MEMS & Imaging Sensors Forum

Technology and Knowledge Open Hub: a Pathway to Future Imaging and MEMS

G. Casse
Director of the Centre for Materials and Microsystems
Bruno Kessler Foundation (Fondazione Bruno Kessler – FBK), Rome, Italy

Abstract
Current and future challenges in novel fields, such as quantum technologies, require a new paradigm of cooperation in the research landscape. In this evolving context, Fondazione Bruno Kessler is adapting its model to operate as an “Open Hub” of knowledge and technologies, with a focus on future sensing and imaging devices. After being conceived and engineered within the internal facility, these can be transferred to high-volume production sites: from radiation detectors to plasmonics, from silicon photonics to single-photon imaging, FBK is giving its contribution to the devices of the future such as quantum technologies, enabling novel mobility and automotive scenarios, space exploration, and faster and secure communications.

Biography
Gianluigi Casse is the Director (since January 2016) of the Centre for Materials and Microsystems (FBK-CMM) at the Bruno Kessler Foundation (Fondazione Bruno Kessler – FBK). It is a research centre with about 100 scientists and engineers and over 30 PhD students and visiting researchers. The Centre mainly focuses on materials and interfaces, sensors, devices and microsystems, renewable energy and environment.
Gianluigi is a particle physicist who has previously worked at CERN and at the University of Liverpool where he holds a personal chair in physics. He is involved in the LHCb experiment and in the preparation for the upgrade of the ATLAS experiment to the high luminosity LHC. He has a long experience in the conception, design, deployment and operations of experiments for particle physics and is a leading scientist in the field, with crucial contributions to the state-of-the-art detector systems operating in the High Energy Physics (HEP) experiments like CDF at Fermilab (Batavia, IL, US) and ATLAS and LHCb at CERN (Geneva, CH).
He is active in several international panels for HEP and instrumentation, has been program chair for a number on international conferences on instrumentation and, since 2010, is the co-spokesperson of the CERN-RD50 experiment for the development of radiation tolerant detectors for future experiments, with 64 institutes worldwide and over 400 member scientists.
He has authored or co-authored over 500 publications in refereed international scientific journals.

Embedded Computing the Next Paradigm Shift for Image Sensors

P. Cambou
Principal Analyst
Yole Développement, Photonics & Sensors,
Villeurbanne, France

Abstract
Imaging is an old industry which started in the 1830's on copper plates, from still images it moved to motion picture in the 1890's, the medium switched to organic film such as celluloid and then acetate. In the 1930's tube based cameras allowed television as we know it and was the first step for electronic based imaging. In the 1970's the transition to silicon based image sensors called CCDs allowed for mass adoption of electronic cameras. By the year 2000 digital photography and video took the world by storm. Since then a radical transformation of imaging applications and technology took place with Mobile applications and thanks to the CMOS image sensor technology. The world reached a peak in smartphones sales in 2017, nevertheless the sales of image sensors have grown 40% since then and the growth is expected to maintain for the 5 years to come. Two trends have contributed to this growth. The first one is the proliferation of cameras per phone and the second is the introduction of sensing cameras, mainly for biometric identification but also to help the photographic aspects such as bokeh. Innovation in imaging will not stop there and the next wave of innovation will come from artificial intelligence. While some of the innovation currently takes place either in the cloud or in the central APU, there is a trend to bring compute close to the sensor and actually embed significant amount of intelligence within or close to the sensor. In this presentation we will look at the reasons to do so and why it is important for the future of imaging. We will look at who are the players active in this new technology shift and for which kind of application.

Biography
Pierre Cambou MSc, MBA, is a Principal analyst in the Photonic and Display Division at Yole Développement (Yole). Pierre's mission is dedicated to imaging related activities by providing market & technology analyses along with strategy consulting services to semiconductor companies. He is responsible for the CIS Quarterly Market Monitor while he has authored more than 15 Yole Market & Technology reports. Pierre has an Engineering degree from Université de Technologie de Compiègne (France) and a Master of Science from Virginia Tech. (VA, USA), Pierre also graduated with an MBA from Grenoble Ecole de Management (France).

