



## Master thesis proposal

INSP  
tour 22-32, Max  
Marangolo

**Title: Self-suspended membrane for structural and elastic investigation in industrial applications**

**Keywords:** Glass, clean room, time resolved pump and probe, elasticity

### Scientific description:

Worldwide leader in light and sustainable construction, **Saint-Gobain** designs, manufactures and distributes materials and services for the construction and industrial markets. Its integrated solutions for the renovation of public and private buildings, light construction and the decarbonization of construction and industry are developed through a continuous innovation process and provide sustainability and performance.

To answer these challenges, we must provide materials with complex structures. E.g., new functions are given to the glass by the deposition of thin films like in electrochromic glasses and in thermally insulating glasses. These solutions allow to reduce the energy consumption in buildings and vehicles thanks to saving in air conditioning and heating.

The investigative resources needed to study these thin films, with thicknesses of less than 50 nm, are often the prerogative of large academic research laboratories. This is the background to the collaboration with the Institut des NanoSciences de Paris.

The properties of these deposits targeted in this internship are those linked to elasticity and microstructure, which strongly condition their adhesion to glass and hence the functionalization of Saint-Gobain products.

To facilitate this type of study, an innovative approach is to develop these deposits in a self-suspended membrane geometry, in order to neglect the underlying substrate. In this context, we will attempt to elaborate such objects using nanostructuring processes in the INSP cleanroom.

The resulting membranes will be characterized at INSP using pump-probe methods enabling the generation of acoustic waves with frequencies up to a few hundred GHz allowing to obtain very good in-depth resolution. Complementary bulge-test measurements will be carried out at Saint-Gobain.

**Techniques/methods in use:** Clean room process, ultrasonic picosecond approach

**Applicant skills:**

**Industrial partnership:** Yes in collaboration with Saint-Gobain Research Paris

**Internship supervisor(s)**

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**Internship location:** INSP 22-32 room 311

**Possibility for a Doctoral thesis:** Yes from CIFRE or doctoral school funds