Fab Management Forum (FMF)

Drivers of Digitalisation: What is Digitalisation and Why can it Change so much?

G. Hopf
Professor for Digital Transformation
Duale Hochschule Baden-Württemberg (State Cooperative University Baden-Württemberg), Ravensburg, Germany

Abstract
Digital Transformation is often misunderstood as a mere collection of computer-based technologies which allow for more efficient processes and possibly new product or service features. The change brought about by digitalisation however is more fundamental. The keynote will present and discuss the underlying powers of change which drive the digital transformation and which need to be understood in order to grasp and utliize its full powers of “creative destruction”.

Biography
Prof. Dr. Gregor Hopf received his PhD at the London School of Economics and is Professor for Digital Transformation at Baden-Württemberg’s State Cooperative University. In his research he specialises on questions of digital transformation namely online business models and online communication. Until 2016 he was the Head of the Taskforce for Digital Transformation of the State of Baden-Württemberg, coordinating all aspects of the government’s digital transformation agenda directly reporting to the prime minister.

How can a supplier help its customers fight climate change in the semiconductor industry? -The Air Liquide case-

A. Misra
Group VP Sustainability
Air Liquide, Paris, France

Abstract
Air Liquide is a world leader in gases, technologies and services for industry and health. Its strategy for profitable growth over the long-term is that of a customer-centric transformation. It is based on operational excellence and the quality of its investments, on open innovation and the network organization already implemented by the Group worldwide. Air Liquide's ambition is to be a leader in its industry, deliver long-term performance and contribute to sustainability.

Air Liquide's performance and its sustainability commitment go hand in hand. This commitment is key for both motivating the Group's teams, nurturing the long-term trust of stakeholders and the Company's long-term sustainability. All of the Group's businesses are rolled out in a way that contributes to major environmental and societal challenges, providing industrial, transportation and healthcare solutions. These challenges, such as the climate and air quality, are growth drivers for Air Liquide. The Group is a responsible industry player, and at the end of 2018 committed to reducing the carbon intensity of its operations. Air Liquide contributes through its business and its commitment to reach certain Sustainable Development Goals (SDGs) introduced by the UN to eradicate poverty, protect the planet and guarantee prosperity for all by 2030. To illustrate this contribution, environmental and societal achievements are associated with the relevant SDGs in the performance section of this report.
As part of its global approach to the climate, Air Liquide has set the most ambitious objectives in its sector. Known as ACE, these objectives break down as follows:

Assets (A)
Within its activities, including production, distribution and services, Air Liquide is committed to reducing its carbon intensity (a) by 30% by 2025, based on its 2015 emission levels.

Customers (C)
With its customers, the Group is also committed to a sustainable industry by promoting low-carbon solutions and developing new solutions.

Ecosystems (E)
With ecosystems, via an active dialog with all players (public authorities, industrial partners, NGOs, etc.), Air Liquide is contributing to the development of a low-carbon society, notably by developing biomethane for industry and transport and promoting hydrogen which, in both terms of mobility and energy, will play a key role in the fight against climate change and energy transition.

For Air Liquide, strengthening dialog with Group employees, customers and patients, shareholders, suppliers, local communities and the public sphere is a strategic objective which contributes directly to the responsible growth that the Group seeks to implement. Through these ongoing discussions, the Group is committed to take into account their issues, identify priority development issues and share its ambition to contribute to a more sustainable world.

In particular, with its customers, the Group is committed to working towards a clean and sustainable industry. Thanks to its essential molecules management (oxygen, hydrogen, carbon dioxide…) and the in-depth knowledge of its customers' processes, Air Liquide offers technologies which allow them to improve the energy efficiency of their industrial processes and reduce their emissions.

Air Liquide has identified two key drivers to reach this objective:

(1) Rolling out low-carbon offerings and solutions
Air Liquide provides its customers with the possibility of outsourcing some of their processes in order to pool assets and thus reduce the amount of energy used by up to 20%. The Group is also developing offerings which will reduce transport related emissions, in particular through small production units installed at customers' sites and new-generation cylinders which are 40% lighter than those made of steel. To improve the energy efficiency of combustion in the steel and glass industries, Air Liquide provides oxy-combustion solutions. This process consists of enriching air with oxygen to reduce energy consumption.