Toward Event-Based Vision Wide-scale Adoption

L. Verre
CEO
PROPHESEE, Paris, France

Abstract
Since their inception 150 years ago, all conventional video tools have represented motion by capturing a number of still frames each second. Displayed rapidly, such images create an illusion of continuous movement. From the flip book to the movie camera, the illusion became more convincing but its basic structure never really changed.

For a computer, this representation of motion is of little use. The camera is blind between each frame, losing information on moving objects. Even when the camera is recording, each of its “snapshot” images contains no information about the motion of elements in the scene. Worse still, within each image, the same irrelevant background objects are repeatedly recorded, generating excessive unhelpful data.

Evolution developed an elegant solution so that natural vision never encounters these problems. It doesn’t take frames. Cells in our eyes report back to the brain when they detect a change in the scene – an event. If nothing changes, the cell doesn’t report anything. The more an object moves, the more our eye and brain sample it.

This is the founding principle behind Event-Based Vision – independent receptors collecting all the essential information, and nothing else.

Prophesee is the inventor of the world’s most advanced neuromorphic vision systems. Composed of patented Metavision® sensors and algorithms, these systems enable machines to see what was invisible to them until now.

With 10-1000x less data generated, >120dB dynamic range and microsecond time resolution (over 10k images per second equivalent), Prophesee Metavision® opens vast new potential in areas such as **autonomous vehicles, industrial automation, security and surveillance, mobile, IoT and AR/VR**. Its solutions improve safety, reliability efficiency and user experiences across a broad range of use models.

Biography
Luca Verre is Co-Founder and CEO of Prophesee, the inventor of the world’s most advanced neuromorphic vision systems. Prophesee’s patented technology is inspired by human vision, giving sight back to the blind and unlocking new safety and autonomy standards for cars, robots and mobile devices.

Luca is a World Economic Forum Technology Pioneer. He has extensive international management experience in the industrial and electronics sectors. His experience includes project and product management, marketing and business development roles at Schneider Electric. Prior to Schneider Electric, Luca worked as a Research Assistant in Photonics at the Imperial College of London. Luca holds a MSc in Physics, Electronic and Industrial Engineering from Politecnico di Milano and Ecole Centrale and an MBA from INSEAD.

120fps, Ultra High Definition (8K UHD), Low Noise, Global Shutter Sensor for High-end Rigid Endoscopy

J. Segovia
Senior Principal Engineer
Teledyne e2v, Technology & Product Development, Seville, Spain

Abstract
Teledyne e2v presents the use of our Emerald 36M CMOS image sensor (which is a derivate version of Emerald 67M) for use in high-end rigid endoscopy. Teledyne e2v has several image sensors suitable for rigid endoscopy: Emerald 2M, Emerald 8M and finally Emerald 36M. This particular sensor provides ultra-high definition resolution, low noise (2.8eRMS) and high speed (120fps), enabling the medical surgeon to have a system with a reduced number of total cameras, increased precision in surgery and also improved patient comfort.

Biography
Jose Segovia Senior Principal Engineer

B. Eng. Engineering Telecommunications Electronics Seville University 2003
MhD. Degree Microelectronic Master: Design and applications of Micro and Nanometer systems (December 2010). University of Seville

Telecommunications Electronics Engineer from the University of Seville. Joined Teledyne AnaFocus in 2005 as analog and mixed-signal design engineer. He was involved in high-speed pipelined ADCs, current steering DACs, LVDS drivers between others. In 2009 he was promoted to technical director in image sensors project. Under Jose's direction, more than 5 projects has been successfully developed becoming specialist in ultra-high speed sensors and low noise CIS, with strong background on analog and mixed-signal design. In 2010 he received the MhD. Degree from University of Seville and Microelectronic Institute of Seville. Recently, in June 2019 he has promoted to Senior Principal Engineer taking care of the technology development of images sensors inside Teledyne in several sites. He has written several papers in international conferences and he contributes actively to the development cutting-edge technology in Teledyne.

