

Post-doctoral position proposal

Title: Incoherent light and Phonon management in micro-nanopatterned materials for efficient depollution and artificial PhOtosyNthesis

Keywords: Optics and nanophotonics, phononics, thermal management, photocatalysis, depollution, green energy.

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Duration: 24 months

Contract/financing: net salary of ~2000€/month

Locations: Institut des Nanotechnologies de Lyon (INL) – at Ecole Centrale de Lyon site, Laboratoire Hubert curien (Lab.HC) – at Université Jean Monnet, and Institut Lumière-Matière (ILM) – at Université Claude Bernard Lyon I.

Subject:

The post-doc position is open in the frame of the "IPPON" project ("Incoherent light and Phonon management in micro-nanopatterned materials for efficient depollution and artificial PhOtosyNthesis"), funded by the Lyon-Saint-Etienne IDEX "Scientific Breakthrough" program. It is an ambitious project including specialists in Physics, Chemistry and Engineering.

General context of the project:

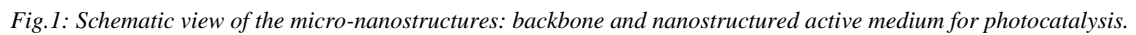
In our contemporary society, one of the most urgent challenges is the need to reduce CO₂ emissions and to live in a clean environment, making it crucial to develop novel concepts for efficient depollution and energy conversion and storage in a variety of forms, among which chemicals. Photocatalysis is the key approach to reach these objectives, based on the use of sunlight or inexpensive artificial light sources. **Still, the efficiency of these reactions would substantially benefit from the unprecedented potential of nanophotonics to trap and confine light and of nanophononics to control temperatures locally.**

Objectives of the global project:

The objective of this project is to develop novel concepts based using advanced micro and nanostructured media enabling both **incoherent light confinement** and **thermal trapping**. To achieve this, we will develop a complete methodology based on theoretical predictions, multi-domain and multi-scale modelling, chemical synthesis and micro-nanopatterning of functional materials, advanced experiments in optics, phonon dynamics and photochemistry, by combining the skills of scientists from 4 laboratories in Lyon and Saint-Etienne: INL, Lab.HC, ILM and IRCELYON, specialists in physics, chemistry and engineering, from CNRS, ECL, INSA Lyon, UCBL and UJM. Several post-docs and a PhD student will be recruited in the frame of this project, working together with a view to achieve important breakthrough including:

- The design and fabrication of micro-nanostructured media dedicated to photocatalysis, using original and scalable approaches.
- The demonstration of novel photocatalysis regimes, with enhanced yield, due to local thermal trapping in illuminated nanostructured media.

These demonstrations will be based on demonstrators including structures like photonic crystals, acting as an optical backbone, covered with a photocatalytic medium, as schematised below.



The main objectives of this post-doc will be to design the targeted demonstrators, and to measure their properties. He/she will also contribute to their realisation in cooperation with another member of the project: an engineer/post-doc, also to be recruited in the frame of this project. The post-doc will benefit from the know-how and equipment available at INL (electromagnetic simulation, nanofabrication, optical characterisation), at Lab.HC (multi-physical modelling nanopatterning, optical spectroscopy) and at ILM (modelling of thermal trapping).

Candidates are expected to have a strong background in (nano)Photonics. He/she should have a substantial know-how in at least one of the following topics: electromagnetic simulation (FDTD, RCWA), optical characterization (spectroscopy, micro-reflectance, etc), micro and nano-patterning (clean room technologies), photonic crystals, phononics. A strong motivation for both simulation and experimental work is expected.