(2) Co-developing innovative processes with its customers
Air Liquide is working in partnership with its customers to introduce new solutions that will reduce the environmental footprint in various business areas:
either by reducing, where possible, the CO2 emissions of its customers by offering innovative solutions (EnScribe offer for semiconductor industry, for example);
or by capturing CO2 to give it a second life (CCUS – Carbon Capture, Utilization and Storage)
or by storing it permanently (CCS – Carbon Capture and Storage, in depleted offshore natural gas reserves, for example).

Biography
As the Group VP of Sustainable Development at Air Liquide, Ashutosh is responsible for development and deployment of the Sustainability roadmap across the organization. This includes all environmental and societal components that are key to the Group's strategy. Prior to his current position, Ashutosh was the Chief Technology Officer of Air Liquide's Electronics business line, leading the definition of global technical vision and product development strategies for the semiconductor market. In previous role as the Worldwide Director of ALOHA™ Electronics Performance Materials, he oversaw Air Liquide's advanced precursor business that supplies leading edge materials for CVD and ALD processes.
Ashutosh joined Air Liquide in 1997. He holds a Ph.D. in Physical Chemistry and was nominated Air Liquide Group Senior Fellow in 2018. He is a co-author of the Handbook of Chemicals and Gases for the Semiconductor Industry, holds 27 US and International patents and has published over 25 research articles in refereed journals.

Efficiently managing your resources in production – I4.0 and AI are the keys to success

F. Melzer
CTO
Festo SE & Co. KG., Esslingen am Neckar, Germany

Abstract
coming soon

Biography
Dr. Frank Melzer is Member of the Management Board Product and Technology Management at Festo SE & Co. KG.
As an innovative company, Festo has always distinguished itself on the market with excellent products and cutting-edge technology. Software, electronics and new materials are the new drivers of innovation in an ever faster world, enabling many new product and service ideas. His aim is to inspire customers with agility and innovative strength and to open up new growth markets for Festo.
After Dr. Melzer completed his mechanical engineering studies receiving his doctorate at the University of Stuttgart. He also holds a MBA from the University of Toronto.
Dr. Melzer began his professional career at Robert Bosch GmbH, where he held various positions from 1994 to 2004.
From 2004 to 2012 he was CEO of Bosch Sensortec GmbH and from 2012 to 2015 Senior Vice President Driver Assistance Robert Bosch GmbH.
From 2015 to 2017 he was President Autoliv Electronics in Munich and Stockholm.
Since 2017 he is CTO of Festo SE & Co. KG in Esslingen, is a member of the ZVEI Executive Board and, since the end of 2018, chairman of the steering committee of Platform Industry 4.0.”

Introduction

J. Robson
Corporate Vice President / Regional General Manager
Applied Materials Europe, Munich, Germany

Abstract
coming soon

Biography
James Robson is responsible for European customer accounts and achieving operational efficiencies across all segments and support functions. In this role, he chairs the European Regional Council to ensure that Applied Materials has the correct resources to support its strategy. He is also co-legal managing director for Applied's site in Alzenau, Germany.

James joined Applied as an etch process engineer and has served in engineering, sales, marketing, and management roles across the business units, including GM of European Crystalline Silicon Solar Products; VP of global sales for the Energy and Environmental Solutions group; and GM of the Glass and Web divisions. Earlier, he worked at Siemens Microelectronics and General Instruments.

He received an honors BS degree in electrical and electronic engineering from the University of Edinburgh.

Smarter tools for smarter fabs - taking automation to the next level

R. Dorn
Industry Lead Hightech & Semiconductors
Google Corporation, Munich, Germany

Abstract
For years Semiconductor Manufacturers have been investing in automation and information technology. Typically, many industry 4.0 pilots and POC installations can be foud - often with unclear ROI.
The keynote will focus on new technologies like industrialized AI / ML to dramatically the cost and resource requirements of algorithm development, management and enterprise wide deployment. It will present and discuss the requirements for secure data collection and ingestion as well as outline the trends to support and automate AI model generation / deployment. These new technologies are critical to scale AI / ML across fabs, re-deploy scarce resources and ultimately achieve cost savings in the manufacturing process.

Co-presented with Jörg Recklies, Senior VP, Infineon Technologies

Biography
Ruediger Dorn is responsible for driving the Google business across customers in the High Tech and Semiconductor industry. In his work he specializes on how leading digital technologies can solve real business problems with a specific focus on innovation and operational excellence.
Prior to Google Ruediger has worked in several international leadership roles for leading US IT companies as well as consulting firms.

