Breakthroughs in Medical Technology

Smart MedTech, a SEMI global initiative

M. Grupen-Shemansky
CTO & VP Technology Communities
SEMI, Milpitas, United States of America

Abstract

Smart MedTech is a SEMI global corporate initiative that has broad market and societal impact. Microelectronics (semiconductor chips) are ubiquitous in today's society from PCs, mobile phones and automobiles. Our reliance on microelectronics is exponentially increasing as it propels the world into the Data Age fueling autonomy, 5G and IoT, AI and high-performance computing, and digital medicine. We are on the cusp of a healthcare revolution shifting from a provider-centric model to a personalized health care model that is outcome-based, decentralized, specific to personal health and medical needs, and executed by a team of providers connected like never before.

Microelectronics play an increasingly critical role in the advancement of medical technologies. They drive critical tools and displays in diagnostics and therapeutics, from sophisticated imaging like magnetic resonance to everyday vital signs measuring devices like pulse oximeters. Continuous advancements from physical fitness (steps), vital signs monitoring (heartbeat, pulse, blood pressure), wound healing, smart fabrics, intelligent clothing for diabetes & cardiovascular disease monitoring and smart drug delivery further promotes the rise of the SMART MedTech expansion. Smart, connected and wearable medical devices are now technologically and economically feasible. As health care shifts from institutional to outpatient and home settings, the next decade will be critical in linking data from SMART MedTech devices with data from traditional systems and integrating that information into everyday practice.

We will review the progress SEMI's Smart MedTech initiative has made to date and help set the stage to discuss the future of electronic medical technology, data, and AI. The objective is to explore how SEMI may help the industry to address challenges that are best addressed collectively.

Biography

Melissa Grupen-Shemansky, PhD, Dr. Melissa Grupen-Shemansky currently serves as Chief Technical Officer (CTO) at SEMI / FlexTech. She is responsible for the technical advisory councils and program oversight of consortium R&D projects that are in-part funded by the Department of Defense. These programs support development in flexible hybrid electronics (FHE) and nano-bio applications. Two consortia, the FlexTech FHE and the Nano-Bio Manufacturing Consortium (NBMC), collectively represent over $160M in federal and industrial investment over the span of 8 years furthering the advancement of FHE technologies and ecosystem development. In addition, Dr. Grupen-Shemansky is CEO of the FlexTech Alliance, Inc., a not-for-profit subsidiary of SEMI responsible for the Manufacturing Innovations Institute, NextFlex.

Prior to joining SEMI, Dr. Grupen-Shemansky held various executive management roles in the semiconductor industry. With over 25 years in the industry, she has both Fortune 100 company and start-up

innovation experience in research and development, manufacturing, business development and technology strategy. Dr. Grupen-Shemansky began her career at Motorola in semiconductor research and development. Over the course of 10 years, she held various management positions in silicon and gallium arsenide device fabrication, packaging, interconnect and system integration. Following Motorola, she was the Director of Interconnect Technology and Design Engineering in Lucent, Bell Labs, microelectronics division. She later joined Spansion, the flash memory division of AMD, as Vice President of Packaging and Interconnect Technology. And before joining SEMI, Dr. Grupen-Shemansky was the Senior Vice President of Engineering for Advanced Nanotechnology Solutions, Inc., a startup in 3D ICs and cybersecurity.
Dr. Grupen-Shemansky holds both bachelor's and master's degrees in Chemical Engineering from Pennsylvania State University and a Ph.D. in Chemical Engineering from Arizona State University. She has received various corporate and educational awards, has seven issued patents, numerous technical publications, and is a contributing author to *Failure-Free Integrated Circuit Packages.*

References

From centralized to decentralized: The next era of smart healthcare

J. Mouly
Deputy Director
Yole Group, More than Moore, Villeurbanne, France

Abstract
Healthcare sector, including diagnosis and therapy, has been shifting from a centralized to a decentralized model over the last two decades. This trend was accelerated during the COVID-19 pandemic, with several companies now offering decentralized healthcare monitoring solutions (PCR tests, telemedicine…). Thanks to advancements in technology, miniaturization, artificial intelligence, a deeper understanding of biology, and new techniques, the boundaries of decentralized healthcare settings have been reduced.
For example, microfluidics is now widely adopted in the medical market, increasingly incorporating semiconductor-based technologies such as CMOS image sensors, photonic devices, or acoustic sensors. PoC echography technology is emerging with semiconductor-based ultrasound technologies to better meet the need for patient proximity. MEMS technologies and miniaturized sensors are also expanding the range of conditions (ECG, irregular heart rate, oximetry, sleep apnea, hearing loss) that can be monitored using consumer electronics like wearables along with intelligence at the sensor level.
These developments are bringing the medical and consumer markets closer than ever before. The presentation will highlight the latest market trends and forecast at the sensor level with ecosystem dynamics between consumer and healthcare players.

