

Internship proposal 2023/2024

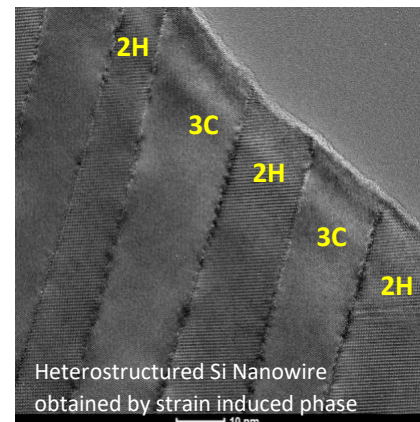
Development of selective wet etching for seeded epitaxy of SiGe-2H

General framework

SEEDs team has long standing know-how in synthesis and characterisation of group-IV semiconductor. At the moment we are especially investigating different ways to synthesize the very promising hexagonal SiGe-2H phase (an allotrope of the standard diamond cubic 3C structure) which exhibits a direct band gap and excellent light emission capabilities [1] with a tuneable emission wavelength in the mid infrared between 1.8-3.5 μm by a concentration range of 0-40% of Si. This material may therefore provide additional photonic functionality to the silicon technology and fill the gap between electronics and photonics industry. We aim at integrating SiGe-2H light sources on silicon on insulator in a CMOS compatible way.

We have pioneered an original method to achieve a shear induced phase transformation in Ge and Si nanowires NWs resulting in unprecedented heterostructures with quasi periodic embedded 2H domains distributed all along the nanowire (fig). The process is described in refs [2,3]. Using Si/Ge/Si heterostructures enables promoting and localising the transformed domain in the Ge section.

We propose to combine this strain-induced process with selective epitaxial growth on the transformed SiGe-2H seed. We aim at developing a highly selective etching method to remove the cubic untransformed top part and uncover the 2H transformed domain which is expected to serve as a seed for further epitaxy in order to subsequently increase the volume of the 2H segment.

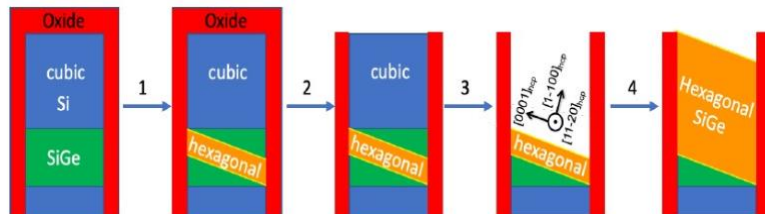


- [1] E.M.T. Fadaly et al. *Nature* **580**, 205–209 (2020).
 [2] L. Vincent et al. *Nanoletters* **14** (2014) p.4828
 [3] L. Vincent et al. *Nanotechnology* **29** n°12 (2018)

Objectives and work plan

The student is expected to contribute to :

- participate to the realization of Ge thin layers in Si using UHV-CVD
- selective etching of the cubic Si top part to uncover the Ge-2H surface
- develop the seeded epitaxial regrowth on the Ge-2H



Contact

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