AMLS Hybrid Implant Technology and Product

G. Horn
Director
Middlesex Industries SA, Sorengo, Switzerland

Abstract
Automated **M**aterial **L**ogistic **S**ystems (AMLS) are the infrastructures of modern manufacturing. In semiconductor factories there have been a) **M**anual **D**iscrete **L**ot (**MDL**), b) **A**utomated Discrete **V**ehicle (**DV**), and c) **A**synchronous **T**rack (**AT**) Work in Process transports employed. DV and AT systems span the 200 to 300 mm Wafer format manufacturing. Capabilities and shortcomings characterize each of the above. Integrating the two is superior to either one alone. A new technology c) Hybrid, is the implantation of AT networks into existing DV installations.

b) DISCRETE VEHICLE (DV) AMLS. Conceptually simple discrete vehicle delivery is popular. Discrete vehicles delivering wafer lots is easily understood. It is exactly as manual delivery before, but automated. Also easily understood is the dropping of wafer lots from overhead. Therefore, AMSL systems combining these concepts are dominant. They simply automate the manual delivery method. But discrete delivery logistics has no absolute mathematical solution. It works with heuristics. Capacity constraints and system instability, requiring storage, are the draw backs.

c) AT NETWORKS. Asynchronous Track AMLS is based on continuous flow of work, massively parallel, and asynchronous. Such networks are always, and immediately available to transport, without capacity constraints. And can respond to load spikes, eliminating instability. And so, reduce fab cycle times. However, they need external hoists to connect to tools.

d) DV & AT HYBRID AMLS. Asynchronous Track (AT) network island implants into Automated Discrete Vehicle (DV) AMLS impart greatly increased fab capacity, (balanced process capacities).

Ref: Nonlinear growth of Variance in the Process Gaps. A cause of long Cycle times. G. W Horn, W. Podgorski, PhD, CSTIC, 2020

Biography
George W. Horn

Mr. Horn received his BA degree from Harvard University in 1961, and his BS/MS degree in Applied Physics in 1963, also from Harvard University. He spent 7 years working at Ilikon Corporation in space technology. The company was a contractor for the Gemini and Apollo space programs. Later he focused on manufacturing science and statistical process control. He is a past director of the Washington based Automation Forum.
During his years at Ilikon he served as Director of Applied Physics (Special Applications of Kinetic Theory). In 1970 Mr. Horn joined Middlesex General Industries as a founder, and served there as Applications Manager. In 1998 He founded Middlesex Industries SA, Switzerland and Middlesex Industries KK in Japan. He now serves as Chairmen for all Middlesex corporations. Mr. Horn has several publications and holds patents related to upper atmosphere simulation, and manufacturing technologies. He has developed the guiding principles for AMHS in Clean manufacturing industries such as Disk Memory Media, Pharma, and primarily Front end Semiconductors, concurrently developing the principles for conveyor based transport of Silicon Wafer Carriers. Globally first, his design was used to build integrated AMHS, direct tool to tool method, in IC manufacturing. His latest studies in AMHS are published in IEEE transactions. He is holder of numerous recent US, China, Taiwan, EU, and Korea patents in AMHS technology.

Mr. Horn is a 20-year resident of Switzerland, where he lives today.

Cost-effective Automation for Legacy Factories

D. Suerich
Product Evangelist
PEER Group, Kitchener, Canada

Abstract
The Industrial Internet of Things (IIOT) and rise of 5G have increased demand for electronics, and have introduced renewed need for automation at existing 200mm facilities. These “legacy” factories already run at full capacity and have little or no room for expansion, so manufacturers are seeking innovative ways to introduce Smart Manufacturing initiatives, increase productivity, and optimize throughput and yield to meet the increased demands. New facilities built to support older nodes sizes also want to capture market share, and have the same needs as their legacy counterparts.
Although older node sizes and technologies are back in fashion, that doesn’t mean these facilities are limited to outdated manufacturing paradigms. Ambitious factories are looking at hyper-automated 300mm facilities to learn best-in-class methods for deploying automation and advanced manufacturing techniques. The SEMI® automation standards related to 300mm manufacturing describe efficient ways to implement automation, and these same models can be used in any facility, new or retrofit, to achieve major gains. PEER Group® provides products and solutions (including our PEER FACTORY® Station Controller, PFSC™) to rapidly update factory-wide connectivity, data collection, and control systems and allow any factory to integrate new and existing equipment efficiently. We help customers leverage best practices for factory automation and enable the latest advancements in analytics, scheduling, advanced process control, and predictive maintenance.

