Electrification & Power Semiconductors

The SiC Power Revolution is Ready for High-Volume Car Manufacturing

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Abstract
Early adopters are already receiving significant quantities of SiC devices as we ramp up for the broader automotive industry. SiC wide-bandgap characteristics enable extraordinary efficiency in EV traction systems, on-board chargers, and DC-DC converters, as well as new applications including climate compressors, fuel cell power DC-DC, and high-speed air compressor pumps.

By 2025, most European carmakers will have transitioned to the 800V DC bus domain where the high-voltage efficiency and thermal performance of SiC is even more appealing.
The SiC revolution has many strategic implications and we will describe ST's manufacturing and vertical integration initiatives to meet the mounting demand, the ambitious electrification targets of legislators, and the stringent quality requirements of critical automotive applications.

Biography
Manuel Gärtner–Director – Wide bandgap & Electrification–Automotive & Discrete Group - STMicroelectronics

Manuel Gärtner joined STMicroelectronics Munich in 1999 and is Director of wide bandgap & electrification for automotive applications. He has worked as a development engineer for smart power products and as a research engineer at the university of Berlin.
He has published over 35 articles and conference speeches on automotive power electronics and holds more than five different patents.
He is member of the EEHE Scientific Advisory Board, the SIA POWER TRAIN & ELECTRONICS scientific committee for Power Electronics, and he represents STMicroelectronics as principal partner in ECPE.

Paving the Road to Electrification - Approaches to Silicon Carbide epitaxy - Materials and Challenges

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Abstract
Epitaxy represents a fundamental step in the realization of silicon carbide devices. The quality of the epitaxial process is in fact one of the determining factors both for the electrical yields of the devices and for their durability. The epitaxial reactor is the main instrument, and it represents the result of decades of development.
Silicon carbide epitaxy brings with it several unique challenges, long known in research and development but only recently proven in industrial volume production.
The need to face and solve these challenges has led the world's few manufacturers of epitaxial reactors to take significantly different directions of development. Some important criteria in the design of the reaction chamber of an epitaxial reactor are by way of example the relative direction of the gas flow relative to the wafer, the temperature of the walls, as well as the number of wafers processed per cycle. The solid, liquid and gaseous materials inside the reaction chamber hold a delicate balance and allow to safely reach the high temperatures typical of this process.
The purpose of the presentation is to illustrate the main challenges related to epitaxy on Silicon Carbide and to retrace the most common choices adopted today on the market. The focus is on the key performance indicators used in epitaxy selection – namely device yield, cost of ownership and footprint density driving customer equipment choice.

Biography
Silvio Preti - born in Milan in 1990 - graduates in 2015 from Polytechnic of Milan (Bachelor in Mechanical Engineering and Master's Degree in "Turbomachinery and Internal Combustion Engines). In the same year he joins LPE as a mechanical designer. Immediately after the SiC business undergoes a sudden and tremendous growth, and within LPE the need to respond to the growing demand with an adequate product becomes evident. Silvio Preti is then assigned the management of the engineering department, a function he holds for 5 years before dedicating himself completely to product development. Following the acquisition by ASM, he holds the position of Global Product Manager for SiC epitaxial reactors.

Radiation Hardness of SiC TrenchMOS Devices for Automotive Applications

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Abstract
The lecture will investigate the cosmic radiation hardness of SiC TrenchMOSFET devices. It will sum up the effect of cosmic radiation on SiC power devices and the way of characterizing the cosmic radiation hardness. We will point out guidelines to improve the cosmic radiation hardness of devices and a method to estimate it in early computational design. Furthermore, we present our experimental results of the investigation of the cosmic radiation hardness of SiC TrenchMOSFET devices. Finally, we will evaluate on the results with respect to the operation of the devices in a traction inverter for electric vehicles in different operations modes.

Biography
Stephan Schwaiger studied physics at the university of Hamburg and finished with a doctorate degree in 2012. He started in semiconductor industry in Bosch's central research department working power semiconductors. Since 2015 he works on the development of SiC semiconductors for the section Automotive Electronics at Bosch focusing on technology and device development.