

## Postdoctoral position (24 months): Photoinduced nanocrystallization by fs-laser inside novel oxide glasses for high temperature environments

**Key words:** Glass Science, Femtosecond Laser, Nano-crystallization, nanogratings.

**Where:** Université Paris-Saclay, Institut de Chimie Moléculaire et des Matériaux d'Orsay (ICMMO), SP2M, group MAP – Building 670 Henri Moissan.

**When & Salary:** Targeted start: **October 2026**; gross income: **2500€/month**.

**Candidate profile:** Background in glass science (thermodynamics, physical properties, solid state physics, characterization techniques), and ideally in light-matter interaction and optical fibers.

**Application procedure:** Please send your Curriculum Vitae & Cover Letter at: [maxime.cavillon@universite-paris-saclay.fr](mailto:maxime.cavillon@universite-paris-saclay.fr) and [matthieu.lancry@universite-paris-saclay.fr](mailto:matthieu.lancry@universite-paris-saclay.fr)

**Context of the project:** High temperatures (HT, typically in the 800°C – 1500 °C range) monitoring is mandatory in a wide range of technological fields, including turbine engines, manufacturing processes, hydrogen production processes, nuclear reactors, structural health monitoring, and fire alarm systems. To address the instrumentation of such severe environments, glass-based optical sensors / devices in the form of optical fibers have been proved ideal candidates. To develop them (e.g., Bragg gratings or waveguides), the glass must be functionalized, which typically involves stable refractive index modulation. Femtosecond laser direct writing (FLDW) is the most suitable tool for this purpose, as it enables high pressure and temperature localized transformations in a confined volume of just tens of  $\mu\text{m}^3$  through nonlinear light absorption. Among the possible transformations at reach, nanoporous structuring induced in silica or Ge-doped silicate glasses (labelled Types IIp and III) are the best HT options to date. However, their erasure, inherently linked to the glass viscosity, happens at “only” at 900 °C for 1 year in telecom fibers. To fulfil the HT performance requirements of most applications, targeted operating ranges of 900 – 1200 °C and 1000 – 1500 °C for respectively long (years) and short (mins/hours) timescales are expected. To achieve this goal, a paradigm shift is therefore required. Preliminary results by ICMMO and CEMHTI demonstrated in 2024 that nanocrystallization of refractory crystals ( $\text{ZrO}_2$ , Mullite) in novel oxide bulk glasses can yield persistent index contrasts ( $\Delta n \sim 10^{-3}$ ) up to 1600 °C for 30 minutes. This new world-record stable regime is attributed to chemical migration and nanocrystallization in the irradiated zone, acting fundamentally different from porous structures. Building on this proof-of-concept, this project aims to further explore, master and exploit this new regime.

**Expected work from the candidate:** The expected work (ANR funded project) includes, but is not limited to, femtosecond laser irradiation in novel optical glasses (bulk and fiber forms), thermal annealing and characterization of the fs-laser modified regions using various techniques (optical and electron microscopy techniques, Raman spectroscopy etc.). Moreover, the candidate will be partly responsible for the Laser Platform within the group and participate in the mentoring of M2 level students and PhD students.

**Why joining our group:** At the heart of Université Paris-Saclay (Top French University in France, 13<sup>th</sup> Shanghai Ranking in 2025), our group is very active and recognized worldwide on the topic of fs-laser transformation in glass. Moreover, this work is part of a large consortium project (ICMMO & CEA List in Paris Saclay, PhLAM in Lille, and CEMHTI in Orleans) which is ideal to build up a network as an early career scientist. This work has both fundamental and practical/technological interests. The candidate will actively participate in publishing novel work and disseminate his/her findings internationally at conferences (e.g., ICG, GOMD, BGPP).