Biography
Doug Suerich is Product Evangelist at The PEER Group Inc., the semiconductor industry’s leading supplier of factory automation software for smart manufacturing and Industry 4.0. Doug focuses on big data and remote connectivity solutions that help manufacturers collaborate securely on tools and data in production environments. A passionate advocate for smart manufacturing, Doug serves as an active member of the SEMI® SMART Manufacturing Technology Community, Americas Chapter.

Doug has over 20 years of experience leading software teams for a variety of industries including semiconductor, manufacturing, and transportation. Most recently, he was involved in architecting PEER Group’s remote connectivity solution, Remicus™, and he was a champion in promoting the use of cloud computing and latest-generation web technologies.

Prior to joining PEER Group, Doug was a software development manager, automation engineer, information systems specialist, and consultant. He has extensive experience designing and integrating robust automation software solutions. Doug holds a Bachelor of Applied Science with Honours in System Design Engineering from the University of Waterloo.

Correct Material Selection and Life-Time Prediction of Elastomer Parts Using FEA Simulations

M. Gulcur
Material Development Manager
Trelleborg Sealing Solutions, Tewkesbury, United Kingdom

Abstract
Choosing the right elastomer sealing material has utmost importance to maintain vacuum integrity in semiconductor processes therefore keeping the tool downtimes at minimum. Qualification of a new elastomer sealing material brings some risks for the end user as installing a new material can cause contamination or premature failures which can cause more damage than the benefits of the new sealing material. At this point, it is important for an elastomer part manufacturer to provide relevant data to prove the suitability of the material to the application such as plasma exposure tests in various different process gasses, outgassing, trace metal and extractables analyses results and to help understand other factors like the damping behaviour of the material.
During a new material qualification another important topic is to determination of the lifetime of the sealing materials. It is extremely important for semiconductor OEMs to specify the right sealing material and microchip manufacturers to maximize the mean-time between cleans (MTBC). Sealing force created by a sealing part and its decrease over time. By using correct tests on this behaviour for input in advanced Finite Elemental Analysis (FEA), it is possible to predict the lifetime of the sealing parts by simulation. Such an analysis allows to capture the influence of both material properties and seal design on the lifetime. By combining data measured at elevated temperatures, a lifetime prediction for long time scales can be carried out based on test data of short time scales. The FEA will provide a prediction on the loss of sealing force over years and these results allow to estimate how many years the function of the seal can be fulfilled.

Biography
Murat Gulcur is Material Development Manager at Trelleborg Sealing Solutions UK. He has 17 years of experience in the field of elastomer technology and semiconductors, mainly single molecule/organic electronics. He holds a PhD degree in chemistry from Durham University (UK), has co-authored research papers in renowned journals and holds several patents.

Future wafer handling concept powered by permanent magnetic levitation

J. Frangen
Chief Expert Production Automation Engineering
Robert Bosch GmbH, Corporate Sector Research
and Advance Engineering, Renningen, Germany

Abstract
The semiconductor process technology permanently undergoes disruptive changes while aiming at higher integration, whereas the wafer transportation and handling technology has been comparably stable over decades.
Levitating wafer transport in a vacuum is a door opener towards higher efficiency, higher yield and increasing wafer diversity in a Semiconductor Factory of the Future. While coil based levitation technologies suffer from inefficiencies in magnetic field generation, the cutting-edge permanent magnetic levitation technology provides a huge leap forward. Based on permanent magnets, smart AI and high precision sensing, it enables highest forces and torques, full planar motion in six degrees of freedom, including full rotation around the vertical axis and a huge levitation gap, at low power consumption and without surface heating.
Permanent magnetic levitation technology opens the way towards large and modular cluster tools in a linear arrangement, with multiple wafers being transported simultaneously on individual paths and in individual process sequences. Based on software defined transportation and processing, the benefit of Industry 4.0 can be realized in a semiconductor plant.

