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Cultivating a Thriving SiC Market

Turbocharged Transistors: Silicon Carbide Shifting to Next Gear

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Strategic Vision. Smart Implementation.

Abstract

In the context of global megatrends – including the climate crisis, the impact of AI on various industries, and global decoupling – the demand for high-performing, efficient, and reliable power electronics remains substantial. Silicon carbide-based power semiconductors offer technical advantages over traditional silicon-based solutions. The automotive sector is expected to drive significant market growth. However, in specific applications, other substrates like Si, GaN, or ultra-wide bandgap materials may remain relevant or take precedence. To foster a fast-growing and sustainable SiC market, addressing three key challenges in product development, process optimization, and raw material supply chain management will be essential for the entire value chain.

Biography

Since 2019: Porsche Consulting Germany and France Manager with competence focus semiconductor technology, product strategy and development, product cost optimization, design to cost, cost reduction and profitability programs.

References

Challenges in Scaling SiC Power Chip Manufacturing: A Material Supplier's Perspective

M. Puttock
Sr. Director - Advanced Technology
Engagements, Office of CTO
Entegris GmbH, Office of CTO, Dresden, Germany



Abstract

The era of SiC-based power chips has undeniably begun. Factories are producing substrates and chips to meet current demand, but given that these chips aim to improve end-use efficiency, is the manufacturing process of SiC chips itself running efficiently?

The answer is, not yet. But that should not be surprising as high volumes have not been running for long enough for teething problems to be solved. Here we will touch on some of the areas where SiC material properties present the chip makers with challenges. These challenges are at varying levels of resolution and will no doubt be solved in time. This resolution will enable SiC power chips to take its predicted place in the future eco system.

Our examples shown are based on Entegris's view which is determined by our particular contact points. So, this may not be an exhaustive list. What we see are challenges relating to:

- 1. CMP** (Chemical Mechanical Planarization): SiC is harder than Si.
- 2. Handling**: SiC is more brittle than Si.
- 3. Implantation**: SiC is more difficult to implant than Si.
- 4. Thermal processing** for wafer growing and epi processes: SiC processes are hotter than Si.

For each of these areas, we will provide insights and considerations, highlighting the path toward achieving efficient, high-volume SiC power chip manufacturing.

Biography

Mark has worked in the semiconductor industry for over 30 years with a background in Physics and Plasma processing. From 2014, as a team member of the Entegris CTO office, Mark follows technology trends and collaborates with Entegris' global product development teams to develop timely and differentiated new materials and components for the world's leading semiconductor manufacturers.

References

M. Puttock
Sr. Director - Advanced Technology
Engagements, Office of CTO
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Biography

Mark has worked in the semiconductor industry for over 30 years with a background in Physics and Plasma processing. From 2014, as a team member of the Entegris CTO office, Mark follows technology trends and collaborates with Entegris' global product development teams to develop timely and differentiated new materials and components for the world's leading semiconductor manufacturers.

References

SiC End to End Manufacturing Fab Management

L. Riva
SiC Campus Fab Manager Director
ST Microelectronics, Quality Manufacturing
Technology, Catania, Italy



Abstract

Silicon Carbide, thanks to its electronic and thermal properties, is a revolutionary bulk substrate for Power Devices Schottky Diodes and Field Effect Transistors, both in the automotive and industrial market segments. SiC substrate, since its discovery in 1893, has been a case of study but only in the last few years has become a subject for manufacturing first at 150 mm and now also at 200 mm where fully vertical integration from powder to final product is a key factor of cost and quality success. Automation supported by Any Logic model is functional to industrial KPI. Most of the defects present in the crystal ingot, micropipes, polytype and others, only partially recovered during the epitaxy steps can determine electrical failures at device level. For that reason Artificial Intelligence with the associated statistical models is suitable to identify specific defects improving significantly the quality of the substrates and increment yield.