Biography
Jérôme Mouly is Deputy Director, More than Moore Business Line at Yole Group.
Jérôme manages the expansion of the technical expertise and market know-how of the team. In addition, Jerome's mission focusses on the management of business relationships with company leaders and the development of market research and strategy consulting activities.
He has conducted more than 100 marketing and technological analyses for industrial groups, start-ups, and institutes in the field of MEMS and sensing technologies.
Jérôme has been also deeply engaged in Yole Group's finance activities with a dedicated focus on the commercial exploitation of smart system technologies and access to funding opportunities.
Jérôme Mouly earned a Master of Physics degree from the University of Lyon (FR).

References

Bioelectrical Energy Harvesting and Human Tissue Stimulation

G. Teepe
CEO
Celtro GmbH, General Management, Dresden, Germany

Abstract
To date, almost all medical electronic devices are powered by batteries or through external energy transfer. Technologies have advanced in key domains, opening opportunities to remove the batteries from medical implants. Those are specifically:

1. Moore's Law has further reduced the size of electronic components in conjunction with power requirements significantly. Modern semiconductor technologies are now able to operate in the nanowatt range.

2. The reduction of mechanical structures also reduces the size of the electrodes, which are now able to capture electrochemical potentials from the intra-cell space, that were previously unattainable.

3. Previous cardiac pacemakers were connected to the tissue via few connections and mostly leads. However, new technical possibilities are able to drastically increase the number of connections to the tissue for energy harvesting and increased reliability.

This talk will present on the CELTRO-project to demonstrate and build autonomous pacemakers, opening the technology to further battery-free implants in the human body.

Biography
Dr.-Ing. Gerd Teepe studied electrical engineering at RWTH Aachen University, Germany, where he earned a diploma and a PhD degree. He has been working in the semiconductor industry for 37 years with the following chip companies: NEC, Motorola, AMD and GLOBALFOUNDRIES. He held managerial positions for departments in research, development, marketing and product management. He worked out of Tokyo, Geneva, Toulouse, Munich and Dresden, where he lives together with his wife since 2004.

Gerd Teepe is co-founder and CEO of Celtro Inc., a startup company based on the concept to harvest energy from living tissue to power medical implants.

References

M. Grupen-Shemansky
CTO & VP Technology Communities
SEMI, Milpitas, United States of America

Biography
Melissa Grupen-Shemansky, PhD, Dr. Melissa Grupen-Shemansky currently serves as Chief Technical Officer (CTO) at SEMI / FlexTech. She is responsible for the technical advisory councils and program oversight of consortium R&D projects that are in-part funded by the Department of Defense. These programs support development in flexible hybrid electronics (FHE) and nano-bio applications. Two consortia, the FlexTech FHE and the Nano-Bio Manufacturing Consortium (NBMC), collectively represent over $160M in federal and industrial investment over the span of 8 years furthering the advancement of FHE technologies and ecosystem development. In addition, Dr. Grupen-Shemansky is CEO of the FlexTech Alliance, Inc., a

not-for-profit subsidiary of SEMI responsible for the Manufacturing Innovations Institute, NextFlex.
Prior to joining SEMI, Dr. Grupen-Shemansky held various executive management roles in the semiconductor industry. With over 25 years in the industry, she has both Fortune 100 company and start-up innovation experience in research and development, manufacturing, business development and technology strategy. Dr. Grupen-Shemansky began her career at Motorola in semiconductor research and development. Over the course of 10 years, she held various management positions in silicon and gallium arsenide device fabrication, packaging, interconnect and system integration. Following Motorola, she was the Director of Interconnect Technology and Design Engineering in Lucent, Bell Labs, microelectronics division. She later joined Spansion, the flash memory division of AMD, as Vice President of Packaging and Interconnect Technology. And before joining SEMI, Dr. Grupen-Shemansky was the Senior Vice President of Engineering for Advanced Nanotechnology Solutions, Inc., a startup in 3D ICs and cybersecurity.
Dr. Grupen-Shemansky holds both bachelor's and master's degrees in Chemical Engineering from Pennsylvania State University and a Ph.D. in Chemical Engineering from Arizona State University. She has received various corporate and educational awards, has seven issued patents, numerous technical publications, and is a contributing author to *Failure-Free Integrated Circuit Packages.*