Biography
Joachim Frangen is Chief Expert for Production Automation Engineering at Robert Bosch GmbH, Corporate Sector Research and Advance Engineering in Renningen (Germany). Joachim focuses on Industry 4.0 and levitation technology.
Joachim joined the Bosch Group in 1990 after receiving a diploma degree in physics at the University of Paderborn. After 5 years assignment as a Project Manager for Engine Management Systems, he changed to Corporate Research where he became Senior Expert for Industrial Image Processing and Sensor Technology. In 2001, his next position was Senior Manager for a research group in Assembly Technology and Industrial Robotics, with focus on Convertible Production and Collaborative Robotic Systems.
After an intermediate position as a Business Development Manager for Transportation Sensor Systems at Bosch Engineering in 2009/2010, he returned to Corporate Research as a Senior Manager for Industrial Image Processing and Machine Learning Technologies. In 2014, he became Chief Expert for Production Automation. From 2015 to 2020 he headed the Strategic Research Program ‘Industry 4.0 – Connected Industry’ as a Program Director.

How Precision Maintenance Enables Agile Fabs

A. Meyuhas
Founding Partner and COO
MAX Group, Boston, United States

Abstract
Practices & methods variability is the enemy of agility. Many engagements we work on with our clients show that equipment availability and maintenance practices carry high variability, killing capacity and cycle time performance even in very advanced Fabs. We have studied this problem over many years and have developed a very effective suite of tools, best practices and methods we call Precision Maintenance™ for Fabs. Agile Fabs focus their efforts on creating standard approaches, tools and practices aimed at reducing variability in every area of operation and this case study reflects their story. A recent engagement collaborating with a European 200mm Fab will show how we deployed Precision Maintenance™ practices to increase equipment uptime, reduce variability of uptime, ultimately increasing overall capacity and reducing Fab cycle time.

Biography
I am a founding partner and chief operating officer of the MAX Group. The firm is providing a unique range of operational solutions that increase factory and supply chain performance - More product out the door, faster cycle times, higher yields and lower cost of operation. With almost two decades of experience in providing operational consulting to leading edge companies, from start up phase to a mature factory, you can cash in on our success. With over 23 years of experience in the semiconductor industry, I bring vision, innovation, a strong relationship base helping a large portfolio of clientele. I am continuously driving our firm to be the best at what we do providing world class expertise and service. My role focuses on leading people with energy and passion, turning around operations and transforming factory performance in semiconductor companies. I hold a M.Eng in engineering management and a B.Sc. IE degrees.

Data Sharing and the Cost of Inaction

E. Collart
Global Product Manager EdCentra
Edwards, Sanborn, United States

Abstract
In this web cast Erik Collart examines how customers are using data to improve effectiveness of the SubFab, reduce the maintenance effort and avoid unplanned downtime.

Biography
Erik Collart joined Edwards in July 2015 as Global Product Manager for Edwards' vacuum and abatement equipment monitoring, data acquisition and integrated data management platforms. He has over 30 years of experience in the semiconductor industry. Prior to joining Edwards, he held several different positions in semiconductor R&D and process development, semiconductor equipment development, and Product Management and Marketing. He has authored and co-authored well over 80 publications in peer-reviewed scientific and industry journals and proceedings and holds several patents. He graduated with a Master Degree in Physics from Katholieke Universiteit Leuven (KUL) in Leuven, Belgium, in 1986.

Technology and Equipment Roadmaps Enabling the More-than-Moore Wave

M. Rosa
Sr Director, Technical Marketing
Applied Materials, Santa Clara, United States

Abstract
During the past 20 years, the semiconductor industry has seen multiple transitions in enabling technologies supporting the growth of new markets, from what was the PC era to the era of Mobility and Social Media to what has now come to be defined as the era of AI, Industry 4.0, and Big Data. With each transition, these enabling device technologies also evolved—some moving to smaller nodes or larger wafer sizes, others requiring new materials or new unit process technologies. And, while the advanced-node devices continue to scale in support of these transitions, the growing segment of device technologies known as More-than-Moore (MtM) has swelled in volume to the point where none of the MtM market segments today (IoT, communications, automotive, power, and sensors) would be possible without these enabling device technologies.

This presentation addresses the pivotal role MtM device technologies have played amidst the waves of industry transition. Through a lens of nine distinct megatrends currently shaping our society, it looks at what the future holds for this growing class of enabling device technologies. Along the way, it also discusses on-wafer technology inflections and their impact on product roadmaps of equipment providers in this space. Finally, it highlights several key device-level industry segments and discusses the key material or unit process technologies enabling next-generation capabilities in each, together with the role Applied Materials' 200mm/300mm MtM equipment plays delivering them.

