PhD position

Self-assembly of chiral synthons and elaboration of responsive chiral supramolecular polymers

Institute Laboratoire de Chimie (LCHENS de Lyon)
Research team Supramolecular Chemistry and Chemical Biology
http://www.ens-lyon.fr/CHIMIE/recherche/Teams/Chimie_Organique_et_Materiaux_Nanostructures
Supervisor Dr Laure GUY (Laure.guy@ens-lyon.fr)

Context During the past years, we have demonstrated that helicenes-like molecules (shown in figure 1) are accessible at large scale and as pure enantiomers following an optimized pathway.[1] Moreover, we have shown recently that, those molecules, act as molecular switches upon various stimuli such as pH or metal coordination. Due to differences in the conformation and the electronic structures, the reversible reaction between the two states of these molecules possessing an axial chirality is easily monitored by chiroptical analysis such as electronic circular dichroism (ECD) or circularly polarized luminescence (CPL).

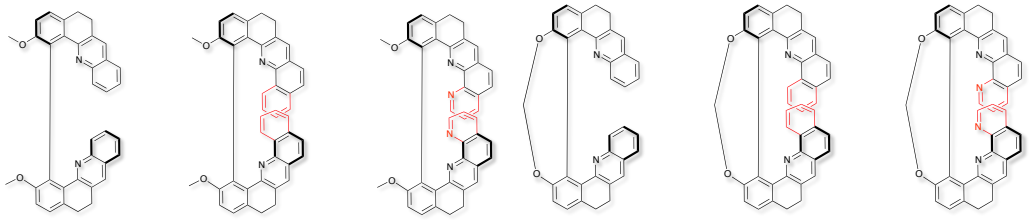

Figure 1 : Series of chiral switching molecules previously studied in the group.

Description of the project This PhD project aims at using the molecular properties to control macroscopic supramolecular assemblies. Indeed, supramolecular self-assembly provides a means of achieving "bottom-up" fabrication of nanoscale materials from the assembly of relatively simple molecular building blocks.[2] These smart materials feature a responsiveness capability due to the reversibility of the noncovalent interactions that lead to the change in properties (chemical or mechanical). The project includes a large part of organic synthesis to introduce functions that will induce the self-assembly by H-bound, π- π interactions, or coordination chemistry. The other part of the research work will deal to the characterization of those assemblies using spectroscopic techniques (NMR, UV-vis, ECD, CPL…) or by the measurement of the rheological properties and the study of their modification upon application of a stimulus. Modulating the properties of a self-assembled polymer using the conformational changes of an axially chiral structure is unprecedented and makes this project original and challenging.

Profile and skills required The candidate should principally have skills in organic synthesis, pronounced affinity for chemistry and spectroscopic measurement. Moreover, she/he should have a strong motivation and involvement to carry out this multidisciplinary project.

References [1] J. Mahieux, M. Sanselme, S. Harthong, C. Mélan, C. Aronica, et al. *Crystal Growth and Design*, American Chemical Society, 2013, 13 (8), pp.3621 - 3631. Loïc Jierry, Steven Harthong, Christophe Aronica, Jean-Christophe Mulatier, Laure Guy, et al. *Organic Letters*, American Chemical Society, 2011, 14 (1), pp.288 - 291. [2] Michael J Serpe and Stephen L Craig. *Langmuir* : the ACS journal of surfaces and colloids, 23(4) :1626–1634, 02 2007, Viviane A. Friese and Dirk G. Kurth. *Current Opinion in Colloid & Interface Science*, 14(2) :81 – 93, 2009. Diederik W. R. Balkenende, Souleymane Coulibaly, Sandor Balog, Yoan C. Simon, Gina L. Fiore, and Christoph Weder. *Journal of the American Chemical Society*, 136(29) :10493–10498, 2014.