

## Internship Offer

### Ultrafast laser interaction for chemical and topological functionalization of surfaces

**Period:** March to August 2024

**Consortium:**

- Laboratoire Hubert Curien (UMR CNRS 5516), Université Jean Monnet Saint-Étienne
- Laboratoire Georges Friedel, École des Mines de Saint-Étienne (LGF)
- Center for Research in Photonics, University of Ottawa (CRPuO)

**Project:**

**The goal of this work is to exploit ultrafast laser-matter interaction to generate new surface functionalization by not only creating topographical texturation but also by modifying and controlling the chemical state of the irradiated substrate, in particular oxidation processes and stoichiometry modifications in the case of alloys.**

Ultrafast laser processes are a favored method for texturing material surfaces, in particular metals. Irradiation with ultrashort pulses (ps time-scale and below) generates Laser-Induced Periodical Surface Structures (LIPSS) on multiple scales, ranging from tens of nanometers to several micrometers in period. Applicative domains include wettability, tribology, diffractive effects, etc. Many questions remain on the role of laser-induced chemical processes, in particular oxidation, on the changes of a surface's properties compared to the influence of topographical structuration. This is very relevant when considering that detrimental surface aging is associated with chemical processes, and thus could be limited by a good control of the surface chemistry.

**Environment:**

Although the student will be mainly based in Saint-Étienne and spend his time between the Hubert Curien and Georges Friedel Laboratories, regular mobilities at CRPuO (Canada) will be funded by the consortium. The various surface irradiation and characterizations will be performed at these three labs. Usual topographical studies will be performed by using SEM and AFM, and the surface chemistry characterization will be carried out using XPS (including in situ XPS), TEM-EELS and HR-EDS spectroscopy equipment. The project will be developed within a multidisciplinary team of experimental and theoretical collaborators.

**Requirements:**

**The student should be in her/his second year of a Master's program or equivalent, specializing in either Optics and Photonics or Material Sciences.**

The student should demonstrate a high level of motivation in the domains of physico-chemistry, materials and optics. She/He will be expected to possess strong organization skills and teamwork ability, as she/he will have to travel and partly coordinate work across three international laboratories. Knowledge in the fields of non linear optics, solid state physics, material sciences and physico-chemistry will be strongly appreciated.

**Prospect:**

**This project has received funding for a 3-year PhD Thesis by the Manutech-SLEIGHT Graduate School. Should the appointed intern decide to apply, she/he will have increased chances to be selected for this PhD position.**

**How to apply:**

Interested applicants are invited to send their CV **before 15/12/2023**, to:

**Florence Garrelie, Professor: [Florence.Garrelie@univ-st-etienne.fr](mailto:Florence.Garrelie@univ-st-etienne.fr)**

**Florent Bourquard, Associate Professor: [florent.bourquard@univ-st-etienne.fr](mailto:florent.bourquard@univ-st-etienne.fr)**