SEMICON® EUROPA OCT 25–27, 2016 GRENOBLE, FRANCE CONNECT

## Photonics

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EPIC European Photonics Industry Consortium

**Biography**
Carlos Lee is director general at EPIC, Europe's photonics industry association. As part of the EPIC mission, Carlos works closely with industrial photonic companies to ensure a vibrant and competitive ecosystem by maintaining a strong network and acting as a catalyst and facilitator for technological and commercial advancement. He brings with him a strong background in microelectronics which was acquired through several management positions held at the international association SEMI. He has been responsible in Europe for the SEMI International Standards program, managed technical and executive programs, and together with the advisory board advocated for a more competitive semiconductor and photovoltaic manufacturing industry.

## Electronic-Photonic ICs for Low Cost and Scalable Datacenter Solutions

S. Meister
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Sicoya GmbH, Berlin, Germany

sicoya

**Abstract**
The enormous growth of bandwidth will fuel the data center equipment market growth and the demand for optical components and interconnects. Besides new approaches to network architectures, this requires disruptive optical interconnect technologies using highly integrated components and scalable manufacturing processes.
The most viable way to reduce costs tremendously lies in on-chip integration. Sicoya and its foundry IHP GmbH have, over 10 years, developed a process that is capable of manufacturing both the analog electronics and the optics on the same silicon chip with no loss of performance. This has been for 15 years the holy grail of silicon photonics. It means that cost of electronics is vastly reduced, power loss by the on-chip electronics is significantly reduced, and high-speed performance is significantly enhanced.
There is a comprehensive library of photonic and electronic components available, that has reached an advanced product maturity for 100Gb/s optical interconnect solutions. Furthermore the design platform enables a fast transition to 200Gb/s and 400Gb/s transceiver chips.

**Biografie**
Stefan Meister is Chief Technology Officer and Founder of Sicoya GmbH. He has a strong background in Silicon Photonics design and integration. At Berlin Institute of Technology he builds up and leads a silicon photonics group from 2008 to 2015. He holds Diploma degrees in engineering and physics and received a Ph.D. degree in Fiber Optics at Berlin Institute of Technology.

## Silicon Photonics: an Industrial Perspective

A. Fincato
Senior Photonic Designer
STMicroelectronics, Milan, Italy

**Abstract**
Silicon Photonics is the more active discipline in the field of integrated optics but in spite of his rapid gain of importance as a platform for a wide range of applications in datacom, telecom, optical interconnect and sensing, after 25 years of research only recently this technology seems to reach an industrial maturity for mass production.
The comparison with the evolution of electronics CMOS technologies is natural but the hope that Silicon Photonics will follow the same path may be disappointed.
The challenges still to be overcome are many, and loss reduction, thermal control and compatibility with different standards written mainly for other technologies are just a few of them.
In recent years there has been a great number of breakthroughs in Silicon Photonics and among them an interesting solution is the separation of electronics functions by the photonics function with 3D assembly of two different chips through the use of copper pillars.
This platform is targeting markets applications in the field of active optical cables, optical Modules, Backplanes and Silicon Photonics Interposers, with Electronics and Photonics technologies not limiting each other as in a monolithic integration.
Data center market is the main driver for the next 5 years, through 100G, 200G and 400G products, and electro-optical transceivers will be the first real test for an industrial application of Silicon Photonics allowing the required size and cost reduction.
Just thanks to the possibility offered by the integration of numerous material, integrated Photonics on Silicon substrate has the great potential to address future applications allowing to compensate its intrinsic weaknesses.

**Biografie**
Antonio Fincato is a senior photonic designer and since 1986 he is working in optics and photonics mainly for fiber optical telecommunications on Silicon Photonics, Glass on Silicon and Microoptics, participating in many European and national research projects. In 2000 he joined STMicroelectronics, Milan Italy, where is responsible for the design of advanced optics and photonics devices within the R&D of Digital and Mixed processes ASIC Division. Until 2000 he was working at Italtel and previously at AT&T Bell Labs, University of Milan and CERN.
He obtained his Degree in Physics in 1984 from Pavia University with a Specialization in Elementary Particle Physics and holds several Patents in the field of Optoelectronics and is author or co-author of several papers and Conference contributions.