C-SOI® and patterned wafers enabling advanced MEMS and Sensor applications

A. Haapalinna
CTO
Okmetic, Vantaa, Finland

Abstract
Okmetic is the leading supplier of advanced silicon wafers for MEMS Sensors as well as RF and Power applications. MEMS and Sensor applications benefit from Okmetic's decades-long crystal growth and SOI wafer expertise. Additional advantage for advanced MEMS manufacturing is provided by the company's unique in-house patterning line for embedded C-SOI® structures, enabling improved device performance and reliability with shortened cycle time. Okmetic has complete set of 150-200mm SSP, DSP, SOI and High Resistivity wafers for even the most demanding application needs.

Biography
Dr. Atte Haapalinna − CTO of Okmetic
Born 1969, D.Sc. (Tech)

Key employment history:
Okmetic
•Senior Vice President, Products 2014-2017
•Business Development Manager, new business development 2011-2013
•Application Manager 2008-2011
•Senior Application Engineer, Customer Support Engineer, Development Engineer 1998-2008

Fraunhofer Institut für Prodktionstechnologie (IPT)
•Visiting Scientist 2001
•Helsinki University of Technology
•Scientist 1995-1998

Above and Beyond Methodology: Robustness Validation of Automotive MEMS Sensors

S. Vos
R&D Director, PL Motion Sensors
NXP Semiconductors, Chandler, United States

Abstract
MEMS & Sensor devices have been used for safety applications for 2 to 3 decades, but quality and reliability requirements continue to outpace capabilities. The electronics industry has not defined an advanced quality and reliability beyond the AEC Q100 and ZVEI Robustness Validation specifications.
NXP is proposing an "Above and Beyond" methodology intended to 1) produce higher body of evidence to enable lower ppm resolution of stress testing, 2) run serial reliability testing to better evaluate failure mechanisms and produce physico-chemical models of these mechanisms, 3) test reliability stress-to-fail to enable reliability modeling of failure mechanisms, and 4) reliability test corner lots to understand the design-process-manufacturing space with respect to quality and reliability.
In the presentation, NXP will propose a methodology for tailoring these four types of quality and reliability evaluation testing to MEMS/Sensor products and their intended use-cases: supply chain / assembly and end-user application.
Moreover, NXP will promote adoption of this methodology as a means of addressing the continuously stricter requirements particularly related to the security and safety of automotive applications.

Biography
Sandy Vos received her PhD from University of Minnesota in Materials Science and Engineering and has 20 years of industry experience in MEMS, microsystem, materials, component, composite and semiconductor technology and product development. She joined NXP in 2018 and is currently Director of R&D focused on inertial sensing, including automotive safety-critical devices. Her work requires the incorporation of functional safety and advancements in the state-of-the-art quality to MEMS physical sensors, within the significant challenges of an aggressive automotive-focused market as it extends into the vision of autonomous vehicles. Dr. Vos was Director of MEMS Engineering and Sr Manager of Product Development at Knowles Corporation in their Consumer Electronics division. At Knowles she was also a technical and design lead for consumer and hearing health microphone development programs in acoustic MEMS sensors. She has worked in the fields of surface mount fuse and suppressor design and manufacturability at Littelfuse, Inc and plastic composite design and manufacturability at Azdel, Hanwha.

Sensors to Make the World Greener, Easier and Safer

P. von Schierstaedt
Vice President & General Manager of Radio Frequency & Sensors
Infineon Technologies, Neubiberg, Germany

Abstract
At Infineon, we are committed to making the world safer, smarter and greener with our innovative and leading sensor portfolio.
Already today, many IoT trends such as smart devices and wearables, electromobility and connected cars, smart factories and homes, are being driven by our technologies, products and systems based on our XENSIV™ sensors families.
We have the vision to further “sensorize” these IoT devices and provide them with more intelligence with our latest innovations in order to make your life safer, smarte and last but not least greener.
In this talk, different use cases and sensors products and solutions are presented to show the benefits and the positive impact.

