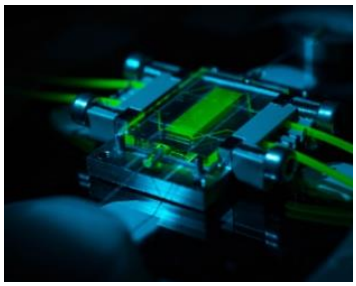
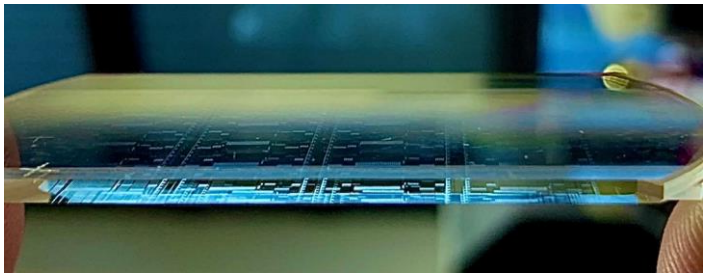
Centre de Radiofréquences, Optique et Micro-nanoélectronique des Alpes

M2 Internship Proposal

Temperature Dependence of Ion-Exchanged Waveguides on Glass: From Fabrication to Environmental Impact

Location: CROMA Lab (UMR 5130), Grenoble, France
Supervisors: Lionel BASTARD and Davide BUCCI
Period and length: Spring 2026, 6 months.





Why this project?

Waveguides are at the heart of many optical technologies — from telecommunications to lab-on-chip sensors. Among the different platforms used to build these devices, **glass** stands out as a low-cost, robust, and optically transparent material [1][2]. It's also compatible with **microfluidics**, making it ideal for next-gen bio-sensors.

At **CROMA**, we've been developing integrated optics on glass for nearly 40 years using a technique called **ion exchange**. This process changes the glass' refractive index by replacing sodium ions (Na^+) with other ions like potassium (K^+) or silver (Ag^+), allowing us to "write" waveguides into the material.

But there's a challenge: **temperature**. Ion exchange relies on heat to diffuse ions into the glass (typically above 300°C), and later steps like **wafer bonding[3]** (100–150°C) could potentially affect the waveguides' quality. So how stable are these waveguides across different temperatures? And at the same time, can we make this process more eco-friendly?

Internship Objectives

During this internship, you'll help answer that question by working at the intersection of materials science, integrated optics, and sustainability.

 # integrated photonics

 # glass technology

 # life-cycle analysis

Desired profile & skills

2nd year Research Master or
3rd year Eng. School

- Microtechnology & fabrication
- Photonics
- Affinity & curiosity for experimental and numerical work

Send application to:

lionel.bastard@grenoble-inp.fr
davide.bucci@grenoble-inp.fr

GRENOBLE INP UGA — UNIVERSITÉ SAVOIE MONT BLANC — UGA Université Grenoble Alpes — cnrs

Centre de Radiofréquences, Optique et Micro-nanoélectronique des Alpes

M2 Internship Proposal

You will:

1. Do a literature review on ion exchange in glass and temperature effects.
2. Use CROMA's cleanroom facilities and ion-exchange tools to produce test samples under varying thermal conditions.
3. Measure how light propagates through the waveguides.
4. Perform a **Life Cycle Analysis (LCA)** of the ion-exchange technique and compare it to other fabrication methods (e.g. silicon photonics), contributing to the push for greener photonic technologies.

What you'll use and learn

- Ion-exchange waveguide fabrication
- Optical characterization techniques
- Cleanroom fabrication tools
- Simulation tools for optical design
- Life Cycle Assessment (LCA) methodology

Ideal Candidate

- M2 student in photonics, applied physics, materials science, or nanotechnology
- Interest in integrated optics, fabrication technologies, and sustainable engineering
- Motivation to work in both experimental and analytical environments

Additional information:

- CROMA lab:

Technical references

[1] microsensing of plutonium
[2] glass integrated laser
[3] wafer bonding

GRENOBLE INP UGA — UNIVERSITÉ SAVOIE MONT BLANC — UGA Université Grenoble Alpes — cnrs