



## Thermo-plasmonics in bi-stable nanoporous media : from theory to devices

This PhD is part of the ERC TEMPORE project aiming at fabricating a new generation of autonomous and bio-inspired devices.

In the last decades, nanoporous materials have attracted increasing interest in a number of applications such as sensors, photocatalysts, electric insulators or antireflective coatings etc. Certain nanoporous materials exhibit thermo-optical bistability. This behavior opens new perspectives for their utilization as smart optical devices especially when coupled with local heating sources such as plasmonic antennas.

This PhD project aims at (i) investigating, theoretically and experimentally, the thermal and optical behaviors of nanoporous materials in which local heating is induced at the nanoscale by plasmonic nanoparticles (ii) provide a proof-of-concept of smart optical devices such as optical-switches for smart windows and/or temperature sensors compatible with smart-phone assisted detection.

The project includes two aspects:

In the first part, thermo-optical numerical simulations will be carried out at the Institut d'Optique Graduate School (IOGS). This theoretical study will (i) give a better understanding of coupling mechanisms between optical and thermal phenomena; and (ii) provide guidelines to design more performing materials. These simulations will be performed with an in-house software (Matlab environment) based on the finite element method.

In the second part, composite plasmonic nanostructures will be fabricated by a versatile methodology based soft-Nanoimprint Lithography toward the demonstration of an optical device. This task will be accomplished through a well-established collaboration between C2N and Sorbonne University. Spectroscopic ellipsometry and microscatterometry microscopies will be used to investigate the thermal and optical properties of the films and compared to simulations.

**Application background:** *The candidate should possess a degree in materials physics, chemistry or engineering, or related subjects. A optics, physical chemistry and/or materials chemistry background would be an asset. Although not strictly necessary, a MSc. in optics or spectroscopy is highly appreciated together with a basic knowledge in coding (e.g. labview, matlab). Excellent communication skills in fluent English are necessary.*

*We offer a fully funded PhD studentship to work on an multidisciplinary project realized in collaboration between three highly recognized laboratories in the Parisian Region: Institut d'Optique Graduate School (IOGS), Centre de Nanoscience et Nanotechnologie (C2N) and Laboratoire Chimie de la Matière Condensée (Sorbonne University). The candidate will have the opportunity to interact with other scientific collaborators and attend and present his/her results in national and international conferences. We will provide support and training throughout the project, becoming proficient in the use of simulation and nanofabrication tools.*

### **Locations:**

Laboratoire Chimie de la Matière Condensée de Paris, Sorbonne University  
Institute d'Optique Graduate School, France  
Centre de Nanoscience et Nanotechnologie (C2N)

To apply, please contact: [marco.faustini@upmc.fr](mailto:marco.faustini@upmc.fr), [mondher.besbes@institutoptique.fr](mailto:mondher.besbes@institutoptique.fr), [andrea.cattoni@c2n.upsaclay.fr](mailto:andrea.cattoni@c2n.upsaclay.fr)