Biography
Philipp von Schierstädt
Vice President & General Manager
Business Line Radio Frequency & Sensors (RFS)
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85579 Neubiberg

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Philipp von Schierstädt has been Business Line Head RFS and Extended Board Member of the Power & Sensor Systems Division at Infineon Technologies AG since 2011. Philipp von Schierstädt was born on 19th May 1970 in Munich. He
has studied mechanical engineering and economics (Dipl. Ing. Technical University Berlin), holds a Master in Economics (University of St. Andrews) and has written his engineering diploma thesis at the Massachusetts Institute of Technology (MIT USA).

He joined Infineon Technologies AG in 2001.

Emerging piezo MEMS devices, trends and perspectives

M. Mohssen
Director & Head of Research Unit MST
Silicon Austria Labs GmbH, Graz, Austria

Abstract
Even though if innovation of new MEMS products lays mainly on new design however the recent advance in piezoelectric material and high quality piezo thin-film deposition technologies open new opportunities for piezo based MEMS devices. In this talk I will give an introduction about Silicon Austria Labs GmbH and our perspective about the future of piezo electric MEMS.

Biography
coming soon

Introduction by SPEA

E. Bardo
Sales & Development Semiconductor Director
SPEA, Volpiano, Italy

Abstract
SPEA is a leading supplier of capital equipment for MEMS wafer level testing & final test and calibration for a variety of MEMS and sensors, including accelerometers, gyroscopes, pressure sensors, environmental and gas sensors, humidity sensors, silicon microphones and speakers, proximity and ToF sensors, magnetic sensors, light sensors, 6/9 DoF sensors.
The company is among the most innovative players in this sector, striving to stay ahead with constantly evolving technology driving down the cost of test and calibration with best-performance equipment.
Complete test cells for MEMS devices, combining pick&place handling, testing, contacting, and physical stimulus can represent a huge competitive advantage. Based on a modular architecture, they can optimize the cost of capital equipment, making it flexibly adaptable to test different, evolving technologies, while the capability of accurately handling also the smallest packages based on a self-calibrated system, without needing any external calibration tools, is a key factor.
SPEA is also at the forefront with analog mixed signal testers. The company recently came up with a revolutionary device-oriented testing (DOT) architecture, representing a new way to test semiconductor components. DOT800 combines the capabilities of two testers into a single, test-head-only system, giving a true zero-footprint solution. Superior test performance comes with a multi-site efficiency >99.5% for a broad range of devices, ranging from consumer to automotive, from power management to SerDes, from MCU to RF and wireless.
A dedicated line of test equipment addresses the needs of power semiconductor devices, with the possibility to combine on a single machine all the resources to perform ISO, AC, DC test on the whole range of power applications: power discretes (Si/SiC/GaN technology), IGBT modules, IPM, KGD, at wafer, DBC or final test stage.

Biography
Emanuele Bardo is currently Sales & Development Semiconductor Director at SPEA, a tier-1 company in the field of automatic test equipment and automation for semiconductor, MEMS, sensors and electronic boards. He has held this position since 2018, being involved in Sales Management since 2007. Prior to that, he developed a deep technical knowledge with a master's degree in Front-End Manufacturing Processes at the Politecnico di Torino, Italy, then working as Test Application Engineer at SPEA, since 2005.

MEMS Actuators at the Core of Emerging Applications

A. Hofmeister
Group Vice President - General Manager MEMS Actuator Division
STMicroelectronics, AMS Group, Agrate Brianza, Italy

Abstract
not available yet

Biography
Anton Hofmeister is Group Vice President at STMicroelectronics (STM) and General Manager of the MEMS Actuator Division. He is located in Agrate Brianza/Italy.
Anton has been with STM for over 30 years and has worked in Germany, France, USA and Italy. During his career, he has held managerial positions in Key Account Management, Product and Strategic Marketing, Advanced R&D and General Management. For the past >10 years, he has managed various product divisions in the MEMS sector. Anton has also served as a board member of the Singapore based Molecular Diagnostics company “Veredus Laboratories” and is Managing Director of STM’s German subsidiaries.

