

Innovation Showcase (pre-recorded)

High Throughput Thin Film Coatings combining Maximal Uniformity and Minimal Defects for the Future of Acoustic Wave applications

D. Pereira
Bühler Alzenau GmbH, Semiconductor, Alzenau,
Germany

Abstract

The evolution of RF filters for 5G has driven significant advancements in acoustic wave filter design and manufacturing, with several structures now widely tested and adopted in mass-market applications. The more recent trend is towards building Surface Acoustic Wave (SAW) filters on Piezo-on-Insulator (POI) wafers, a technology that extends performance into higher frequency bands essential for 5G. Challenges arise on the production of defect-free, high density oxides that couple to the piezoelectric materials (like LiTaO₃ or LiNbO₃) or on the supersmooth surfaces required for the production of the devices, particularly as pitch sizes decrease to accommodate higher frequencies.

In this presentation, we explore the challenges associated with the manufacturing of SAW filters on POI substrates. We focus on how Bühler Leybold Optics' Semiconductor portfolio leverages decades of expertise in optics thin-film processing to address the complexity of next-generation RF devices. With emphasis on advanced thin-film deposition and planarization methods - including Magnetron Sputtering, Ion-Beam Assisted Deposition, and Ion Beam Trimming - these ensure mass-production solutions for the creation of consistent, high-quality films with minimal defects and maximal uniformity. These techniques not only enhance the performance and reliability of acoustic wave filters but also enable efficient processes such as wafer-to-wafer bonding, a critical requirement for POI technology.

Biography

Daniel Sá Pereira joined Bühler Leybold Optics in 2021 working on the Semiconductor Market Segment as a technical Sales Manager. Daniel is a Microelectronics Engineer from the New University of Lisbon, Portugal (2015) and a PhD in Physics from the University of Durham, United Kingdom (2019). His research focused on the characterization of organic materials for application in organic light emitting diodes (OLEDs). Since leaving academia, Daniel has joined Business Unit Optics at Bühler Alzenau GmbH to focus on emerging applications that combine the worlds of Optics with Semiconductor like Augmented Reality, RF Communications, Photonic Integrated Circuits, Ambient Light Sensors, etc.

References

Strategic Raw Materials and Sustainability: The Importance of Hyperpure Silicon.

M. Bünnig
Wacker Chemie AG, Burghausen, Germany



Abstract

WACKER Chemie AG is the global market, technology and quality leader for hyperpure silicon. Hyperpure silicon is the enabling material for silicon wafers. In 2023 Wacker started to invest once more in our hyperpure silicon capacities and capabilities. Therefore, Wacker is part of the public funded IPCEI ME/CT (Important Project of Common European Interest for Microelectronics and Communication Technologies) program with our strategic investment project “**Etching Line Next**” in Germany, Burghausen. Within this project, WACKER develops and deploys an innovative etching process for hyperpure silicon combined with a novel pre-treatment via thermal crushing and an innovative automated morphology sorting. This will result in an innovative silicon that will specifically meet future technical requirements to allow production of future leading-edge devices. We want to talk about the innovations of the project and in general about sustainable and challenging production of hyperpure silicon.

These includes:

- How to improve product quality and enabling the production of hyperpure silicon at constant level,
- why hyperpure silicon enables the production of 300 mm wafers and why it is essential for future microelectronic applications,
- how to face cost challenges e.g. energy costs with a high degree of automation and enhances sustainability in several respects.

With hyperpure silicon being a strategic key raw material for semiconductors we are going to showcase how our investment project will contribute to a resilient European semiconductor supply chain while further supporting sustainability strategies and green technologies in the industry and therefore how hyperpure silicon in general contributes to a sustainable future.

As hyperpure silicon for semiconductor application is the indispensable base for the global electronic value chain and the continuously growing market pushed by digitalization and decarbonization and ever tighter technical requirements trigger the same trend on the silicon supply side – growing demand and increasing technical requirements while also focusing on sustainability. All these challenges will be addressed in our pre-recorded talk.

Biography

Professional Career

Since March 2023 back with WACKER

Senior Marketing Manager for Polysilicon

Wacker Chemie AG, 2011 - 2021

Sales Manager Silicones for Customers in Energy Sector in DACH-Region

Walter De Gruyter, 2021 - 2022

Senior Manager Book Production and Team Lead

Education

Humboldt-Universität zu Berlin, 2020 - 2023

Master of Arts - MA, Philosophie

Steinbeis University, 2014–2016
Master of Business Administration (M.B.A.), Marketing

University of Applied Sciences, 2005 - 2011
Diploma Industrial Engineering

References

Rethinking Chip Design with Open Source EDA

C. Alexandre
keplertech.io, Paris, France



keplertech.io

Abstract

The rise of open source hardware, driven notably by RISC-V adoption, is generating growing interest in more open and flexible Electronic Design Automation (EDA) tools. Despite this momentum, the EDA landscape remains largely proprietary — with critical stages of both digital and physical design flows controlled by a small group of vendors. This limits reproducibility, collaboration, accessibility, and innovation.

