Compound Semiconductor Process Technologies, Design Kits, and Volume Production

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The measure of “Best” technologies has evolved over the past 20 some years, from raw device performance to additional stability, controllability, etc., and now gauged by total design cost and product revenue. Many Electronic Design Automation (EDA) Solutions for electrical simulation, physical verification, design for test, design for manufacturing, design for yield, etc., are aimed at lowering the total design and product cost. Silicon based process technologies, with a head start over compound semiconductor and its target applications of more complicated circuits in terms of device counts and lower power, have incorporated these commercial and/or in-house EDA solutions in their respective Process Design Kit (PDK). For compound semiconductor process technologies, which find their applications in large signal RF MMIC and high speed Analog-Mixed Signal (AMS) applications, very few of their PDKs are implemented and supported with such solutions. Semiconductor history and current reality shows that the best performing technology won’t be product relevant without an adequate PDK as its window and delivery vehicle.

This presentation will demonstrate one the few PDKs for compound semiconductor process technologies with a complete implementation of electrical/physical/electrical magnetic and statistical yield/manufacturability functionalities, emphasizing large signal RF MMIC applications. The underlying EDA solutions and automation opportunities between design, manufacturing and industrial engineering will also be discussed.

The problems a PDK addresses will be elaborated with a discussion of requirements by two somewhat opposite aspects of a semiconductor process. One end of the spectrum is the application – focusing on the total cost of product development, especially the pains experienced by designers, while the other is the process development – focusing on the application support and releases, especially the migration of a product from one generation technology to the next. Clear distinctions will be made for PDK implementation considerations for mature technologies, and ones in development, for applications of technology to initial and derivative product development. Those distinctions are important for a fables house or vertically integrated player. It will be shown the effect and impact a PDK can have on both compound semiconductor process technology - its adoption and efficient use, and product development cost saving – technology clarity, error reduction and elimination, yield improvement, etc.

Dr. Hongxiao Shao received his Ph.D. in Computational Condensed Matter Physics from Rutgers University in 1992. In late 1992, he joined Rice University as a Post-Doctoral Researcher where he focused his work on the studies of dynamic effects of impurities at surfaces/interfaces, and quantum dot systems. In 1993, he joined Quantum Electronic Structure Institute (QUEST) at the University of California at Santa Barbara as a research fellow, continuing his studies on Quantum Electronics and the research on Stochastic Process of Surface Morphological Phenomena. In 1995, he joined the R&D staff at EDS, and then HP/Agilent working on Computer-Aided-Engineering, Design and Manufacturing Solutions for electronic systems. Since 2000, he has been a part of Advanced Development Group at Conexant/Mindspeed/Skyworks Solutions, responsible for Design Kit and Design Environment development for Semiconductor/Package Process Technologies. His current interests include circuit simulation and field solver technologies in both time and frequency domain for electronic systems, and product level end-to-end development methodology and automation, from spec to final product verification to post product release customer support.