

European Strengths and Gaps in Emerging Semiconductor Technologies

SEPTEMBER 11th, 2023 | LISBON, PORTUGAL



icos-semiconductors.eu

ICOS/SiNANO Institute Workshop “European Strengths and Gaps in Emerging Semiconductor Technologies”.

ESSDERC/ESSCIRC – September 11th, Lisbon

International cooperation is key for speeding up technological innovation, and will allow to strengthen Europe’s position in global value chains in this area, which is one of the objectives of the EU Chips Act. This SINANO/ICOS workshop will gather an overview of the main EU and International activities in leading countries in the field of semiconductors, with the most promising technologies for possible international collaborations. In particular, the future technologies in advanced computation and future technologies for advanced functionalities, covering smart sensors, smart energy, energy harvesting for autonomous systems and semiconductor-based photonics will be presented and discussed by renowned experts.

PROGRAMME

13:30 – 13:45

Francis Balestra, CNRS/Grenoble INP/Director Emeritus of the SiNANO Institute

Welcome words, introduction of the SiNANO Institute and Horizon Europe ICOS-International Cooperation On Semiconductors

13:45 – 14:20

Léo Saint-Martin, Decision

Review of the EU and main non-EU semiconductor Ecosystems

14:20 – 14:55

Olivier Faynot, CEA-Leti and Nadine Collaert, imec

Advanced Computing: review of the main actors and the most promising technologies

14:55 – 15:30

Alan O’Riordan, Tyndall National Institute

Smart Sensors: review of the main EU and International activities and technologies

Coffee Break 15:30-16:00

16:00 – 16:35

Markus Pfeffer, FhG

Smart Energy: review of the main EU and international activities and technologies

16:35 – 17:10

Gustavo Ardila, Univ. Grenoble-Alpes

Energy Harvesting: review of the main EU and international activities and technologies

17:10 – 17:45

Roel Baets, Univ. Ghent/imec

Silicon Photonics: review of the main EU and international activities and technologies

Open discussion 17:45-18:00

• ABSTRACTS & SPEAKERS

Introduction of the SiNANO Institute and Horizon Europe ICOS

ICOS, a three-year Coordination and Support Action (CSA) from the European Commission in the frame of Horizon Europe, was launched in January 2023. It aims to support the growth of the European Semiconductor and Semiconductor-based photonics industry through focused international research cooperation, which is key for speeding up technological innovation, in line with the objectives set out by the EU Chips Act. The consortium gathers academic partners, research and technology organizations, academic and industrial associations, semiconductor manufacturers and industry consultants from nine European countries. This SiNANO/ICOS workshop will present an analysis of the value chains of semiconductors for electronics and photonics, the main European and international activities in leading semiconductor countries, and the most promising technologies for possible international collaborations.

Francis Balestra has been Director of several Laboratories. Within FP6, FP7, H2020 and Horizon Europe, he coordinated several European Projects (SiNANO, NANOSIL, NANOFUNCTION, NEREID, ICOS) that have represented unprecedented collaborations in Europe in the field of Nanoelectronics. He is member of several European Scientific Councils, of the Advisory Committees of International Journals, of the IRDS International Roadmap Committee, and founded or organized many international Conferences. He is currently Vice-President of Grenoble INP, in charge of European activities, and Director Emeritus of the SiNANO Institute he founded 15 years ago



Review of the EU and main non-EU semiconductor Ecosystems

DECISION will provide an overview of the competitive position of the EU industrial ecosystem along the semiconductor value chain, identifying strengths, weaknesses and strategic dependencies on third countries. The analysis covers the entire value chain, from wafer manufacturing to design, including manufacturing equipment, front-end, back-end... It distinguishes the different semiconductor products (micro, memories, power, etc.), and measures market shares, production shares (by location), trade balances, etc.

A comparative analysis will be presented with third countries within the scope of ICOS (United States, China, Japan, South Korea, Taiwan and Singapore) outlining the potential for future collaborations.