Biography
Mike and his team are responsible for defining strategic and technical product marketing and communications, technology inflections, and roadmap requirements for the continued development of ≤200mm and 300mm semiconductor equipment and processes for More-than-Moore (MtM) device technologies. Mike also supports the MtM Equipment group in a strategic business development capacity, focusing on M&A and inorganic revenue generation. With over 20 years of technology-focused product and business development experience Mike brings to his role significant MtM domain knowledge and technology commercialization expertise. Before joining Applied Materials, he held various contributor level and senior leadership positions within the United States and Australia, working for technology-focused companies that include Xerox Corp., PARC Inc., Australian Microelectronics Centre (AMC) and National ICT Australia (NICTA).

He holds a Ph.D. in MEMS / microsystems design and fabrication and an MBA with dual majors in marketing and business strategy. He has authored more than 40 journal and conference publications and holds more than 28 U.S. patents concerning various applications of MtM technology.

Evolution of Smart Manufacturing - Integrated and Collaborative Smart Systems

J. Behnke
General Manager Final Phase Systems
INFICON, Final Phase Systems, Austin, United States

Abstract
The semiconductor industry has been on the forefront of developing advanced technologies used to fuel innovation and accelerate technology development since its inception. Its understanding and access to advanced technologies coupled with its need to continuously improve manufacturing efficiency and customer satisfaction has pushed the industry to develop and adopt Semi specific Smart Manufacturing/Industry 4.0 methodologies. Ironically the Semi Industry's development of powerful compute capabilities and low cost memory is the leading enabler of these Smart/I4.0 solutions.
These Smart/I4.0 methodologies are heavily integrated solutions which enhance existing systems and capabilities. Data from these multiple systems, such as MES, yield, metrology, fault detection, process control, maintenance, and demand integrate to create a learning real time digital representation of the factory. This Digital Twin or Cyber Physical System is an intelligent learning information hub that when properly designed and deployed supports a broad range of sophisticated new Smart/I4.0 applications. The most common first deployed Smart/I4.0 application is advanced WIP scheduling as it generates the largest ROI and most immediate impact upon a fabs performance. There are many other Smart/I4.0 applications available or under development which when integrated with a fab's Digital Twin address other needs or improve the fidelity of the existing Smart/I4.0 applications. Some of these are evolutionary like automation/robot additions, improved labor allocation, better starts planning, improved PM planning, etc. but others are revolutionary like AI analysis of Big Data to find subtle causalities, comprehensive in-line product risk management, integrated AI/ML enabled FDC solutions, augmented reality based PM procedures, integration of process support tools (think pumps, abatement and more) into the fab Digital Twin to optimize their use and performance as an integrated part of the fab which is critical to the realization of greener factories.
An overview of this evolution of Smart Manufacturing solutions and how they are integrated to provide their capabilities will be presented in this talk.

Biography
Mr. Behnke has 35 years of semiconductor industry experience including: logic and memory manufacturing, technology/product development and fab operational excellence. As the GM of Final Phase Systems an INFICON Product Line, John leads a team that develop and deploy SMART software solutions that enable fabs to improve their manufacturing efficiency. FPS's suite of software solutions are built upon a common Datawarehouse which enables advanced Fab Scheduling and optimized WIP movement as well as other related capabilities. He is also a Co-Chair of the Semi North America Smart Manufacturing Special Interest Group.
Prior to FPS John served as the CEO and President of Novati Technologies, the SVP and GM of the Semiconductor Group of Intermolecular, the CVP for Front End Manufacturing, Process R&D and Technology Transfers at Spansion and the Director of AMD's Fab 25's Engineering and Operations groups where he was a founding member of AMD's Automated Precision Manufacturing (APM) initiative which led the Semiconductor industry's development and use of APC and other advanced factory systems. He also led the successful conversion of Fab 25 from Logic to Flash memory which was enabled through the virtual automation of the fab.
Mr. Behnke earned a B.S. degree in Mechanical Engineering with an Industrial Engineering Minor from Marquette University. Mr. Behnke holds five U.S. patents.