Unlike cloud or AI software stacks — where open source has become foundational — semiconductors and EDA have remained predominantly closed. But that paradigm is beginning to shift. A growing community of contributors and increasingly capable open source EDA projects are forming a viable ecosystem with real-world applicability.

This talk will explore how open source EDA can be effectively leveraged today — not as a full replacement for industrial tools (at least not yet), but as a complementary layer that provides value in specific, practical contexts:

- CI/CD for open hardware projects, enabling community-driven regression testing with license-free flows.
- Early-stage architecture exploration and prototyping for SMEs, academic teams, startups, and newcomers — without requiring access to commercial toolchains.
- Cloud-native flow scaling, where open licensing enables elastic, parallel experimentation on standard compute infrastructure.

We will also highlight the contribution of keplertech.io, and introduce Naja — a modular C++/Python framework for post-synthesis netlist analysis, optimization, and EDA tool development.

I will also consider the strategic relevance of open source EDA in the European context — how it can reduce dependency, foster innovation, enable reproducible flows, and support skills development, all of which are critical to Europe's pursuit of greater semiconductor sovereignty.

Biography

Christophe Alexandre, Keplertech.io

With 20 years of experience in Electronic Design Automation (EDA), I began my journey with a PhD in microelectronics from Sorbonne University (2008). In 2009, I co-founded Flexras Technologies, a startup specializing in FPGA prototyping tools, which was acquired by Mentor Graphics (now Siemens EDA) in 2015. There, I served as Chief Software Architect, leading global R&D teams and helping evolve our technology into a widely adopted commercial product.

In 2022, I co-founded a new venture: keplertech.io, an EDA startup built on the belief that Open Source can unlock innovation in one of the most closed and complex industries—semiconductors, integrated circuits, and the tools used to design them. In a space dominated by a handful of major players, we aim to create meaningful opportunities for smaller, agile actors to thrive.

I'm passionate about building complex systems from scratch and bringing ideas to life in the real world.

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Mastodon: <https://mastodon.social/@xtofalex>

naja GitHub: <https://github.com/najaeda/naja>

References

Innovative Etching Gas Development using Digital Twin

N. Ichikawa
Daikin Industries, Ltd., Chemicals Division,
Product R&D Department, Settsu, Osaka, Japan

Abstract

Author: Natsumi Ichikawa¹, Hisataka Hayashi¹, Simon Pelz², Julian Rechman²

□¹Daikin Industries, Ltd. and ²Daikin Chemical Europe GmbH□

In the semiconductor industry, advancing device miniaturization and integration demands improved performance. The stringent requirements for dry etching, crucial to device function, pose technical challenges. As a chemicals manufacturer, we address these with gases, but exploring optimal process conditions (applied power, gas flow rate, pressure) is time-consuming. To approach these issues, we adopted inductively coupled plasma etcher and capacitively coupled plasma etcher mirroring those in the 300mm mass production process. These etchers allow replication of issues using latest pattern wafers from client, alongside the ability to rapidly evaluate multiple gases due to the tool's stand-alone nature and user-friendly gas cylinder replacement. Leveraging this equipment and digital twin technology, we've innovated a method to optimize new gas capabilities. Utilizing Design of Experiments (DOE) and Machine Learning (ML), we've created a precise model predicting etching characteristics (profile and depth). Digital twin technology facilitates virtual experiments to find optimal conditions. In developing a C₄F₈ (GWP: 10300) alternative for the Bosch process, DOE shortlisted 19 conditions from 54. The digital twin, simulating 1960 conditions, identified CH₂=CF₂ (GWP: 0.052) as a promising alternative in a region distinct from C₄F₈'s conditions, achieving optimal results for CH₂=CF₂.

To construct a more accurate prediction model, we also focused on plasma physical quantities such as electron and ion density, which represent the plasma state during etching. Unlike traditional ML that uses only process conditions incorporating plasma physical quantities significantly improved model precision. In optimizing conditions where SiO₂ etching rate exceeded 400 nm/min and SiO₂/Si selectivity reached 4 via CF₄ with H₂ incorporation, ion density inclusion, measured via quadrupole mass spectrometry, cut prediction error from 7.4% to 1.9%. These findings, presented at conferences such as DPS2024, are widely acclaimed. Our ongoing mission is to swiftly and effectively contribute to the semiconductor sector by developing new gases and process conditions using digital twin technology.

Biography

Natsumi Ichikawa is currently a chemical researcher at Daikin Industries. She holds a Master's degree in Catalytic Chemistry. She has strengths in synthetic and complex chemistry. Currently involved in semiconductor dry etching process, specializing Bosch Process and digital twins.

