

UMR ENS-UCBL-CNRS 5182

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<http://www.ens-lyon.fr/CHIMIE>

**Open Postdoctoral position in chemistry:
"Hybrid thermoplasmonic substrates"**

► **Key words:** nanoparticle, colloidal synthesis, sol-gel, thermoplasmonics

► **Project:** Thermoplasmonics is a growing research field based on the optical heating of metallic nanoparticles (MNPs) excited at their plasmonic resonance wavelength. Because thermo-induced phenomena play a central role in physics, chemistry, and biology, thermoplasmonic approaches offer powerful tools to address a wide range of scientific problems at the microscale.[1]

One convenient geometry used by the community, and notably by our partner from Institut Fresnel,[2] is based on uniform layers of MNPs deposited on glass slides for thermoplasmonic studies under an optical microscope. The main objective of the project is to develop a new generation of thermoplasmonic substrates that overcome some limitations of those currently in use.

In LCH, we have developed the colloidal synthesis of MNP based on the controlled growth of gold or silver onto pentatwinned gold seeds. A large variety of shape, with well-controlled plasmonic properties, is now easily reachable like gold nanobipyramids. Such MNP have also been successfully incorporated into hybrid silica glasses by sol-gel process.REF

The present postdoctoral research will focus on the following challenges:

- Colloidal synthesis of NMPs of precise shapes to control their thermoplasmonic properties and optical heating ability.
- Coating of glass slides by sol-gel process leading to a robust, homogeneous and reusable substrate. MNPs should be incorporated into the hybrid silica matrix, preserving their thermoplasmonic properties and without altering the properties of the coating.
- Synthesis, and incorporation in coating with MNPs, of thermosensitive nanoparticles (TNPs) like lanthanide-based nanothermometers for absolute temperature measurement.

The resulting substrates will enable simultaneous optical heating and absolute temperature measurements, and their performance will be demonstrated in vitro in cell biology experiments, particularly for the growth of hyperthermophilic microorganisms.

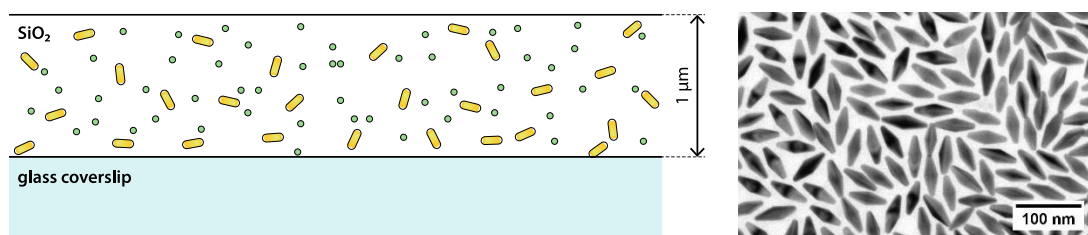


Figure - Left: Scheme of the targeted thermoplasmonic substrate : a uniform layer of hybrid SiO₂ deposited on a glass substrate, containing MNPs and TNPs. Right: TEM image of gold nanobipyramids synthesized in LCH and used as MNPs for thermoplasmonics in the project.

► **Lab & context:** The work will be performed in the Chemistry Laboratory of ENS Lyon (UMR 5181) in the team « Molecules and nanomaterials for optics ». The team develops research on hybrid materials devoted to optical applications. In particular the expertise lies in the design of original molecular systems coupled with inorganic materials and the characterization of optical interactions and responses (absorption, emission, nonlinear responses...). The applications are in the fields of optical protection, bioimaging, photocatalysis... The preparation of nanoparticles and substrates, as well as routine characterizations will be performed in the lab. Thermoplasmonics properties will be studied by advanced spectroscopy by our partners G. Baffou and coll. in Fresnel Institute (Marseille, France) as part of a ANR project. Collaborative work, with regular meetings, is expected with our partner.

► **Skills/techniques:** Synthesis and surface modification of NPs – sol-gel process – spin coating – electron microscopy (SEM, TEM) – UV-vis-NIR absorption – ellipsometry – profilometry

► **Candidate profile:** We are looking for a highly motivated chemist in nanomaterials with expertise in colloidal synthesis and/or sol-gel process, as well as skills in common analytical techniques (UV-vis abs, TEM/SEM, etc...). Ideally, the candidate should have experiences in the fields of spectroscopy, plasmonics or thermometry applied to nanoparticles. The candidate must hold a PhD in chemistry or materials science with a focus on inorganic nanomaterials. The post-doctoral fellow will be offered a 18 or 24-months full time position starting in 2026 or 2027 (with possible extension, ANR fundings).

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► **References:**

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