

## Two-dimensional Materials: Research to Manufacturing

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### Abstract

The success of 2D materials-based technology will depend on the scientific and engineering community's ability to identify applications whose performance characteristics can only be achieved using 2D materials. It is critically important to learn from the semiconductor industry's approach they used to create their ecosystem in order to support a 2D material-based product industry. The creation of a focused device-based or application-based roadmap can provide critical information and guidance to the scientific and engineering community from universities to government labs to industrial labs, and finally to equipment, materials and chemical suppliers. This approach will solidify the ecosystem that will support technology development and manufacturing for 2D materials products. In this presentation, I will discuss 2D materials status and integration challenges that the community is facing together with a discussion on how universities, government and industrial labs can play a role to promote collaborations with suppliers.

### Bio



Dr. Luigi Colombo earned BS (1975) degree in Physics from Iona College (NY) and PhD (1980) degree in Materials Science from the University of Rochester (NY). He is now an Adjunct Professor of Materials Science & Engineering at the University of Texas at Dallas after a 36-year career at Texas Instruments (TI). He joined TI in 1981 to work on infrared detector materials where he performed research on II-VI compounds and developed a HgCdZnTe liquid phase epitaxy process and put in production in 1991; this process is still in production today. Luigi has developed high-k capacitor MIM structures for DRAMs, SiON/poly-Si and Hf-based high-k gate/metal transistor gate stacks for advanced transistor devices beyond the 90 nm node. For about 10 years he was responsible for the development of new materials such as graphene, hexagonal boron nitride and transition metal dichalcogenides and their integration in new device flows as part of the Nanoelectronics Research Initiative (NRI). During this period Luigi developed the first catalytic CVD graphene process on Cu in collaboration with researchers at UT Austin. Over the last 3 years he has kept busy with a few consulting jobs on 2D and I-VI materials in addition to studying new materials for radiation sensors. He has authored and co-authored over 170 refereed papers, made over 200 invited and contributed presentations, has written 5 chapters in edited books,

and holds over 125 US and international patents. He is on the Strategic Advisory Council of the European Graphene Flagship, has been on the advisory board of the UC Berkeley Center for Energy Efficient Electronics Science External Advisory Board, the SRC-NRI Technical Program Group, and the SRC-STARnet Strategic Advisory Board. He is also a retired-TI Fellow, and is an IEEE and APS Fellow.