SEMI S30 - Safety Guideline for use of energetic materials in semiconductor R&D and manufacturing processes

H. Samadi
Application Engineer
Edwards Vacuum, Munich, Germany

Abstract
Many processes used in manufacturing semiconductors require reactive chemistry; some of the process chemicals used are "energetic materials", that is, they are hazardously exothermic, pyrothoric, or water reactive. Using some process chemicals can produce byproducts that are energetic materials.
Control mechanisms are in place to mitigate the risks of such materials.
This Safety Guideline is intended as a minimum set of safety criteria for the procurement, storage, handling, and use of energetic materials in semiconductor R&D and manufacturing processes in all phases of use, from process chemical supply through abatement.
This Safety Guideline is intended to be industry best practices as of its publication date.

Biography
Hassan Samadi is an Application Engineer at Edwards Vacuum. He has been with Edwards for 2 years. His main tasks are supporting semiconductor and solar manufacturing companies throughout the EMEA region. Before joining Edwards, Hassan spent almost 3 years as a process engineer with Centrotherm developing semiconductor processes. He holds a M.Sc in Physics from the University of Heidelberg.

Atomic Layer Deposition process and equipment set to transform the More-than Moore era

P. Rabinzohn
Business Executive, Semiconductor Business Line
Beneq, Espoo, Finland

Abstract
After its inception with electroluminescent displays in the mid-80's, Atomic Layer Deposition technology has enabled three decades of scaled advanced-node CMOS devices with high-k for DRAM and Gate oxide in the late 90's, Gate metal and advanced patterning films around 2010 and 3D NAND Flash nano laminates since then. At the same time, the functional diversification of semiconductor devices with the addition of non-digital functionalities increasingly contributed to the miniaturization of electronic systems. In view of added functionality, this trend was designated by More-than-Moore (MtM). MtM devices complement the digital processing and storage elements of an integrated system by powering the system and allowing interaction with the outside world. The semiconductor industry entered the MtM era to support the megatrends of Mobility, Smart Automotive/Transportation, 5G, Industry 4.0 & Industrial IoT, Hyperscale Data Centers, New Human Machine Interface & AR/VR, Green Energy and Healthcare/Life Sciences. With its unique capability to precisely and conformally deposit a large range of critical materials as pin-hole free thin films at low temperature ALD is now set to enable More-than-Moore device technologies for the years to come. This presentation reviews current and future applications of ALD across Power Devices, RF filters and IC's, MEMS and sensors, Image sensors, Photonics and LED's and future market segments. It emphasizes the ALD materials and technologies enabling key functionalities such as high-k, surface passivation, nucleation and seed, chemical and moisture barriers. Beneq Transform™ ALD cluster tool platform and roadmap deliver manufacturing worthy processes with un-equaled versatility for wafer sizes from 75 mm to 300 mm and is set to transform the More-than Moore era.

Biography
Dr. Rabinzohn is Business Executive, Semiconductor at Beneq. He has 35 years of semiconductor industry experience across the Semiconductor, Semiconductor Equipment and Materials markets and has extensive knowledge on Equipment, Process, Process Integration and Technologies. Prior to Beneq he held several high profile roles including CTO for IoT/MEMS and Advanced Packaging at Lam Research, General Manager at Intermolecular, Managing Director for Microelectronics at Alchimer, and CTO Europe at Applied Materials. He graduated from Ecole Superieure d'Electricite (Supelec) and received a Ph.D. in Materials Science from Paris University.

From Smart Manufacturing Vision to Innovative Advanced Service Solutions

E. Shekel
Senior Vice President Service Strategy and Excellence
Tokyo Electron Limited, Hadera, Israel

Abstract
AI technology continuously becomes a key enabler for smart manufacturing. We / Tokyo Electron（TEL） see our equipment on a development roadmap from Single Standalone Tool to providing integrated manufacturing solutions enabled by AI. TEL will provide an insight where we see the actual benefits of data analysis in the process from R&D and Ramp Up, to High Volume Manufacturing. (e.g. Process Optimization and Virtual Metrology.)
Through TEL SERVICE ADVANTAGE, we can respond to our customers' requests and technical advancements promptly. An important component is our remote connection and data analysis capability. TEL analyzes equipment data from various sensors without the need of a physical on site presence, and provides solutions matched to customer-specific needs.

