

# SEMICON® EUROPA

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## Integrated Photonics

### Germanium Substrates for Photonics: GaAs Replacement Advantages and New Production Possibilities through CMOS Integration



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#### Abstract

Fast growth of consumer and automotive markets drives developments of new photonic devices such as micro-LEDs, multi-junction VCSELs and imagers both in the NIR and SWIR spectrum. While most of the photonics devices produced today are manufactured using GaAs substrates as a platform, there are more and more developments showing advantages of using Germanium (Ge) over GaAs. In this presentation we are focusing on technical advantages of using Ge, explain nuances of epitaxial growth on Ge substrates such as auto-doping effects and anti-phase domains and how to avoid them. In addition, we are going to discuss in more details the environmental and financial benefits of performing Ge substrate recycling for volume applications.

Another aspect of photonics device manufacturing is processing of epitaxially-grown wafers into functional devices. While most of the photonics devices are manufactured by traditional III-V IDMs and foundries, cutting edge photonic chips could be made in close collaboration between III-V companies and Silicon semiconductor / CMOS players in order to improve a form-factor, device performance and to drive down production costs. This possibility is currently limited by GaAs wafer size and CMOS fab contamination requirements. Umicore works on 8" and 12" Ge substrates that can serve as a bridge between III-V world and Semiconductor industry due to the size and Germanium material compatibility with CMOS specs. In this presentation we are going to present our roadmap to CMOS compatible Ge wafer development.

#### Biography

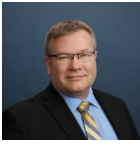
Ivan currently serves as a Business Development Manager at Umicore, where his focus lies in Germanium-based materials for the photonics market. He specializes in Vertical-Cavity Surface-Emitting Lasers (VCSELs), Light Detection and Ranging (LiDARs), and Augmented Reality/Virtual Reality (AR/VR) technologies.

Before joining Umicore, Ivan gained substantial experience in the field of microelectronics, having worked at multiple companies including ASM International and IMEC.

Ivan holds a PhD in Chemistry from KU Leuven in Belgium. His research, undertaken at IMEC, revolved around exploring various techniques for metal deposition in microelectronics.



## PhotonixFAB – The EU-funded Pilot Line to Empower Photonics Innovations



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### **Abstract**

photonixFAB project aims to empower photonics innovation by SMEs and large entities by providing low barrier access to both low-loss silicon nitride (SiN) and silicon-on-insulator (SOI) based photonics platforms with indium phosphide (InP) and lithium niobate (LNO) heterogeneous integration capabilities. Project objective is to establish a European photonics device value chain and initial industrial manufacturing capabilities. Thus, providing a path to scalable high-volume manufacturing for innovative product developers. This will strengthen the continent's manufacturing capabilities in key emerging areas.

### **Biography**

Joni Mellin has acted as Photonics product marketing / business line manager at X-Fab since 2022. He joined X-FAB from ams OSRAM, where he held Engineering director and other positions in the Full Service Foundry division since 2014. Prior to that, he held managerial and R&D positions at Microsoft, Nokia, Micro Analog Systems and VTI technologies. Joni Mellin holds Licentiate of Science and Master of Science degrees in semiconductor technology from the Aalto University and a dual Global Executive MBA degree from WU Vienna and University of Minnesota.

## **Photonic IC Design: Innovation and Scalability**

P. Dumon

CTO

Luceda Photonics, Dendermonde, Belgium

### **Abstract**

Photonic integrated circuits are steadily growing in scale from just 5-10 integrated components to hundreds, as well as in number of process steps and materials. Because of the breadth of the application space, numerous material and process platforms serve different submarkets. To increase IC complexity, re-use and addressable markets, heterogeneous integration of dies and chiplets of different optical materials is becoming a market reality. There is an equal diversity in the maturity level of the photonic IC technologies.

Device design, compact modeling, circuit analysis, placement and routing and verification all require tools and algorithms specific to the physics as well as application requirements of photonic ICs. We will discuss recent technology innovations in photonic design automation technology of photonic ICs to address the above scaling challenges.

### **Biography**

Pieter Dumon is CTO of Luceda Photonics, which he co-founded in 2014 as a spin-off from Ghent University, imec and VUB. He obtained his EE MSc degree in 2002 and a PhD in photonics in 2007 with work on silicon photonic wavelength filters. Pieter coordinated ePIXfab, the first multi project wafer service for photonics from 2007 until 2014, where he extended the collaboration to include more technology providers as well as design and packaging providers. At Luceda Photonics, he is responsible for R&D and leads the PDK team that manages over 30 photonic design kits of more than 20 photonic foundries.