## MIRPHAB: A Pilot Line offering fabrication of Mid-IR sensors

S. Nicoletti
MIRPHAB Pilot Line Coordinator
CEA-LETI, Grenoble, France

**Abstract**
MIRPHAB (MidInfraRed Photonics devices fAbrication for Chemical sensing and spectroscopic applications) is an EC funded project, in a public-private partnership with Photonics21, with the ambitious goal of creating a commercially viable pilot line for the fabrication of Mid-IR sensors that is ready for business by 2020. This result will be achieved by setting up and operating a fabrication platform with open access for fast Mid-IR device prototyping to European industry. The application process for the access of the technology of MIRPHAB, as well as the deadlines for submission (starting 31 December 2016) will be presented.

Spectroscopic sensing in the Mid-IR wavelength band (3 - 12 µm) is a powerful analytical tool. Chemicals exhibit in this wavelength band, so-called “fingerprint region”, intense adsorptions features allowing superior detection capabilities and unambiguous identification. MIRPHAB’s target is to enable the widespread use of laser-based Mid-IR-spectroscopic sensors to strengthen the competitiveness of the European industry in this field.

The aim of the MIRPHAB project is to setup and run a dedicated pilot line based on a Mid-IR photonics platform. This initiative will support the emergence of laser-based spectroscopic chemical sensing in the Mid-IR wavelength band, providing services for device design and fabrication from chip processing on wafer level to packaging and testing. Based on a massive use of IC/MEMS technologies, the pilot line will enable a variety of new key functionalities for next generation chemical sensing and spectroscopy, allowing cost, power consumption and size reduction. Where required, the development of novel process modules exploiting the capability of a mixed Si/III-V technology will bring unexplored capabilities to sensors, enabling a number of applications not addressable with the technologies and components available today.

**Biografie**
Sergio Nicoletti (Business Development Manager) is a Senior Sensing & Photonics specialist with extensive background in technology and working since late ‘90s to the development of Smart Sensors/Systems for indoor and outdoor air quality monitoring. Owning more than 20 patents and more than 75 publications in peer reviewed he has contributed to several proposals for EC and national founded programs, now part of the projects portfolio of CEA-LETI activity.

## Fabless trends in photonic integration

I. Artundo
CEO
VLC Photonics S.L., Valencia, Spain

**Abstract**
Photonic integration has matured in the last years, allowing it to be applied not only in telecom, but also in datacom, microwave photonics, metrology, quantum optics, biophotonics or sensing systems. Successful market validation is pushing advances in the technology and attracting investment in its development and commercialization.

Following the success story of electronic integration, it has given birth to an ecosystem of optical chip design houses, foundries and packagers that mimics the fabless business model of CMOS.

Moreover, there are also generic multi-project wafer platforms organizing shuttle runs for several materials like silicon photonics, indium phosphide, and silicon nitride, enabling low-cost and easy access to photonic integration for SMEs and large corporations alike.

And recently, valuable design IP is starting to be licensed through modules and libraries of building blocks offered by software process design kits adapted to each foundry. This talk will review and roadmap all these topics, with special focus on main trends for the upcoming years.

**Biografie**
Obtained the M.Sc. in Telecom Engineering at the Universidad Publica de Navarra (Pamplona, Spain) in 2005, and received his Ph.D. in Applied Physics and Photonics at the Vrije Universiteit Brussel (Brussels, Belgium) in 2009. He has been involved in several national and European research projects and networks of excellence focused on reconfigurable optical interconnects, the design, fabrication and characterization of micro-optic devices, and on flexible access and in-building fiber network architectures. He has worked as a reviewer for several scientific journals and national funding agencies. He holds specializations in Business Financing, Commercial Management and Research, and Strategic Marketing. He is a member of IEEE, SPIE and COIT.

# SOI wafer: where optical communication joins microelectronics to enable high volume Silicon Photonics

A. Rigny
Business Development Manager
SOITEC, Business Development, Bernin, France

**Abstract**
Internet of Things, cloud computing and big data drives the rapid growth of data communication through the internet network as well as within the data centers. In consequence, there is a strong need to increase the interconnection data rate within data centers to limit data flow congestion. Optical communication technology is an answer but faces specific cost/high volume constraints in data centers. The microelectronics industry is now able to provide Silicon Photonics solution to answer theses needs.

