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Electrification & Power Semiconductors

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

M. Gärtner
STMicroelectronics, EMEA Region - ADG Marketing and Application, Aschheim-Dornach, Germany

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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.

Epitaxial Growth of SiGe/Si Multi-Layers for Advanced Logic Devices

R. Khazaka
ASM, Leuven, Belgium

Abstract
In this talk, we will review the requirements and challenges of SiGe/Si multi-layers epitaxy for advanced technology nodes, namely complementary FET (CFET). CFET concept relies on stacking top and bottom devices vertically. To enable such integration, the epi stack should be thicker and different compared to gate-all-around architecture. Thus, requiring two different Ge contents in the stack to create etch contrast. In general, high Ge content SiGe layers show relaxation signs earlier than low Ge content SiGe layers, due to the increased lattice mismatch with Si substrate. Therefore, the high Ge content combined with several SiGe/Si layers would make it prone to relaxation and misfit dislocation (MD) appears on the surface. These defects would be detrimental for device performance and needs to be eliminated. Firstly, the characterization techniques suitable to detect such defects would be discussed. Moreover, optimized process conditions to enable fully-strained MD-free wafers will be presented highlighting the feasibility of the stack on industry relevant specs. Finally, transmission electron microscopy images will be shown depicting the sharp interface transition and smooth top surface morphology.

Biography
Dr. Rami Khazaka is Principal Technologist leading the Research and Development (R&D) epitaxy team at ASM Belgium. Dr. Khazaka joined ASM in 2018 as Senior Process Engineer to develop Group IV epitaxy processes. Before joining ASM, he was a postdoctoral researcher at CEA-LETI where he developed material for both CMOS and optoelectronic applications. Dr. Khazaka has more than 15 filed US patents and co-authored more than 30 papers in peer-reviewed journals. He holds a Master degree in renewable energies science and technology from Ecole Polytechnique, Paris, France and Ph.D. in Electronics from the François Rabelais University, Tours, France.

Radiation Hardness of SiC TrenchMOS Devices for Automotive Applications

S. Schwaiger
Robert Bosch GmbH, Automotive Electronics,
Reutlingen, Germany

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.