Novel Bonding Technologies for Photonic and MEMS Sensor Integration

B. Dielacher
Business Development Manager
EV Group, St. Florian am Inn, Austria

Abstract
MEMS sensors are a key technology for many of today´s applications and must meet the highest standards of performance and reliability. Current devices on the market already have a high level of integration to fulfil these requirements, such as inertial measurement units. Emerging MEMS applications are diversifying in their capabilities and increasingly focus on integrating technologies from other disciplines, such as photonics, biomedical and nanotechnology. Innovative manufacturing technologies are thus developed to enable such integration schemes. In particular, high precision adhesive wafer-level bonding provides a reliable interface to facilitate the integration of different materials and technology platforms. Advances in pre-processing such as surface preparation, coating and adhesive patterning will be discussed including the preparation of ultrathin adhesive films and EVG´s adhesive layer transfer technology. Furthermore, wafer bonding capabilities will be presented and it will be shown how individual photonic chips can be transferred and integrated with a collective wafer-based process.

Biography
Dr. Bernd Dielacher is business development manager at EV Group where he is responsible for the MEMS as well as the bio- and medical technology market.

Bernd holds a master’s degree in Microelectronics from Vienna University of Technology and received a PhD in Biomedical Engineering from ETH Zurich, where he explored metal nanostructures for electrical and plasmonic sensing in biomedical applications.

Deposition and Etch Processing of highly-doped AlScN for Piezo-MEMS applications

C. Jones
SPTS Technologies Ltd, Newport, United Kingdom

Abstract
Aluminum nitride has proven to be a popular material choice to replace PZT in a variety of piezoelectric applications which include MEMS microphones, sensors, energy harvesters and some RF filters. In recent years it has been shown that the addition of scandium increases the material's piezoelectric properties, improving device performance. This more-complex alloy, however, does present wafer processing challenges to the device manufacturer, namely the AlScN films are more difficult to deposit using PVD where even producing high Sc-content sputtering targets is a major hurdle, and also AlScN becomes more difficult to etch with increasing Sc content when using conventional inductively coupled plasma (ICP) etching.
In this paper we will present the latest PVD technology solutions to deposit very thin, highly doped layers of AlN. We will discuss how to control the critical aspects of doped AlN deposition, like the layer thickness uniformity, the crystallographic texture of the film, the control of mis-orientated grains and most importantly the control of the stress state of the film within the wafer.
Increasing the Sc makes plasma etching more problematic because of the low volatility of scandium halides relative to those of Al and N. In fact, this etch process becomes impossible in a standard ICP module at Sc-contents >25%. We will also present the latest etch data from both standard ICP type reactors and a high density plasma etch.

Biography
Chris Jones is Senior Director, PVD & ECD Product Management at SPTS Technologies and is responsible for the company's PVD and ECD product lines covering all aspects of marketing including product positioning and the provision of support to the worldwide sales team.

After completing his BEng in Mechanical Engineering in 1995 at the University of Bristol, UK, he joined SPTS working in Field Service and then Process Engineering before moving into Product Management in 2005.

Chris has presented widely on SPTS products and is an author of several technical articles.

High-throughput Semiconductor Wet-Chemical Wafer Processing for Silicon and Compound Material Technology

E. Rueland
VP Sales, Marketing & Product Management
RENA, Guetenbach, Germany

Abstract
RENA started 1993 with customized solutions for wet-chemical equipment in the Semiconductor market. A strong focus on engineering excellence and efficient manufacturing of production tools was the basis of success. Building special machines led to a first prototype for a new process technology in solar industry, which was an initial start at RENA of developing wet-processing equipment platforms combined with a strong development of process solutions.
This concept was transferred to the semiconductor field and together with RENA North America (former MEI LLC) a wide range of customized solutions for wafer manufacturing, semiconductor processing and compound materials are established.
The efficient processing like stripping, etching, cleaning and drying is combined in a high-throughput equipment platform. The carrier-less handling allows extremely flexible and efficient handling of diameters up to 300mm and lot sizes up to 50 wafers each. The integration and combination of highly efficient stripping and etching processes like the metal lift-off FluidJet and TruEtch is leading to a perfect processing platform for MEMS and image sensor solutions. The excellent processing performance in the machine can be shown as well as an outstanding final cleaning and drying efficiency.
The combination of equipment and process performance offers a flexible tool to design and manufacture latest state-of-the art semiconductor devices.

