

Trends and Challenges in Micro- and Nanoelectronics for the Next Decade

C. Claeys
Fellow IEEE, Fellow ECS
Leuven, Belgium

Semiconductor technology knows an exponential evolution in the last decades and is fully integrated in our everyday life. According to the Semiconductor Industry association (SIA) the global semiconductor industry sales reaches US\$ 600 billion in 2022, corresponding with a shipment of more than 1.2 trillion components. This necessitated implementation of many novel materials, advanced design concepts and new transistor structures.

Increased device performance and reduced power consumption, while maintaining a good manufacturability and yield performance without penalizing the cost/function, are driving microelectronic research towards 3-nm technologies. A large variety of device architectures such as FinFETs, TFETs, negative capacitance, Gate-All-Around, nanowires (NWs), nanosheets (NSs) in both horizontal or vertical configurations, CFET and Forksheet structures are extensively investigated for both logic and analog/RF building blocks enabling System-on-Chip (SoC) applications. Innovative heterogeneous Ge and III-V technologies on a Si platform are also gaining interest. Wide bandgap materials such as III-nitrides have a strong potential for RF and power parts. Increased system functionality and density is achieved by 3D integration based on Through Silicon Vias (TSV) and/or monolithic or 3D sequential integration on a Si substrate. The evolution, trends and challenges imposed on materials and devices are discussed for different integration technologies.