References

Unlocking the potential of GaN-Si: Advancing 5G+/6G communication and power electronics

N. Collaert
Imec, Leuven, Belgium



Abstract

Gallium Nitride on Silicon (GaN-Si) has emerged as a transformative technology for next-generation communication and power applications, offering a compelling balance between performance, cost, and scalability. In the realm of 5G+/6G communication infrastructure and handset applications, GaN-Si demonstrates significant promise with its ability to achieve high power density, efficient amplification, and compatibility with existing silicon manufacturing processes. Its scalability to larger wafer sizes provides a cost-effective alternative to GaN-SiC, particularly for base station infrastructure requiring operation at 28V and 48V. However, challenges such as thermal management, substrate losses, and achieving enhancement-mode (E-mode) devices for handset applications necessitate continuous innovation in materials and device architectures.

For power electronics, GaN-Si has transitioned to mass production, delivering breakthroughs in efficiency and performance across a broad voltage range. Yet, as the technology matures, the research community is addressing critical challenges to expand its voltage range, improve integration levels, and enhance reliability under real-world conditions. This presentation outlines our roadmap for addressing these challenges through novel device designs, advanced substrates, and integration of new components. By balancing short-term industrial needs with long-term innovation, we aim to unlock the full potential of GaN-Si technology, driving advancements in high-frequency communication systems and energy-efficient power solutions.

Biography

Dr. Nadine Collaert is an imec fellow and part-time professor at the Vrije Universiteit Brussel (VUB). 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.

References

Fabrication of Recrystallized SiC Wafer Carriers via Additive Manufacturing and CVI

Y. Jung
MADDE Inc., Seoul, Republic of Korea (South
Korea)

Abstract

To address the limitations of conventional silicon carbide (SiC) manufacturing—such as high-temperature sintering, significant shrinkage, and restricted geometry—we present a novel process that enables the production of high-performance recrystallized SiC (R-SiC) components for semiconductor equipment. This approach combines binder jetting additive manufacturing (BJAM) with chemical vapor infiltration (CVI) to rapidly produce complex wafer carriers (baffle boats) with excellent thermal stability and dimensional accuracy.

The process begins with the fabrication of porous green bodies using a custom-developed BJAM system tailored for SiC powders. These printed parts feature complex internal geometries and are subsequently densified through vapor-phase SiC deposition via CVI. Unlike conventional R-SiC fabrication that relies on high-temperature processing and mold-based shaping, this method achieves densification under lower thermal conditions while enabling precise control over residual porosity. The result is improved mechanical strength, reliable shape retention, and minimized material waste.

Using this approach, we successfully manufactured wafer carriers in a fast and cost-effective manner. The printed R-SiC components demonstrated strong thermal shock resistance and dimensional stability under repeated exposure to high-temperature process environments. By combining the geometric freedom of additive manufacturing with the functional reliability of R-SiC, this process offers a scalable and economically viable pathway for next-generation ceramic components in semiconductor manufacturing.

Biography

Youngsuk Jung is the CTO and co-founder of MADDE, a company developing advanced additive manufacturing technologies for both ceramics and metals. He holds a Ph.D. in Automotive Engineering with a specialization in structural design optimization. Prior to founding MADDE, he conducted research on design for additive manufacturing at Hyundai Motor Company. His current work focuses on the development of customized 3D printers and design methodologies optimized for the additive manufacturing of high-performance industrial components.

References

Driving ICT Decarbonisation: Unlocking the Power of Product Carbon Footprint Insights

I. Richardson
Carbon Trust, London, United Kingdom

Abstract

As 2030 approaches and ICT sector confronts mounting climate pressures, hyperscalers are increasingly requesting Product Carbon Footprints (PCFs) from their semiconductor and component suppliers. While this growing demand can pose a challenge for semiconductor companies—many of which have complex supply chains—it also represents an opportunity. This presentation will explore why product-level carbon insights are becoming essential, and how they can unlock new paths to decarbonisation, innovation, and competitive advantage.

Focusing on both the semiconductor industry and the broader ICT sector, the Carbon Trust will explain how PCFs can be robustly calculated, clearly communicated, and effectively leveraged. We will explore how high-quality, transparent PCFs can drive emissions reductions, inform better design and procurement decisions, and align with evolving regulatory and customer expectations.

This session is both a call to action and a practical guide. Attendees will gain insight into starting, or strengthening, their PCF journey, whether to ensure compliance, enhance corporate sustainability strategies, or contribute meaningfully to the sector's collective decarbonisation goals.

Biography

Izzy is an Associate at the Carbon Trust, where she supports corporate clients in the ICT sector on their journey to Net Zero. Izzy specialises in device and component manufacturers, supporting their product emissions reporting to enable accurate, transparent, and clear emissions communication on a B2B and B2C basis.

The Carbon Trust is a mission-driven, not-for-dividend climate consultancy. For over 20 years, we have been pioneers in climate action, partnering with leading businesses, governments, and financial institutions around the world.

We are a global network of 400 experts, with offices in the UK, the Netherlands, South Africa, Singapore, and Mexico.

From strategic planning and target setting to implementation and communication, we are your expert guide for turning climate ambition into real impact. To date, we have helped set over 200 science-based targets and supported more than 3,000 organisations across 70 countries on their journey to Net Zero.

References