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Master thesis proposal

Hosting laboratory:

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Synthesis and Characterization of SiGe Nanocrystals in SiON matrix

A. Bibliographic topic:

Properties of Si and Ge nanocrystals

B. Experimental topic:

Silicon and Germanium nanocrystals have received great interest these last decade because of their potential use in devices such as light emitting diodes, flash memory devices or for solar cells. Such nanocrystals are usually embedded in dielectric matrix such as SiO₂¹ or SiN₂², which make them compatible with modern electronic devices. On the other hand, producing SiGe nanocrystals might have many advantageous such as modulating the emitted light versus the content of Ge and allowing a shift in the absorbed solar spectrum.

The purpose of this master degree training is to synthesis and characterize SiGe nanoparticles embedded in a silicon oxynitride (SiON) dielectric matrix. First the Si nanoparticles will be produced by depositing a Si rich SiON layer and then annealed at high temperature. Germanium will be introduced in the Si-SiON matrix by ion implantation. Different doses of Ge will be implemented in order to vary the composition x of the SiGe_x nanoparticles. A second thermal annealing might be necessary. The SiGe-SiON layers will be characterized by Raman spectroscopy and photoluminescence to assess the formation of SiGe_x nanoparticles, instead of separated Si and Ge nanoparticles.

Tools: Plasma enhanced chemical vapour deposition chambers, ion implanter, furnaces, Raman spectroscopy, Photoluminescence spectroscopy

[1] *Structural and electrical properties of Ge nanocrystals embedded in SiO₂ formed by ion implantation and annealing*; S. Duguay, J.J. Grob, **A.Slaoui**, Y. Legall, M. Amann-Liess
J. Appl. Phys. 97, 104330 (2005)

[2] *Formation of silicon nanoparticles from high temperature annealed silicon rich silicon oxynitride films*

A. **Slaoui**, F. Ehrhardt, F. Delachat, G. Ferblantier, D. Muller

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