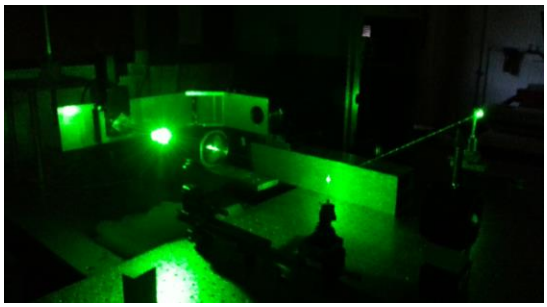
Engineering Thermally Stable and Mechanically Robust Thin Films (THERMO-FILMS)

BACKGROUND

Solar-control glazing modifies the fraction of incident transmitted solar energy allowing for improved thermal insulation of buildings.

It is produced by in vacuum deposition of stacks of thin films based on oxides, nitrides, and silver. The total stack thickness is less than 300 nm and it is composed by 10-30 different layers. Control of the mechanical properties is key to allow for industrial transformation and to fulfill application.

In order to improve mechanical strength and ensure users safety, glass can undergo thermal tempering. This consists in heating the glass up to 650 °C followed by thermal quenching by air blowing. These process can result in thin films mechanical properties modification.



Characterization of thin films mechanical properties by Brillouin light scattering

PhD OBJECTIVE & METHODOLOGY

The objective of the PhD is to understand the effect of thermal tempering on thin film microstructure while focusing on the evolution of mechanical properties and adhesion.

Different thin film stack architectures will be synthetized by PVD techniques (Saint-Gobain), while a comprehensive suite of **advanced micromechanical characterization methods**, including optoacoustic measurements, nanoindentation, and nanoscratch testing (both *in situ* and *ex situ* SEM), will be performed as a function of temperature at LSPM. These results will be systematically compared with conventional destructive testing methods developed at Saint-Gobain Research Paris. Special emphasis will be placed on **the mechanical behavior and interfacial adhesion of silver layers embedded within ceramic multilayer stacks**. The mechanical investigations will be tightly coupled with detailed atomic- and microstructural-scale characterizations, with the objective of establishing robust structure–property–adhesion relationships.

Overall, this project will enable engineering thin film stacks with improved mechanical strength before and after tempering, with significant impact for industry applications.

WORKING ENVIRONMENT

The PhD student will be working on a CIFRE contract in between Saint-Gobain Research Paris and the Laboratoire des Sciences des Procédés et des Matériaux (LSPM, a CNRS laboratory located in the Université Sorbonne Paris Nord). This position will grant to the student a strong background at the intersection between industrial R&D and academic research, providing him an attractive profile for a future career in the industry or in the academic world.

STUDENT PROFILE

Student graduated in materials science, materials physics or mechanics. The candidate should send his/her CV and his/her Master's transcripts to the three contacts below.

DATE

PhD beginning in the period April-October 2026

WORKING PLACES

SGR Paris
41 quai Lucien Lefranc
93303 Aubervilliers

and

LSPM
99 av. Jean-Baptiste Clément
93430 Villetaneuse

CONTACTS

Matteo Ghidelli
(matteo.ghidelli@lspm.cnrs.fr)

Alessandro Benedetto
(alessandro.benedetto@saint-gobain.com)

Martin Robin
(martin.robin@lspm.cnrs.fr)