Léo Saint-Martin is partner at DECISION Etudes & Conseil. He joined DECISION in 2016 to manage a team of economists and bring his expertise in market research and economic analysis in the fields of electronics components and systems. Léo is the project manager of the ICOS project on behalf of DECISION. As Work Package leader, **DECISION** is in charge of the “study of the European microelectronics industry and skills needs” parts, within these projects which will run until 2027. Léo has also been the manager and the main redactor of studies made by DECISION for the European Commission, French government bodies, industry associations and industrials on topics related to the semiconductor value-chain, the electronics value-chain and end-user industries (automotive, defense & security, industrial & robotics...).



Smart Sensors: review of the main EU and International activities and technologies

According to some estimates, there will be 24 billion interconnected devices by 2050, meaning almost every object around us will be connected to the Internet: streetlights, thermostats, electric meters, fitness trackers, water pumps, cars, elevators, even gym vests. The IoT market size is expected to reach \$1.6 trillion by 2025, with a compound annual growth rate (CAGR) of 24.9% from 2020 to 2025. The IoT market is highly competitive and fragmented, with many large and small players operating in different segments and regions. Some of the largest IoT companies in the world by 2022 revenue include apple google Bosch Seimens etc all of whom are investing billions of dollars into IoT technologies. This talk will review some of the major players in Smart Sensors and Systems by technology, and region looking at the main leading Institutions in different countries and the opportunities for future international research cooperation.



Alan O'Riordan received a PhD in Chemistry (Nanotechnology) in 2005. He leads a team focused on developing smart sensors and systems for Sustainable Agri-food and Environmental applications. He has led the European team's contribution on Smart Sensor Systems for the recent IEEE International roadmap on Devices and Systems - More than Moore white paper. He won the Enterprise Ireland Gold Medal for Most Innovative Technology Emerging from Third Level (National Ploughing Contest 2016/2022). He is Core steering committee member of EPoSS SSI conferences 2021 & 2022, and a H2020 Technical evaluator for ICT photonics call.

Energy Harvesting: review of the main EU and international activities and technologies

Providing energetic autonomy to electronic devices will be a key factor in booming technologies like sensor networks and IoTs. This is true in particular in applications with specific requirements, where simple batteries would not be sufficient or where power cords cannot be used. Different wasted energy sources can be exploited and converted into electricity and provide energy to small electronic devices (e.g. sun or artificial light, heat, RF power, mechanical movements, etc.) but the converted energy need to be used wisely (e.g. powering sensors, etc.). Thus, power management circuits and energy storage devices are also important elements. This presentation will highlight the most promising technologies in the IRDS roadmap on Energy Harvesting and will gather an overview of the main EU and International activities in leading countries in this field.

Gustavo Ardila received his PhD degree in Electrical Engineering in 2008 from the Paul Sabatier University in Toulouse. After his postdoctoral in LAAS-CNRS laboratory in Toulouse, he became Associate Professor at the University Grenoble Alpes and a researcher at IMEP-LaHC in the Micro Nano Electronic Devices group, Grenoble, France. He is involved in several French and EU projects related to energy harvesting or sensing applications using piezoelectric materials. He leads the European team to develop the Roadmap of Energy Harvesting technologies contributing to the IEEE-IRDS "International Roadmap for Devices & Systems". He is co-founder and co-organizer of the International Summer School MEMS-LATAM: Microsystems for Latin America and member of the editorial board of the "Energy" section of ISTE-Wiley publisher.



Advanced Computing: review of the main actors and the most promising technologies

With the recent COVID-19 crisis, the importance of Semiconductor technologies has been evidenced, increasing significantly the interest of all the countries due to its impact on sovereignty. Each country launched its own initiative to strengthen its position in Semiconductor. Many organizations all around the world are proposing new solutions for advanced computing. Many options, including disruptive approaches, are investigated in order to provide new solutions for competitive technologies. This talk will detail the main actors and the main solutions that are developed for the next generations of Advanced Computing technologies. Details of the main leading actors (research organizations, universities, industries) will be provided, as well as details on the main technological approaches that are developed. Strengths and weaknesses will also be detailed.