Biography
Eyal is a twenty-seven years veteran in the Semiconductors industry. Upon his graduation as a Mechanical Engineer from the Technion (Israel leading technical institute), Eyal has joined Applied Materials. In 1997 he has moved-on to Tokyo Electron, served as the Regional Service Manager of Israel, and soon after appointed as the company General Manager.
Since 2005 Eyal has been part of the TEL European senior management, and up to 2019 was responsible for the Service and Support Operations for TEL Europe as a Senior Vice President.
Last year, Eyal has transferred this responsibility onwards, and is now SVP for Service Strategy and Excellence. In parallel Eyal co-leads (as two in a box) the corporate Global Service Committee in TEL Japan.

Where is the next generation of technology experts?

A. Schleicher
Director for Education and Skills
OECD, Directorate for Education and Skills, Paris, France

Abstract
We need to learn for the digital world, but the digital world also opens up entirely new opportunities for learning

Biography
Andreas Schleicher is Director for Education and Skills at the Organisation for Economic Co-operation and Development (OECD). He initiated and oversees the Programme for International Student Assessment (PISA) and other international instruments that have created a global platform for policy-makers, researchers and educators across nations and cultures to innovate and transform educational policies and practices.
He has worked for over 20 years with ministers and education leaders around the world to improve quality and equity in education. Former U.S. Secretary of Education Arne Duncan said that Schleicher “understands the global issues and challenges as well as or better than anyone I’ve met, and he tells me the truth” (The Atlantic, July 11). Former UK Secretary of State Michael Gove called Schleicher “the most important man in English education” – even though he is German and lives in France.
Before joining the OECD, he was Director for Analysis at the International Association for Educational Achievement (IEA). He studied Physics in Germany and received a degree in Mathematics and Statistics in Australia. He is the recipient of numerous honours and awards, including the “Theodor Heuss” prize, awarded in the name of the first president of the Federal Republic of Germany for “exemplary democratic engagement”. He holds an honorary Professorship at the University of Heidelberg.

Skills in the Workforce and People in Processes

A. C. Zimmer
Executive Search & Selection Consultant
ZIAN & Co industrial consulting and recruitment,
Munich, Germany

Abstract

Optimizing people and teams for semiconductor fab manufacturing processes

• Go away from vertical structures and organizations, move into horizontal organizations
• Relocate responsibility to where it is sensible, i. e. to the front-office people handling the job currently at hand
• Create specific, cross-functional teams to deal with specific tasks
• Make sure the best prepared person will lead the team, not the most senior
• Everybody should be aware of the fact that he/she might be asked to step down, if somebody else is better prepared to handle the job at hand
• Stop penny-pinching!

Strategies in attracting young professionals to the semiconductor industry

• Go into schools and universities
• Invite young “high potentials” into the company
• Encourage external support by supporting your local school /university
• Describe exactly why semi is attractive, but tell them: You’ll become addicted, once you’ve joined the branch!
• Communicate, communicate, communicate!

Discussions about critical new skills needed in the microelectronics workforce

• Obviously, the willingness to follow up with the development and the requirements in new technologies and applications
• Furthermore, the willingness “never stop learning”; open communication; flexibility, both horizontally and vertically; give orders and take orders; listen to people: colleagues, clients, suppliers; give and accept remuneration packages which will consider the performance of the company, of the team, and of yourself

Talks on transferring skills from leading experts to younger people and new hires as part of succession planning

• Start implementing new ideas and visions into the educational, long-term plan of new hires and internal “high potentials”
• Support external schooling, if necessary
• Plan for enough time for classes “on the job”
• Bring in retired people, who might be happy to lend a helping hand
• Discuss the career path with employers at least once a year AND STICK TO IT!

Business insights for anticipating future skills needs

• Home office work
• New communications
• Faster decisions, locally, not at HQ

• More responsibility delegated
• More room for improvement suggestions in terms of organizational and decisional processes
• Stop controlling, let the people do their job

Biography
Personnel and industrial consultant with 20+ years experience. Specialist for High-End technologies (LED, PV, semiconductor, electronics, test & measurement, etc.). Active throughout Europe. Customers in Europe, USA, Asia. Permanent visitor of leading exhibitions and conferences ww (INTERSOLAR [EU, USA, PRC], EU PV SEC, SEMICON, LIGHT&BUILDING, ELECTRONICA, PRODUCTRONICA). Excellent international peer-network (Web 2.0). Fluent in three languages, written and spoken. Experienced sales & project manager, coach, used to handle budgets and lead personnel. Customer, target and solution oriented. 10 years professional international industry experience in controlling, marketing, sales, change management, re-engineering. Team builder