Biography

Luca Giovanni Riva was born in Monza Italy in 1969. He graduated in Solid State Physics with a thesis on Advanced Metalization Electromigration study. He has been working at ST Microelectronics since 1994. In the first ten years he worked in R&D focusing on new deposition models for micrometric vias filling. Later he developed the integration of BEOL package of BCD devices with memories embedded. In 2001 he moved to reliability department focusing on the interaction between process and failure modes. From 2008 he took the responsibility for the Operations of Analog products in the Analog & Power Group and since 2023 he has been appointed Director of Operations in Catania SiC Campus.

References

Panelist

M. Mueller
Vice President Strategy and Development
Semiconductors Powerelectronics
Volkswagen, Munich, Germany



Abstract

Panelist

Biography

Dr. Maïke Mueller graduated in chemistry from Technical University of Munich and received her doctorate from the Humboldt University of Berlin while working at the Federal Institute for Materials Research and Testing. She started her career in the semiconductor industry as a quality and process engineer at Osram Opto Semiconductors in Regensburg. The past 11 years she has been working in several roles within Infineon's automotive and consumer divisions as product marketing manager for high-power applications and head of product quality management for power and system IC devices among others. Since Oct 2024 she joined VW Group as Head of Strategy & Development of Semiconductors, Group Powerelectronics.

References

Panelist

R. Bornefeld
Sr. Vice President of Business Line and
Engineering Power Semiconductors and Modules
Robert Bosch GmbH, Reutlingen, Germany



Abstract

Coming soon

Biography

Ralf Bornefeld is Senior Vice President with responsibility for business line and engineering of Power Semiconductors & Modules at Bosch. He joined Bosch in November 2019. Before he held various management positions at Infineon Technologies AG: senior director technology in frontend production from 2005-2008, senior director engineering of automotive sensors until 2011 and finally vice president and general manager business line automotive sensors. Ralf started his career at Elmos Semiconductor in 1992 as a technology development engineer. Afterwards he took several management positions until end of 2004, mostly serving as vice president of R&D and eventually as vice president of business line microsystems. Ralf Bornefeld was born in Schalksmuehle, Germany, in 1964. He graduated with a degree in Electrical Engineering from Technical University of Dortmund in 1992.

References

Panelist

E. Sabonnadière
Sr. Vice-President of the Division Automotive &
Industrial
Soitec, Grenoble, France



Abstract

Coming soon

Biography

Since July 2021, Mr Sabonnadiere is Senior Vice-President of the Division Automotive & Industrial of Soitec. He is also in charge of the Strategic Program SiC. From September 2017 to July 2021, Mr Sabonnadiere was CEO of CEA-Leti, one of the most innovative Labs in the industry of microelectronics and biotechnology, based in Grenoble (France). Previous two years, Mr Sabonnadiere was CEO & Chairman of the Business Group Professional of Signify, former Philips Lighting (Amsterdam). From 2014 till 2016, he served as Senior Associate of MidCap Private Equity firm named Gimv (Paris, Antwerpen, Munich, Den Haag). Previously in his career, Mr Sabonnadiere was CEO & Chairman of General Cable Europe & Africa (Barcelona). From 2005 till 2008, he was CEO of NKM Noell GmbH, the German branch of the group REEL. Mr Sabonnadiere was vice-president of the Distribution Transformers division of Alstom T&D for 5 years. He began his career in 1992 with Schneider Electric holding various positions including that of Managing Director of equipment units for 10 years. Mr Sabonnadiere has a strong innovation and technological background combined with a successful business track record over decades and some key innovations adopted into the markets. With 30+ years of executive leadership of large operations, he produced high level performances of operating margins & results and generation of cashflow. He gained a sound experience of change management in large multi-cultural organizations to adapt to new markets conditions and dynamics in European and International environments. He designed and set-up ambitious strategic plans including some merge & acquisitions. Mr Sabonnadiere believes in operational excellence, innovations in technology, talents management and enthusiasm in leadership. His sound experience in the European industry make him a highly knowledgeable and respectful Board member. Mr Sabonnadiere obtained a PhD in physics (France), and an engineering degree in Information Technology (France). He holds an MBA (France). Mr Sabonnadière is a fully qualified instructor at the ski school in Les Ménuires, and member of the Advisory board of IAC Consultant and Sparring Capital firm.

References