Solid State TECHNOLOGY

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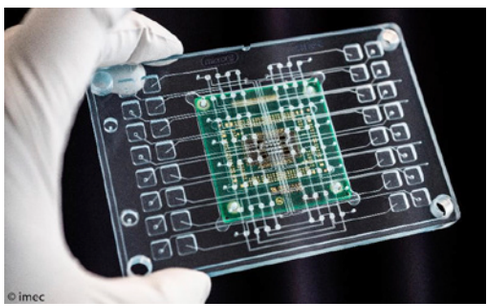
Next On-Chip: Human Organs

BY PETE SINGER

Many new innovations were discussed at imec's U.S. International Technology Forum (ITF) on Monday at the Grand Hyatt in San Francisco, including quantum computing, artificial intelligence, sub-3nm logic, memory computing, solid-state batteries, EUV, RF and photonics, but perhaps the most interesting was new technology that enables human cells, tissues and organs to be grown and analyzed on-chip.



A novel organ-on-chip platform for pharmacological studies with unprecedented signal quality. It fuses imec's high-density multi-electrode array (MEA)-chip with a microfluidic well plate, developed in collaboration with Micronit Microtechnologies, in which cells can be cultured, providing an environment that mimics human physiology.

After an introduction by SEMI President Ajit Monacha – who said he believes the semiconductor industry will reach $1 trillion in market size by 2030 ("there's no shortage of killer applications," he said) — Luc Van den hove, president and CEO of imec, kicked off the afternoon session speaking about many projects underway that bring leading microelectronics technologies to bear on today's looming healthcare crisis. "We all live longer than ever before and that's fantastic," he said. "But by living longer we also spend a longer part of

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DON'T MISS

9:00 am - 9:35 am
KEYNOTE: Machine Learning The Potential to Transform the Semiconductor Industry
Mark Papermaster, Advanced Micro Devices
Yerba Buena Theater

9:35 am - 9:50 am
KEYNOTE: The Future of Autonomy: Semiconductors in the Driver's Seat
Wolfgang Juchmann, AutonomouStuff
Yerba Buena Theater

9:50 am - 10:30 am
KEYNOTE: Industrial AI Applications and Edge Intelligence
Amir Husain, SparkCognition
Yerba Buena Theater

10:30 am - 12:30 pm
SMART MANUFACTURING: Machine Learning and AI in Microelectronics Manufacturing
Moscone South, Smart Manufacturing Pavilion

10:30 am - 11:30 am
PANEL: Federal Strategy for Semiconductor and Microelectronics Innovation
Yerba Beuna Theater

2:00 pm - 4:00 pm
SMART TRANSPORTATION: Future of Automobility Supply Chain: Semiconductors and the New Technology Stack
Moscone North, TechXPOT North

Data Economy Era Begins

BY SHANNON DAVIS

Speaking at imec ITF Forum on Tuesday, Scott DeBoer, Executive Vice President of Technology Development at Micron opened his keynote address with a video that featured astounding statistics: Micron memory and storage is a part of storing the data generated by practically every type of smart device and high speeding computer processing — nearly 2.5 quintillion bytes per day.

"We're turning information into insights and activating data to reach your higher realms of productivity and innovation," the video's narrator said. "We are Micron, and we are transforming how the world uses information to enrich lives."

This would be the central theme of DeBoer's talk, as he outlined the disruptive technology advancements taking place in the memory world and the markets they impact. According to DeBoer, we are in the early stages of the data economy.

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Semiconductor Applications Diversify

BY DAVE LAMMERS

The semiconductor industry is undergoing several macro-level changes that bode well for the industry's future growth, said Paul Stockman, head of market development for the electronics division of the Linde Group. From his base in Taipei, Stockman is watching multiple drivers pulling the industry forward.

New markets, ranging from artificial intelligence to 5G to autonomous vehicles, are demanding new compute and storage strategies.

"There is diversification at the leading edge," Stockman said. "It is no longer just about processors for PCs, servers, and mobile phones. Customers in both the integrated device manufacturer and foundry spaces are seeing strong demand for bleeding-edge products, such as graphics processors being used for AI applications. All of these products have slightly different requirements, they are optimized differently. So it no longer about a single process or a narrow portfolio of processes. Our customers have to be very aggressive about how how they develop their processes."

At the leading edge of seven nanometers, Stockman said "you see the applications really pulling the technology development. We see major customers accelerating their commercialization of seven nanometers in response to that pull."

The memory market is also changing due to new applications on the horizon. "It is not about how fast one can do the same process over and over again, but how you handle very, very large data sets in parallel," said Stockman, who holds a doctorate in chemistry from the California Institute of Technology.

Startups as well as established semiconductor companies are developing new architectures for Deep Learning, some of which involve processing-in-memory approaches. "The jury still is out. The likely answer is that there is not going to be a single winner because the application spaces are diversifying."