Biography
Dr. Eric Rüland is Vice President for product management, sales and marketing at Rena Technolgies and in charge for product strategy of wet-chemical equipment in the market segments of Green Energy, Semiconductor, MedTech, Glass and others.
After studying solid-state physics at the university in Stuttgart and Hamburg Eric Rüland received his PhD from University of Berlin, finishing the PhD thesis about new materials for solar cells.
Working in the solar industry in different management positions for Product Management, Sales and Marketing over more than 20 years and growing GP Solar a start-up business to a mid-size company with a global footprint in solar and semiconductor metrology. After holding another global management position at Jenoptik industrial metrology, offering solutions in the automotive segment, 2020 a re-start in the solar and semiconductor field for wet-chemical solutions at RENA took place.

PICOSUN® Sprinter - a revolution in ALD mass production for 300 mm wafer markets

T. Blomberg
Technology Manager / R&D Leader
Picosun Group, Masala, Finland

Abstract
The PICOSUN® Sprinter is designed to disrupt batch ALD production on 300 mm manufacturing lines in the semiconductor, display, and IoT component industries. The SEMI S2/S8-certified Sprinter combines the leading single-wafer film quality and uniformity with fast processing, high throughput, and uncompromising reliability. Thanks to the fast process times, Sprinter's thermal budget is lower than typical vertical furnace reactors commonly used in batch ALD manufacturing. This makes Sprinter ideal also for sensitive substrate materials and devices. Medium batch size combined with very fast processing guarantees production flexibility with reduced risk without sacrificing throughput. In Sprinter, barrier, high-*k* oxide, and conductive films are deposited with perfect ALD in mass production volumes.

Biography
Dr. Tom Blomberg works as the R&D team leader in Picosun Oy and is responsible for new reactor technology development and research. He has more than 20 years of experience in developing ALD technology for the semiconductor manufacturing market. He has authored or co-authored around 30 publications on thin film deposition and energy related matters and holds more than 30 US or international patents on different subjects in the ALD and related technologies.

Enabling a World of Enhanced Vision

S. Goossens
Co-founder and CTO
ICFO – The Institute of Photonic Sciences,
Barcelona, Spain

Abstract
Qurv develops wide spectrum image sensors that capture previously hidden information. Either information that was hidden by ambient light interference or information that is not available in the visible light spectrum. More information allows improved decision making for machines.
The human eye only sees red, green and blue light. Ubiquitously available CMOS image sensors see visible and near infrared light up to 1um. Qurv image sensors based on nanomaterials are sensitive to visible, near infrared and short wave infrared light: from 300 nm up to 2 um and in the near future beyond 2 um.
Qurv's image sensor technology targets bringing enhanced computer vision applications to everyday life. The technology has a high manufacturability potential and can thus reach low cost products. Key to achieve high manufacturability is Qurv's waferscale back-end-of-line (BEOL) process. A proof of concept wide spectrum image sensor shows the validity of this BEOL process.
Qurv’s wide spectrum image sensor BEOL process is CMOS technology agnostic. Furthermore, all Qurv image sensors will be designed for AI.

