
## 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).

**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

**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
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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.

## 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.

**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

**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.

**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.

# 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.

# 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.