The semiconductor industry is more robust because of that diversification and the pull coming from new application developers, rather than just pushing established products to the next node.

Paul Stockman, Linde Group

"As recently as five years ago, the major IDMs and foundries would lay out a technology roadmap and you would know what products were coming out in a couple years. System companies designed their applications and systems around those roadmaps," he said. Now, the "encouraging thing is that it is not just a single application, and it is not dependent upon a handful of semiconductor manufacturers."

Stockman was asked about the impact of large companies — including Amazon, Facebook, Google, and Microsoft — developing their own processors targeted to their unique data analysis needs. "Companies like those you mentioned have traditionally not gone that way. And then some of the fabless companies like Nvidia are demanding more from the foundries than before."

The result is widening demands on the foundries and IDMs to push performance while also meeting the needs of applications such as power devices, all of which will drive the need for new and expanded fabs. Another factor is the development of new memory types, which will require new fabs over the longer term. The industry "could certainly see a new class of fabs based on these new memory devices," Stockman said.

The pull is diversifying geographically as well, with China as the prime example. China's State Council has laid out guidelines for the "Made in China 2025" plan to strengthen China's integrated circuit (IC) industry. Stockman, who has been based in Taipei for the past 1.5 years, said China's "Big Fund" to support the plan has entered its second phase. Most of the money behind the first phase, which started in 2015, has been allocated, and the second round is underway, open to investments from outside the central government.

China's central government, Stockman said, "is being very public about what the aims are for this second phase of the Big Fund. Investments are welcomed from both inside of China, through private corporations or through investment vehicles for municipal governments, and potentially from outside of China as well."

The central government also has emphasized leadership, in some cases by former government officials. And the second phase appears to be more diversified, he said, with less emphasis on very-large-scale projects and more interest in supporting the wider ecosystem, including equipment and materials suppliers.

"If you think that the big fund just began in 2015 and a typical fab takes somewhere between 1.5 and three years to go from announcement to first commercialization, we are starting to see the first fruits as well as some of the early struggles.

"I think people also are concerned about what the impact is going to be on the overall market. I think the real thing to look at isn't necessarily whether the big projects stick — and we do see a lot of headlines about leading-edge foundry and memory — but rather what is likely to happen in the middle and trailing-edge foundry space. This is an area where the technology can be ramped faster and where the impact on the overall supply and demand is going to be felt first."

China watchers are also keeping a close eye on how the large Chinese telecom companies will develop the 5G wireless technology, including the design of the 5G silicon and whether China-base foundries will make the bulk of the 5G devices.

Stockman said several Chinese companies are "known leaders" in 5G device design. "What remains to be seen is whether some of the foundries in China can come up quickly enough for the ramp in 5G silicon that's expected to start next year," he said.

Another key area to watch is artificial

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Entegris Acquires SAES Pure Gas Business

Entegris, Inc. closed on the acquisition of the SAES Pure Gas business, from SAES Getters S.p.A., an advanced functional materials company headquartered in Milan, Italy. The SAES Pure Gas business, a leading provider of high-capacity gas purification systems used in semiconductor manufacturing and adjacent markets is based in San Luis Obispo, California and will report into the Microcontamination Control division of Entegris. Under the agreement, Entegris will purchase the shares and assets which comprise the SAES Pure Gas business for approximately $355 million, subject to customary purchase price adjustments.

Materials purity plays an increasingly critical role in the performance and reliability of advanced semiconductors as the sensitivity to contamination approaches the parts per quadrillion level. Advanced memory devices require significantly higher gas consumption per processed wafer to support shrinking geometries and multi-layer device architectures. As a result of this heightened sensitivity to molecular contamination and increased gas consumption, semiconductor manufacturers are depending on bulk gas suppliers to deliver process gases that meet new purity requirements.

"With this acquisition, our customers will benefit from a complete portfolio of gas purifications solutions for both bulk and specialty gases," said Bertrand Loy, president and Chief Executive Officer of Entegris. "We are excited about the value this transaction will create, as it demonstrates our strategy of augmenting our organic growth with high-value acquisitions that leverage our global business platform and broaden our technology portfolio."

"As we executed our evolutionary strategy for SAES Group and considered potential acquirers for the SAES Pure Gas business, we viewed Entegris as the ideal partner given its leadership in the semiconductor industry, the complementary nature of its filtration and purification offerings, and its financial and operational strengths," said Massimo della Porta, president of SAES Getters S.p.A.

Semiconductor Applications cont'd from page 8

intelligence, including the technologies behind self-driving vehicles. Stockman said Chinese companies are leaders in the "development of the fundamental compute technology as well as the chip designs. They certainly have the customer base now for these leading-edge processes. I think it's just a matter of time before you see the silicon being realized in China."

By some estimates, the semiconductor industry now accounts for about 2 percent of the world's GDP, and semiconductors are becoming more interdependent with the overall world economy.

"This is a very positive time," Stockman said.