

ITI HiFunMat Master Internship Proposal

M 1

M 2

Fabrication and functionalization of silicon nanoparticles for the development of a biochemical sensor.

Internship supervisor

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Laboratory	ICube, Cronenbourg campus
Collaboration with a HiFunMat member (<i>please indicate their name</i>)	<input type="checkbox"/> No <input checked="" type="checkbox"/> Yes : STEVELER Emilie

Student profile looked for

Master program (<i>more than one box can be ticked</i>)	<input checked="" type="checkbox"/> Material science and engineering <input type="checkbox"/> Chemistry <input type="checkbox"/> Physics
Other indications if necessary	

Internship description

Context: one of the research activities of the MATISEN team at the ICube laboratory is exploring the potential use of hyper-doped semiconductor nanoparticles to generate surface plasmons. Functionalizing these nanoparticles enables the detection of chemical and/or biological agents by modifying the localized plasmonic wave.

Objectives: The aim of this internship is to contribute to the development of sensors through the fabrication of silicon nitride membranes and hyperdoped silicon-based nanoparticles, in order to generate plasmonic resonances in the visible/near-IR range. The nanoparticles will be synthesized in the laboratory via in situ growth using physical deposition (sputtering). Doping will be carried out by ion implantation using a particle accelerator. To achieve quantum confinement effects, the silicon particles must be smaller than 6 nm.

A study of the functionalization of the nanoparticles will then be carried out in collaboration with biologists from the “Dynamics of Host-Pathogen Interactions” laboratory. The functionalization will involve grafting biological molecules onto the silicon nanoparticles. This process will influence the differentiation and recruitment of cells to be detected by the sensor.

A systematic investigation of the structural and optical properties of the systems will be carried out, taking advantage of the characterization platforms available at the ICube laboratory (Fourier transform infrared spectroscopy (FTIR), photoluminescence spectroscopy (PL), Raman spectroscopy, etc.).

The purpose of the internship will be the fabrication of a demonstrator integrating these nanoparticles. Its sensitive parameters will be studied according to the development conditions to evaluate the contribution of these nano-objects.