



**HAL**  
open science

## Telecom band light emission from confined hexagonal Ge grown on self-assisted GaAs NWs by MBE

Iuliia Dudko, Anne Lamirand, Claude Botella, Philippe Regreny, Alexandre Danescu, Matthieu Bugnet, Mathias Krämer, Baptiste Gault, Sumeet Walia, Jose Penuelas, et al.

### ► To cite this version:

Iuliia Dudko, Anne Lamirand, Claude Botella, Philippe Regreny, Alexandre Danescu, et al.. Telecom band light emission from confined hexagonal Ge grown on self-assisted GaAs NWs by MBE. 2nd Workshop Hexagonal SiGe and related materials, Apr 2024, Milan, Italy. hal-04563995

**HAL Id: hal-04563995**

**<https://hal.science/hal-04563995>**

Submitted on 30 Apr 2024

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

# Telecom band light emission from confined hexagonal Ge grown on self-assisted GaAs NWs by MBE

**I. Dudko<sup>a,b</sup>, A.D. Lamirand<sup>a</sup>, C. Botella<sup>a</sup>, P. Regreny<sup>a</sup>, A. Danescu<sup>a</sup>, M. Bugnet<sup>c</sup>, M. Krämer<sup>d</sup>, B. Gault<sup>d,e</sup>, S. Walia<sup>b</sup>, J. Penuelas<sup>a</sup> and N. Chauvin<sup>a</sup>**

<sup>a</sup> Ecole Centrale de Lyon, CNRS, INSA Lyon, Université Claude Bernard Lyon 1, CPE Lyon, INL, UMR 5270, 69130 Ecully, France

<sup>b</sup> School of Engineering, RMIT University, Melbourne 3001, Victoria, Australia.

<sup>c</sup> Univ Lyon, CNRS, INSA Lyon, UCBL, MATEIS, UMR 5510, 69621 Villeurbanne, France.

<sup>d</sup> Max-Planck-Institut für Eisenforschung, Düsseldorf, Germany.

<sup>e</sup> Department of Materials, Royal School of Mines, Imperial College, London, UK.

Corresponding Author: julia.dudko@ec-lyon.fr

In this work, hexagonal germanium (hex-Ge) was grown on the facets of self-assisted GaAs nanowires by MBE using VLS mechanism [1]. A pure wurtzite segment was maintained by adjusting the V/III ratio [2]. After growing GaAs core, Ge shell was grown with a long hexagonal segment. The crystal structure was characterized using high-resolution scanning transmission electron microscopy to confirm the presence of hex-Ge.

We focused our investigations on the start of hex-Ge growth on GaAs nanowire facets. Measurements by atom probe tomography (APT) and high-resolution transmission electron microscopy (TEM) allow us to conclude that hex-Ge growth starts with the formation of small quantum dots (QDs) [Figure 1.a], which then expand until coalescing to form a radial quantum well. Photoluminescence (PL) spectroscopy performed on these hex-Ge/GaAs heterostructures shows a strong quantum confinement in these QDs leading to a light emission in the telecom bands. A redshift of the PL emission is observed when the QD size increases along with a strong decrease of the PL emission when the QD coalescence begins [Figure 1.b].

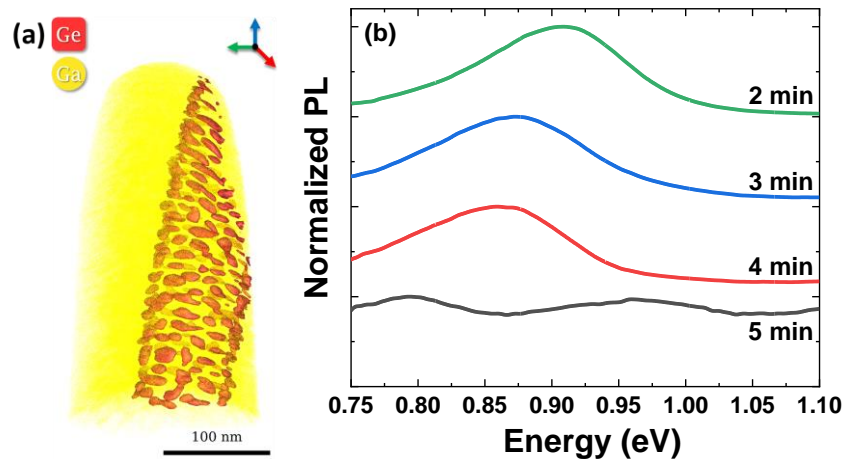


Figure 1: (a) APT showing small QDs. (b) low temperature PL as a function of the Ge growth duration in min.

[1] I. Dudko, *Cryst. Growth Des.* **22**, 32-36(2021).

[2] T. Dursap, *Nanotechnology* **32**, 155602(2021).

Acknowledgment:

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No 801512. This work was supported by the LABEX iMUST of the University of Lyon (ANR-10-LABX-0064), created within the program « Investissements d'Avenir » set up by the french government and managed by the French National Research Agency (ANR).

We thank Uwe Tezins, Andreas Sturm, and Christian Broß for their support at the FIB & APT facilities at Max-Planck-Institut für Eisenforschung GmbH. M.K. and B.G. acknowledge financial support from the German Research Foundation (DFG) through DIP project no. 450800666.