C2N General Seminar

Friday March 12th 2021- 10h 00

"III-V and IV-IV heterogeneous integration on silicon at the nanoscale "

Charles Renard

Centre de Nanosciences et de Nanotechnologies, C2N,

10 boulevard Thomas Gobert, 91120 Palaiseau

Link: https://us02web.zoom.us/j/88274596539

In this presentation, we will focus on the general problematic of heterogeneous integration on silicon of lattice mismatched materials, such as GaAs and germanium. After a brief introduction to this problem, I will present the concept of integration that we have developed to avoid the formation of crippling defects in this type of heterostructures (dislocations and antiphase domains). The concept adopted consists in carrying out growth from limited size seeds (<100nm) by partial deoxidation or localized etching of the substrate. I will then focus more particularly on the monolithic integration by lateral growth of GaAs micro-crystals from nanometric openings made through a thin layer of silica. We will then see that the electric current can cross the thin oxide zone separating the GaAs microcrystals and the silicon substrate, paving the way for the production of electrically injected optical components.

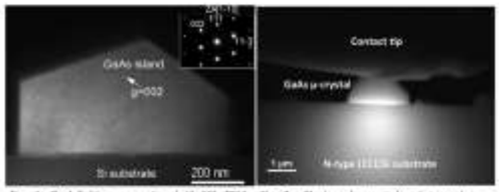

Fig. 1: Dark-field cross-sectional (1-10) TEM images of GaAs microcrystal grown on (111) Si wafers showing no dislocation nor antiphase domain.

Fig. 2 : Electron beam induced current map superimposed with the SEM structural image of GaAs microcrystal grown on (111) n-Si wafers.

Charles Renard has performed his Ph.D. at Alcatel-Thales III-V Lab on the growth of Sb/As heterostructures for optoelectronic applications. Then he spent two years as a post-doctoral fellow at IEF on the growth of nanostructures for ultimate MOSFET. In 2008 he spent 6 months at IMEC, within the Ge III-V explore program. Since 2008, he is CNRS scientific researcher at IEF (now C2N) where he is working on hybrid integration of IV-IV materials on Si, since 2012 he expanded this study to III-V materials on Si. He obtained physics HDR degree in 2019.

A joint research unit