PhD FUNDING – GROSS INCOME 2100 € per year

3 years - Starting date: October 2024, 1st

NANTES UNIVERSITY - FRANCE

MANUFACTURING AND STUDIES OF COOPERATIVE PHOTOSWITCHABLE MATERIALS FOR TUNING THE ORGANIZATION OF COMPLEX BIOLOGICAL SYSTEMS

Context. Materials manufacturing out of molecular compounds nowadays addresses numerous areas of our daily life (drugs, displays, flat screen…). Self-assembling of small functional molecules is often involved to yield nanomaterials or nanometer-thin films with properties ruled by the molecular orientation and density. Optimizing the properties of individual molecules has thus usually been the main concern, and yet mastering cooperative phenomena at the nanoscale has still been overlooked despite its utmost importance. Indeed, bulk activation in response to weak perturbations produced by optical, mechanical, thermal, electrical or magnetic stimuli represents high stakes, addressing many topics (biological scaffolds for growing organoids, thermoelectrical materials to produce energy from heat recovery, spintronics for high-speed and high-density information transfer and storage, production of micro- and nanorobots as future possible actuators in surgery).

Research studies. The targeted research work will thus deal with photoactivatable molecules, amenable to large macroscopic response when processed as materials, which can lead to drug delivery and controlled deformation of thin films (Figure 1). It will address the synthesis of molecules before processing them as thin films, in order to study cooperative processes by inducing major surface deformations, modulate surface properties, and eventually control adhesion and interactions of complex biological systems (cells, protein/DNA assemblies). Physico-chemical investigations will first probe the ability of thin films to deform under light exposure or mechanical perturbation, provoked at the nanoscale by a tip of an atomic force microscope (AFM). They will be expanded to the coupling of biological systems with photodeformable surfaces to modify and quantify in a controlled fashion the resulting organization and responses, through light only.

Profile. All these PhD studies will be carried out in the framework of a national program of the French Research Agency (ANR - EUR LUMOMAT) in tight collaboration between two research units CEISAM – UMR CNRS 6230 and IMN – UMR CNRS 6502 at Nantes University, acquainted with strong expertise in the manufacturing, and photophysical and mechanical investigations of molecular and polymer nanomaterials, for various biological and optoelectronic applications. The recruited candidate is expected to possess a strong working-together spirit, be open-minded and ready to interdisciplinarity, and have strong expertise physical chemistry.

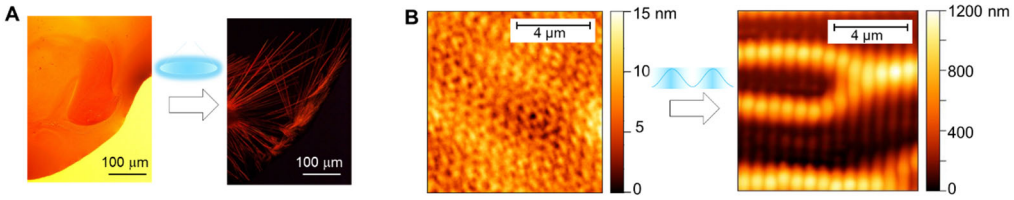

Figure 1. Photoinduced matter changes. A) Amorphous-crystalline transitions under homogenous illumination. B) Formation of micrometer-high reliefs under structured illumination.

Contact: Eléna Ishow / Stéphane Cuénot

Nantes University / France - Faculty of Sciences and Techniques CEISAM & IMN

E-mail : elena.ishow@univ-nantes.fr / stephane.cuenot@cnrs-imn.fr

https://ceisam.univ-nantes.fr / https://www.cnrs-imn.fr

Application will first proceed by e-mail by sending a detailed CV, at least one letter of recommendation and final marks in the master grade.

J. Boucard et al., ACS Appl. Mater. Int. **2019**, 11, 32808−32814. S. Hoang et al., *ChemPhysChem* **2020**, *21*, 2502-2515. F. Rodriguez et al., *Adv. Opt. Mater.* **2021**, *9*, 2100525. T. Gallavardin, *J. Phys. Chem. C* **2021**, *125,* 4665-4674. T. Blondy, *Nanoscale* **2022**, *14,* 5884-5898. S. Cuenot, *J. Mech. Behav. Biomed. Mater.* **2022**, *133,* 105343.