References

Panelist

S. Shanks
Vice President
BlueHalo, Health and Performance Technologies,
Dayton, United States of America

Abstract
Panelist

Biography
Dr. Stephaney Shanks was recently named the Vice President of Health and Performance Technologies Division. Prior to that, she was the Director for Integrative Health and Performance Sciences. Throughout her career, she has fostered a culture of collaboration and excellence to drive innovations that will solve complex human health-relevant challenges. She has collaborated with groups across the United States and is passionate about developing technologies that function in real-world environments. Stephaney has authored several peer-reviewed manuscripts on this topic and a book chapter related to rapid detection capabilities for national security applications. Stephaney received her Ph.D. in microbiology from the University of South Florida that served as the foundation for her development and evaluation of portable biosensor technologies for the Army while at the Center for Biological Defense in Tampa, FL. She then joined UES in 2013 in Dayton, OH, with an initial focus on real-time systems for detection of human performance and disease biomarkers. Over the past decade, Stephaney has led numerous teams across contracts for the Air Force Research Laboratory's 711th Human Performance Wing worth over $200M that have focused on development of wearable, real-time technologies to detect signatures of human molecular responses resulting from stress to infectious agents and exposure to environmental contaminants in military-relevant scenarios. During this time, she has also served as the Industry Chairperson for the NanoBio Materials Consortium since 2020 where she has had the opportunity to work with numerous groups across the public and private sectors to advance the technology readiness level of wearable technologies and to develop roadmaps to set the direction of future wearable technologies that are designed to improve physiological and cognitive performance, as well as to advance the future of medical readiness of the warfighter and to revolutionize the healthcare industry. Stephaney has also participated in the NextFlex Human Monitoring System Technical Working Group for several years where she has assisted in helping roadmaps to improve the manufacturing readiness level of novel human performance-focused technologies. During her time as the NBMC Industry Chairperson, she also had the pleasure to assist in the development and implementation of the NBMC Internship program in collaboration with AFRL that provides opportunities for college graduates and graduate students to engage in hands-on research focused on developing novel monitoring, augmentation, and diagnostic capabilities. Lastly, Stephaney is an inaugural member of the SEMI Smart MedTech Initiative's Governing Council that aims to reduce the time needed to deliver better digital health products and solutions through focus on topics such as Wearables and Artificial Intelligence applications to drive tangible improvements in healthcare delivery and outcomes.

References

Unlocking Novel Opportunities:How 300mm-capable MEMS Foundries will Change the Game

J. Gomez
CEO
Rogue Valley Microdevices, Medford, United States of America

Abstract
Although the semiconductor industry began manufacturing on 300mm wafers in the early 2000s, benefiting from economies of scale, design standards, and standardized process nodes, the MEMS industry has lagged. In MEMS, it's still a single product, single process world – making it time-consuming and expensive to bring new devices to market. As the number of 300mm CMOS fabs continue to increase, so does the demand for 300mm-capable MEMS foundries to support critical technology integration, scalability, and efficiency.

For the MEMS industry, the adoption of 300mm wafers will signify a substantial leap forward in manufacturing automation and cost-effectiveness, yet it still presents many challenges. MEMS processing frequently utilizes non-CMOS compatible materials for metallization, sensing and actuation, making it nearly impossible to support both CMOS and MEMS manufacturing in the same facility. To be successful on a 300mm platform, MEMS foundries will need to manufacture a high mix of products to ensure their facilities run efficiently and at capacity.

This session will explore how Rogue Valley Microdevices – a pureplay, full-service precision MEMS foundry – has reacted to this need for 300mm MEMS with the construction of its second fab, a flexible, 300mm-capable MEMS foundry in Palm Bay, Florida with production set to begin in 2025. Rogue Valley Microdevices expects to address multiple areas of need, including thin film deposition, through-silicon via (TSV), RDL, UBM, wafer level packaging, and is poised to leverage 300mm technology to propel MEMS sensor development to unprecedented heights.

Join us as we explore how flexible, 300mm-capable MEMS foundries promise to revolutionize the integration of microsensors into the supply chain, fostering innovation and unlocking new possibilities for transformative products.

Biography
As founder and CEO of Rogue Valley Microdevices, Jessica Gomez has created a world-class precision MEMS foundry in the heart of Southern Oregon, with a second foundry under construction in Palm Bay, Florida. Integral to her role as CEO, Ms. Gomez practices a business philosophy of offering best-in-class process technology and R&D expertise to customers, to help them achieve the highest quality and reliability in their products. Prior to founding Rogue Valley Microdevices in 2003, Ms. Gomez honed her experience in semiconductor processing and production management through positions at Standard Microsystems Corporation, Integrated Micromachines, and Xponent Photonics.
Ms. Gomez plays an active leadership role within and beyond the technology industry. She is a board member of the prestigious SEMI Board of Industry Leaders, and she is the first executive selected for Spotlight on SEMI Women, which honors accomplished women in the global microelectronics industry.

References