The Evolution of Process TCAD in Semiconductor R&D and Manufacturing

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Abstract: Today, nearly every aspect of an integrated circuit is designed using electronic design automation (EDA) software. Technology computer aided design (TCAD) tools are used for modeling front-end-of-line manufacturing, including the fabrication (Process TCAD) and electrical characterization (Device TCAD) of individual transistors. These tools have been utilized over the last six decades to help realize Moore's law scaling – the driver behind the exponential increase in transistor density – alleviating the high cost of expensive fabrication experiments. The development of each logic node has, in turn, driven the development of the TCAD tools to account for new fabrication and manufacturing techniques.

The basic fabrication steps in building a full transistor with Sentaurus Process TCAD are ion implantation, diffusion and dopant activation, etching, deposition, and oxidation where process conditions such as the ambient chemical composition, temperature, and pressure during individual fabrication steps are typically included. While these basic steps exist in some form in each new technology node, how they are realized changes, for example the development of 3D oxidation models for FinFETs. In addition, as traditional scaling comes to an end, system level design considerations, such as back-end-of-line parasitic capacitance and resistance need to be accounted for opening up new processing techniques such as Atomic Layer Deposition and Etching (ALD/E).

In this talk, I will discuss how Process TCAD has evolved to keep up with technology evolution and how new drivers in electronics applications, such as 5G, IoT, and autonomous vehicles are driving the next generation process TCAD tools.

Bio: Shela Aboud is a Sr. Product Marketing Manager at Synopsys. She has a Ph.D. in EE from Arizona State University and more than 20 years of experience in TCAD tool development, applications support, and product marketing, including 7 years at Synopsys in the TCAD group. Shela is also the author of more than 100 peer reviewed publications and presentations at internationally renowned conferences and workshops.

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