Olivier Faynot received his Ph.D. degree from the Institut National Polytechnique de Grenoble in 1995. He joined CEA-LETI in 1995. Since 2019, he is managing the whole Silicon Component division at CEA-LETI. He is author and co-author of more than 300 scientific publications in journals and international conferences, and was successively in the committees of the main international Semiconductors conferences like IEDM, the symposium on VLSI Technology, the IEEE International SOI conference, the EUROSOI network, SSDM conference and the International S3S conference. He received the 'Général Férié' award in 2012 and the 'Electron d'Or' award with CEA-Leti, ST Microelectronics and SOITEC in 2017.

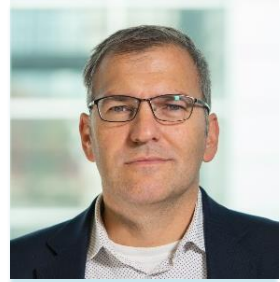


Nadine Collaert is an imec fellow. She is currently responsible for the advanced RF program looking at heterogeneous integration of III-V/III-N devices with advanced CMOS to tackle the challenges of next generation mobile communication. Before that, she was program director of the LOGIC Beyond Si program focused on the research on novel CMOS devices and new material-enabled device and system approaches to increase functionality. She has been involved in the theory, design, and technology of FinFET devices, emerging memories, transducers for biomedical applications and the integration and characterization of biocompatible materials. She has a PhD in electrical engineering from KU Leuven and she holds more than 500 publications and more than 15 patents in the field of device design and process technology.

Smart Energy: review of the main EU and international activities and technologies

As outlined in the workshop announcement, international cooperation is key to accelerating technological innovation. This is also of utmost importance for research and development in the field of smart energy. In the Smart Energy session of this workshop, we will provide an overview of the main EU and international activities in leading countries in the field of semiconductors used for future technologies in this specific area. Various devices for industrial and automotive applications are already on the market. However, cost pressures and technological innovation are driving device performance to the next level. We will highlight the research needs and gaps identified to make further progress in the field of smart energy.

Markus Pfeffer holds a diploma in Electrical Engineering and a PhD (Dr.-Ing.) with specialization in manufacturing optimization both from the University of Erlangen-Nuremberg. Since 2002 he has been working at Fraunhofer IISB in the Business Department Semiconductor Technology, where he is the deputy fab manager of the Fraunhofer IISB Pi-Fab (SiC Processing and Prototype Fabrication) and he is in charge of quality and process control as well as founded research. He was and is involved in several national and international cooperative R&D projects in different functions.