Biography
tba tba

Analyze-first Architecture for Ultra-low-power Always-on Sensing

T. Doyle
CEO
Aspinity, Pittsburgh, United States

Abstract
Abstract:
Over the next five years, billions of hands-free, battery-operated, always-on sensing devices in consumer, IoT, biomedical and industrial markets will assist us in our daily lives at home and at work. As users become more dependent on such devices, they want smaller always-on products with longer-battery lifetimes. MEMS and sensors suppliers who can deliver more power-efficient solutions in ever-smaller form factors will gain a competitive edge — but how is this possible with standard signal-processing architectures?
MEMS and sensors suppliers can achieve incremental improvements in system power by improving each component in the system, but to effect great change, we need a system-level approach that achieves significant power- and data efficiency. The problem is that the current “digitize-first” system architecture digitizes all the incoming sensor data early in the signal chain — even mostly irrelevant data — before sending it to the cloud for processing. Without an alternative architectural solution, MEMS and sensors suppliers can only do so much.
A new “analyze-first” edge system architecture that uses ultra-low-power analog processing and analog neural networks now enables the detection of events — such as voice, specific acoustic triggers or a change in vibrational frequency — from raw, analog sensor data, before the data is digitized.
This “analyze-first” architecture reduces the volume of sensor data that is processed through higher-power system components (e.g., digital processors and ADCs) by up to 100x, which reduces always-on system power by 10x.
MEMS and sensors suppliers can easily integrate with the “analyze-first” edge architecture to enable smart portable products that run for months or a year instead of days or weeks.

Biography
Tom Doyle brings over 30 years of experience in operational excellence and executive leadership in analog and mixed-signal semiconductor technology to Aspinity. Prior to Aspinity, Tom was group director of Cadence Design Systems’ analog and mixed-signal IC business unit, where he managed the deployment of the company’s technology to the world’s foremost semiconductor companies. Previously, Tom was founder and president of the analog/mixed-signal software firm, Paragon IC solutions, where he was responsible for all operational facets of the company including sales and marketing, global partners/distributors, and engineering teams in the US and Asia. Tom holds a B.S. in Electrical Engineering from West Virginia University and an MBA from California State University, Long Beach.

Novel Platform to Solve 3D Nanometrology Challenge

M. Utriainen
CEO
Chipmetrics Oy, Joensuu, Finland

Abstract
The future competitivity of microelectronics is based on the capability to develop components into smaller space with better energy efficiency and high performance. The 3D is a megatrend in semiconductor manufacturing eg. in the form of 3D transistors (FinFETS) and memory (3D NAND, and DRAM). High aspect ratio structures, new materials, and tighter geometries are challenges to the developers of process tools, materials, and inspection and testing.
Chipmetrics business idea is to solve the problem by the MEMS-process based special silicon test chips and on-chip characterization concepts. The starting point is the PillarHall® Lateral High Aspect Ratio (LHAR) silicon test chip innovation for ALD/CVD thin film conformality metrology developed in VTT Technical Research Centre of Finland.
Premium product is 15x15 mm PillarHall® LHAR4 test chip consisting of 18 LHAR test structures. In addition, the test chip has structures to monitor thin film stress in microscopic level. Special carrier wafer allows wafer level mapping of the thin film conformality, film properties on the trench wall and local stress.
The benefits are such as:
• Less need for destructive cross-sectional analyses and equipment investments. No sampling delay. Compatible to standard planar metrology techniques, in a simplest case by optical microscope image analysis.
• The test chip is commercially available as a product, and allows to compare 3D perfomance by any thin film material or equipment vendor.
• Wide compatibility to ALD and CVD systems and process conditions, including plasma assisted processes.
• Extremely high aspect ratios, up to 10000:1, that are not available in the market otherwise
PillarHall platform can accelerate learning about films to go beyond simple step coverage measurements and look at the detailed properties of films in high aspect ratio structures, anticipating problems early in the development process and providing detailed insights.

Biography
Mikko Utriainen received his PhD from Helsinki University of Technology in Chemical Engineering in 1999, with the topic: “Atomic Layer Deposition (ALD) thin films in chemical sensor applications”. At that time, the ALD technology was still in its infancy. Today, ALD tools are main stream in semiconductor industry. In his >25 years working career, Dr Utriainen has also managed tens of R&D project teams in industry and academy developing and commercializing sensors, instruments and automation for various applications. He has also worked as an advisor in R&D&I funding and policy in Finnish National Innovation Funding Agency and in EU-level. Furthermore, Dr Utriainen has founded 3 start-up companies to commercialize research-based deep tech innovations.
Recently, he has founded Chipmetrics Ltd, utilizing his ALD and analytical instrumentation knowledge to commercialize novel 3D conformality nanometrology concept, PillarHall®.