At the heart of this technology is the specific silicon substrate that embedded the material structure to guide light: Silicon on Insulator (SOI). The optical physics imposes technical challenges to the SOI specifications such as thickness uniformity. Furthermore, the technology has to be compatible with microelectronics standards for high volume manufacturing to guarantee high yield, in both 200mm and 300mm wafer size.

We present the latest technical results of SOI wafers showing the compatibility with the technical requirements and the compatibility with industrial standards.

In conclusion, the silicon photonics industry that is emerging has the long term substrate roadmap compatible with future low cost mass production of high data rate optical transceivers.

**Biografie**
Arnaud Rigny has been Business Development Manager since 2011 for Analog and Power application as well as silicon photonics application..
He joined Soitec in 2006 and was managing R&D program between Soitec and CEA-Leti. For several years, he led the customer technical interface for non-digital applications and managed customers in developping new products on SOI and engineered substrates, including imagers, RF, Power and Photonics, working closely with key customers worldwide..
Prior to joining Soitec, he was Product Line Manager at Avanex (prior Alactel Optronics) where he was involved in optoelectronics devices such as pump lasers and Optical add-drops modules. His experience also includes project leader at Corning in optoelectronics device.
Arnaud Rigny holds a PhD and a Master degree in Electronic and Communication from Ecole National Supérieur des Telecomunications at Paris (France).

## Advanced automated packaging and testing equipment to allow high volume manufacturing

T. Vahrenkamp
CEO
ficonTEC Service GmbH, Achim, Germany

**Abstract**
There is little doubt that the cost of packaging and testing of PIC devices will need to come down in order to foster market expansion and thus high volume manufacturing. To achieve this, advanced automation is required. ficonTEC has been consistently focusing on automated photonics assembly machines since the early days of photonics. The talk will use the complex assembly of hybrid photonics transceivers to illustrates topics like flexibility vs speed, machine capital costs, cost of ownership and cost per assembled part and how this scenario will change with the increase of production volumes, and hopefully with the introduction of ‘design for manufacturing rules’.
ficonTEC is a company entirely devoted to the manufacturing of automated PIC assembly equipment, with some 350 machines installed worldwide.

**Biografie**
Torsten Vahrenkamp is CEO and one of the founders of the company ficonTEC which is located in Germany, close to Bremen. When founding the company in 2001, the goal was to provide automatic and semi-automatic assembly and test solutions for the photonics industry. Torsten holds a diploma for Applied Laser Technologies which he got in 1998 at the University of Applied Sciences in Emden, Germany. During his further work at the Institute of Laser Technology in Emden and University of Loughborough he built a fully automatic laser lithography system for rapid generation of micro structures in submicron dimensions and developed a process to generate the world’s first in-glass diffractive optics using ion exchange processes in gradient refractive index glass which is used today for generation of waveguides in glass.

## Opportunities in Photonics

R. Visser
CEO
SMART Photonics BV, Eindhoven, Netherlands

**Abstract**
Semiconductor Photonics have been around for a long time and shows an increased popularity lately. The technology was typically dominated by III-V materials but today it's Silicon all over. What's going on in photonics and why is this technology all of sudden so popular? What technology is to be preferred and for what reason? What are the opportunities in photonics and who can profit from them?

**Biografie**
Richard Visser (CEO and Founder SMART Photonics B.V.) has a background in electronics and business processes and started his career in 1981 as a service engineer on marine and aviation equipment and later on medical equipment for companies like General Electric and Toshiba. He switched in 1991 from a technical position into a commercial position and worked in the industrial inkjet printer market before entering the semiconductor equipment industry in 1997 where he worked for Silicon Valley Group and ASML. In 2007 he moved to Philips Research and was involved with the start and growth of MiPlaza, a research service supplier.
In 2012 Richard founded SMART Photonics, a Pure Play Foundry offering production-services for making photonic components on Indium Phosphide (InP). Next to the uniqueness of the business model in the InP-industry, it's the newly introduced generic integration technology for monolithically integrating photonic components in InP that's making SMART Photonics a fast growing enterprise.