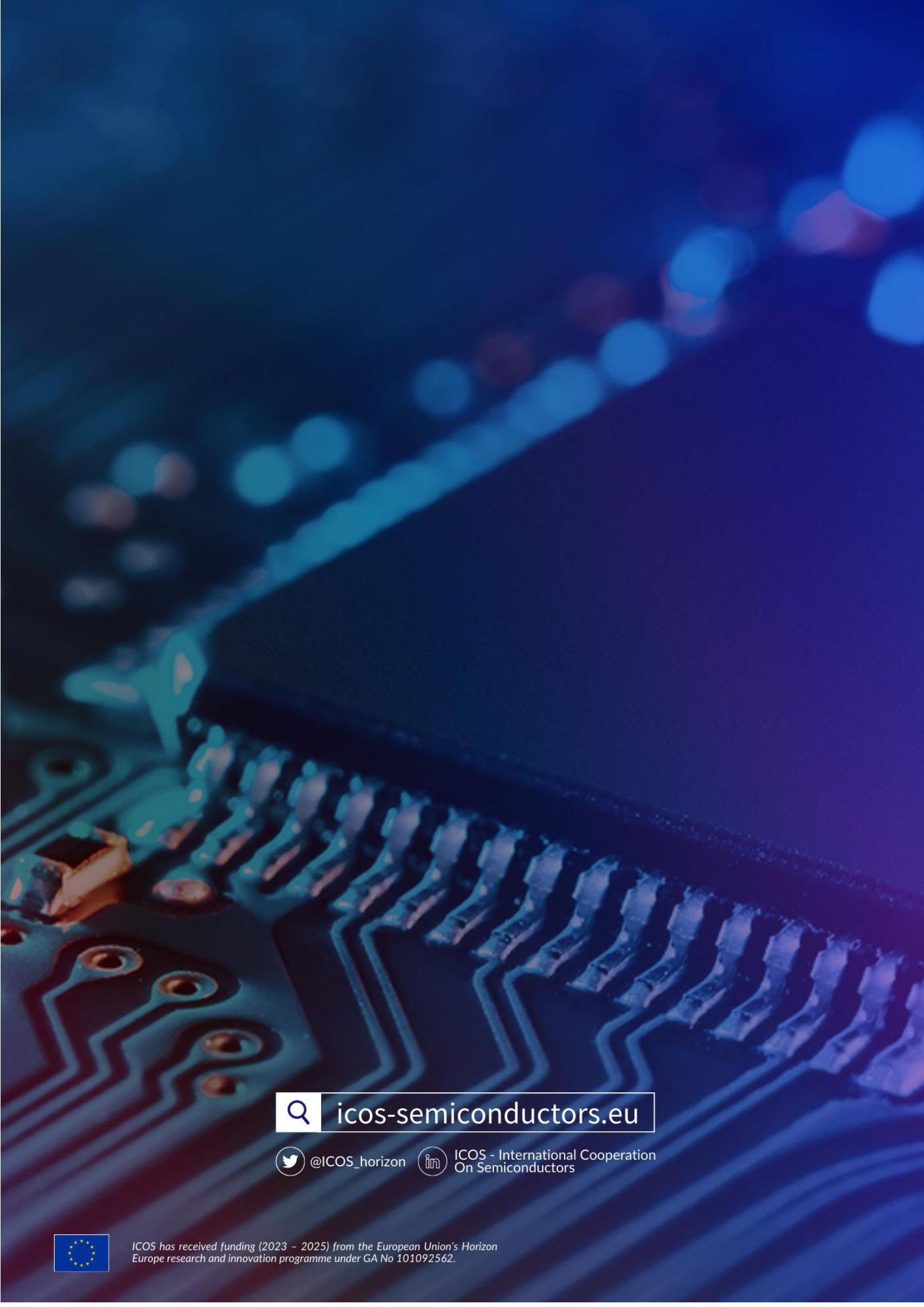


Silicon Photonics: review of the main EU and international activities and technologies

Silicon photonics is a technology that benefits from the existing CMOS infrastructure to manufacture compact and densely integrated photonic ICs at low cost. Today, this technology provides solutions for high-speed connectivity ranging from a few meters to hundreds of kilometres. Millions of modules are in operation, and there is a growing demand due to increased demand for connectivity. In parallel, silicon photonics applications in markets for medical diagnostics, high-performance computing, quantum processing, agri-food, and autonomous driving are gaining traction and maturity. Cost, scalability, miniaturization, and competitive performance are some drivers that make silicon photonics a relevant technology for applications in these markets. This diversification of applications requires the retrofitting of the technology to meet new demands. There are several dimensions of this evolution and will discuss some of the most prominent aspects in this talk. For the last several years, Europe has been in a leading position in R&D for photonic integration in general and in silicon photonics in particular. In the second part of my talk, I will position Europe vis-à-vis the other regions and review the main EU and international silicon photonics activities and technologies.



Roel Baets is a full professor at Ghent University (UGent) and is also associated with imec, both in Belgium. He received MSc degrees from UGent and Stanford University and a PhD degree from UGent. Since 1989 he has been a professor in the Faculty of Engineering and Architecture of UGent where he founded the Photonics Research Group. Roel has led major research projects in silicon photonics in Europe and founded ePIXfab in 2006, the globally first Multi-Project-Wafer service for silicon photonics (now European Silicon Photonics Alliance). Roel is a Fellow of IEEE, of European Optical Society (EOS) and of Optica. He has been a recipient of the 2011 MOC award, of the 2018 PIC-International Lifetime Achievement Award, of the 2020 OSA-IEEE John Tyndall award and of the 2023 IEEE Photonics Award.



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