evaluation of their light-sensitive character and binding capabilities, these tools will be engaged into the preparation of bulk materials (organo or hydro)gels, self-assembling colloids or in the construction of the soft phase in self-assembled nacre-inspired nanocomposites. Owing to the insertion of the photoswitchable units which dictate the association of the supramolecular complexes, gel/sol (gels), aggregation/dissociation (colloids), stiff/tough transitions (nacres) will be observed under irradiation. Explicitly, the light-induced transient states will be solely stable as long as irradiation is maintained. Interruption of exposition will promote backward switching and recovery of the initial material state. Additionally, the structure of the photoswitches will be finely tuned to modulate the photophysical properties of the molecular switches (lifetime of the isomers, absorption spectrum, photostationary state…) and broaden the scope of the resulting adaptive materials.

As the generation of associative photoswitches and the understanding of their supramolecular association/photoisomerization/macroscale mechanical properties has never been

addressed so far, the envisioned results will constitute a major advance in the fields of supramolecular chemistry and adaptive materials.

Keywords: *Organic chemistry, supramolecular chemistry, multi-step synthesis, photo-isomerization, macromolecular engineering, adaptive materials.*

Requirements: We are looking for an ambitious, highly motivated and hard working student. The ideal candidate should have a Master degree in chemistry, with a strong background in organic synthesis, supramolecular and macromolecular chemistries. He/she should have experience with analytical methods (NMR, UV-Vis, IR, fluorescence spectroscopies, and chromatographic techniques such as SEC). Other skills, such as knowledge about ITC, DLS and microscopy techniques will also be appreciated.
An excellent level in english language is required. French language knowledge is welcome but not mandatory.

Interested candidates should contact Dr. Julien Bernard (CNRS researcher, Julien.bernard@insa-lyon.fr) or Dr Stéphane Chambert (Associate Professor, stephane.chambert@insa-lyon.fr) and provide a detailed CV including research experience and list of publications, a motivation letter, and contact details or recommendation letters of at least two academic referees.