

Next Generation Microelectronics Devices Enabled by Atomic Layer Deposition

Mark Saly

^a Applied Materials, USA
Mark_Saly@amat.com

The semiconductor industry has enjoyed unprecedented growth over the last two decades fueled by the PC/internet era (2000s) and the Mobile/Social Media era (2010s). We are now entering the Artificial Intelligence/Big Data era which is predicted to reach \$1T by the early 2030s. AI applications require huge amounts of computational power and power consumption. To keep up with computational demands and ensure that the industry does not surpass the global power supply, device makers are looking at ways to increase compute and while driving lower power consumption. Chip manufacturers are leveraging key device architecture inflections to secure leadership positions in the AI competition. Inflections such as those in high-performance logic (gate-all-around transistors, backside power delivery), compute memory (3D-DRAM, vertical transistor DRAM) and advanced packaging (high-bandwidth memory and heterogeneous integration) are blazing the trail. The image below shows TSMC's device roadmap (Source TSMC). After nanosheet (TSMC's flavor of gate-all-around transistors entering production today), TSMC will enter the 3D regime with transistor stacking. 3D integration of devices is a common theme across the industry from logic to memory. Stacking the devices is shown to increase performance, decrease area cost, and decrease power consumption. Realization of these complex architectures requires very stringent fabrication steps with various patterning techniques. Atomic Layer Deposition is a key enabler to fabricating next generation devices. Applications such as conformal deposition, gap fill, extreme thin film deposition (<10Å), and area selective deposition are all in play as we move to next generation devices. Applied Materials is a key leader in materials innovation for the microelectronics industry, and as such are putting huge efforts into creating solutions for the device manufacturers. This talk will focus on how Applied Materials is leading the industry in solving these extremely difficult problems and give insight into what is still needed as we move forward

