Ph-D proposal in Physical Chemistry @ Lille University (FRANCE)

Photochemistry of novel diarylethenes dedicated to integrate smart textile fibers: ultra-fast spectroscopy approach

Context

An organic photochrom is a molecule that reversibly changes its absorption spectra under illumination. Beyond the change of color (photochromic sunglasses is a well-known example from general public), photochromic materials can be used for their photomechanical effects, especially on textile fibers: a photochromic fiber changing its shape during the change of color [1] under visible irradiation is illustrated in figure 1; reversibility is achieved through visible irradiation.

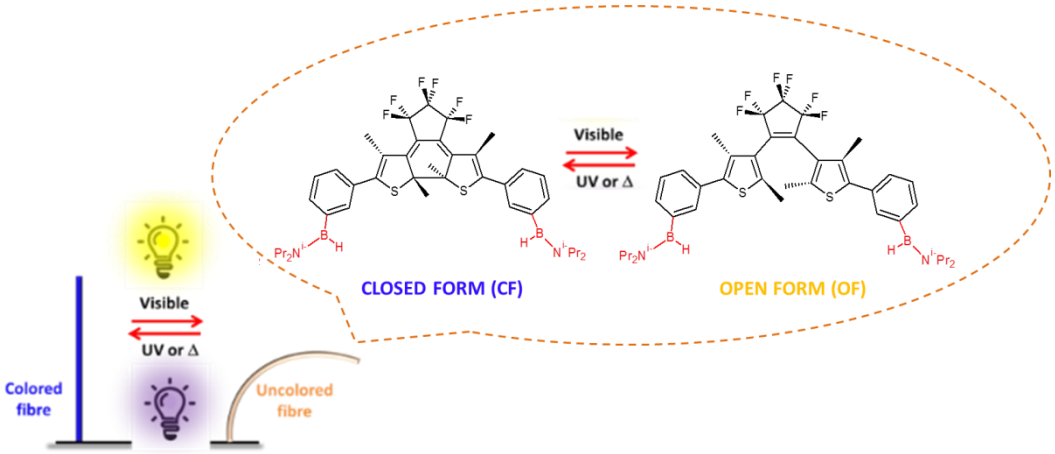

Figure 1 (left) Photochromic fiber actuated by UV/Visible light. (right) Photochromism of diarylethene based on reversion /electrocylization between the closed Form (CF) and the open form (OF).

Project description

During his (her) Ph-D thesis, the student will have to study the photoreactivity of a novel photochromic diarylethene substituted with boron functional groups (the interest of such molecules relies with with the possibility to link the boron groups with hydroxyle of cellulose termination). Following strategies adopted for neighboring molecules,[2, 3] the student have to bring clear answers to the following questions: What is the exact mechanism between CF and OF? How many intermediates are involved during ultrafast processes? What is the influence of the surrounding medium on these processes (protic solvent, elastomeric medium, fiber interface…etc)? To carry out its mission, the student will have access to a very wide panel of basic spectroscopic technics (absorption, fluorescence, NMR…etc) and in particular time-resolved pump-probe setup: ultrafast UV/vis absorption; ultrafast vibrational spectroscopy and time resolved fluorescence. The ideal candidate will have solid skills on chemical physics and spectroscopy. Knowledge concerning transient technics will be appreciated.

1. Nakano, H., R. Ichikawa, and R. Matsui, *Photomechanical bending of azobenzene-based photochromic molecular fibers.* Micromachines, 2013. 4(2): p. 128.
2. Hamdi, I., et al., *Excited-State Dynamics of Dithienylethenes Functionalized for Self-Supramolecular Assembly.* Journal of Physical Chemistry A, 2018. 122(14): p. 3572-3582.
3.Hamdi, I., et al., *New insights into the photoswitching mechanisms of normal dithienylethenes.* Phys. Chem. Chem. Phys., 2016. 18(40): p. 28091-28100.

Keywords. Organic Photochemistry. Photochromism. Time-resolved spectroscopy.

Candidate profile. The candidate must have a Master degree in Physical Chemistry, Chemistry or Physics. A first experiment in a molecular spectroscopy research laboratory would be appreciated. A good level of English is required to read and write scientific publications. No requirement is needed for French language.

PhD thesis supervisor (contact)

Dr. Stéphane Aloïse
UNIVERSITY of LILLE
Stephane.aloise@univ-lille.fr,
Phone number: 0033 3 20 43 40 85

LABORATORY WEB PAGE
http://lasir.cnrs.fr/le-laboratoire/