Semiconductor Technology Node Evolution from Planar to Nanosheets: Towards 2nm & Beyond

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This Seminar is aimed at presenting the latest developments in complementary metal-oxide-semiconductor (CMOS) technology in front up 2nm devices and options for beyond 2nm CMOS nodes. Driven by the requirements for higher speed, energy efficiency and integration density of integrated-circuit products, in the past six decades the physical gate length of metal-oxide-semiconductor field-effect transistor (MOSFETs) in CMOS technology has been scaled to sub-20 nanometres. The technology node definition has evolved over time from physical gate length to other specific metrics such as CPP (contact poly pitch) x BEOL metal pitch approaching 2nm node. Performance improvement beyond FinFETs adopting the Gate-All-Around (GAA) device architecture, such as stacked Nanosheet transistors, offering superior short channel control and allowing performance scaling by increasing the number of nanosheet stacks will be discussed. The CFET, where n- and p- type transistors are stacked vertically and monolithically is thought to be the transistor architecture to come after the gate-all-around multi-channel transistors. These are being adopted at the 3nm and 2nm nodes by chip manufacturing leaders TSMC, Samsung and Intel. We anticipate that innovations in transistor technologies will continue to have a central role in driving future materials, device physics and topology, heterogeneous vertical and lateral integration, and computing technologies.

Agrivoltaics: Where Engineers Meet Farmers

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Agrivoltaics (Agri-PV) is defined as land-use concept that co-locates photovoltaic (PV) energy generation with agriculture and nature conservation, which are dependent on sunlight. Agri-PV presents an opportunity to maximize land use efficiency while promoting eco-friendly energy generation and agricultural productivity. Agri-PV installations should guarantee that the agricultural activity is at least preserved, and at most improved. An approach of PV implementation on farmland in harmony with agriculture and nature conservation, needs to be at the core of Agri-PV development and that is where engineers and farmers need to learn from each other. Certain skills and knowledge are needed to further accelerate the deployment of Agri-PV. The talk will present the design of PV systems involves panel configurations such as monofacial fixed-tilt modules suspended above agriculture, monofacial single-axis modules fitted with trackers which alter their angle throughout the day, and vertical bifacial modules set in fence-like rows. The configurations are based on the type of crops grown for optimal land use, and an increase in land productivity. Beyond that, PV modules can provide shading and shelter in dry climates to make irrigation and water retention easier, fostering more vibrant ecosystems beneath them. Crops beneath or adjacent to panels can also increase their efficiency by cooling the system through transpiring water vapors. Future trends on transparent PV and the integration of artificial intelligence (AI) and machine learning (ML) for planning & monitoring system performance will also be introduced.