All-silicon ultrasonic recognition of the environment

B. Kaiser
Group Leader Reasearch and Development
Fraunhofer Institute for Photonic Microsystems (IPMS), Dresden, Germany

Abstract
Human Machine Interface technology is rocketing in importance since ubiquitous technology is more and more trending in terms of a demand for decoupling of full consciousness from user experience. This seems true for a broader understanding of human machine interaction. A prominent example is among co-working places, where humans and robots closely interact. This symbiosis is paving the way for industry 4.0 in a broad range of industrial tasks. Other applications require thorough knowledge and even forecasting of machine status enabling predictive maintenance. MEMS based ultrasonic transducers enable detection and ranging systems that can be produced at a low unit price for high volumes. Assuming that, they may become just as available as it went to happen with inertial sensors in the past. Fraunhofer IPMS has developed the NEDMUT technology as an ultrasonic transducer for industrial applications bringing together benefits of the MEMS world
with industry digitalization needs. IPMS NEDMUT technology comprises a volume utilizing low footprint approach, ultra-low power electrostatic actuation, lead-free all silicon device, phased array, multichannel as well as combined emitter-receiver on chip capabilities.

Biography
Bert Kaiser received the M.Sc. degree from Technical University Chemnitz, Germany, in 2013 and the Ph.D. degree from Brandenburg Technical University Cottbus-Senftenberg, Germany, in 2016. His Ph.D. research was about electrostatic bending actuators, NED, in microelectromechanical systems. His main research interests include electrostatic bulk MEMS systems design, simulation, fabrication and characterization for acoustic and ultrasonic applications. His main work focus is on commercialization of the NED technology in various applications ranging from audio devices to valves for microfluidics. Since 2013 he has been working within the department of monolithically integrated actuator and sensor systems in the Fraunhofer Institute of Photonic Microsystems, Dresden, Germany. There he heads the acoustic transducers group. Main project is the all-silicon speaker and ultrasonic device technology utilizing the chips volume for sound generation. This technology is commercialized for the audio field of application in close collaboration with the spin-off Arioso Systems GmbH.

XENSIV™ PAS CO_2 Sensor: New Environmental Sensor Technology: Photoacoustic Spectroscopy (PAS) Miniaturizes CO2 Sensor for High-volume Applications

A. Kopetz
Director Environmental Sensing
Infineon Technologies, Munich, Germany

Abstract
City dwellers often spend a large amount of their time indoors – whether it be in an office, at school or simply at home. Buildings, however, tend to trap air especially as the level of insulation increases for energy efficiency purposes. This could lead to the development of bad indoor air quality in case of poor ventilation, negatively impacting human comfort, productivity and health. The concentration of carbon dioxide (CO2) is a good indicator of indoor air quality.
Today´s market solutions for monitoring this odorless and colorless gas are bulky and costly or simply not good enough for widespread adoption. Leveraging its advanced MEMS microphone technology, Infineon Technologies has developed a disruptive CO2 sensor based on photoacoustic spectroscopy (PAS). XENSIV™ PAS CO2 sensor is an exceptionally miniaturized sensor designed to accommodate high-volume manufacturing; it is the first real CO2 sensor with SMD capabilities. It also includes an on-board microcontroller for easy system integration in customer products.
The innovation will enable widespread adoption of air quality monitoring in high volume applications in variety of markets such as automotive, industrial, medical and IoT.

Biography
Andreas Kopetz received his Master of Computer Science from Vienna University of Technology in 2004 and a Master of Engineering Management from Duke University, in 2005. Andreas started to work for Infineon in 2005 in the Operations & Supply Chain group covering several positions in USA, Austria and Germany. In 2010 Andreas joined Infineon's Automotive division as product marketing manager for Electric Drivetrain power modules for hybrid and electric vehicles. In 2013 he transferred to the RF & Sensors business line within Infineon's Power & Sensor Systems division. He has been substantially growing Infineon's MEMS Microphone & pressure sensor business since then, recently as Director Marketing heading the product marketing and application engineering teams. Since March 2019 he is in charge of the accelerator program for environmental sensing.