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Silicon Carbide (SiC) Market for Electric Vehicles - A Global and Regional Analysis: Focus on Propulsion Type, Vehicle Type, Application Type, Product Type, Voltage Type, and Country-Level Analysis - Analysis and Forecast, 2023-2032

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Abstracts

Silicon Carbide (SiC) Market for Electric Vehicles (EVs) Overview

The global silicon carbide (SiC) market for electric vehicles is projected to reach $9,031.2 million by 2032 from $513.0 million in 2022, growing at a CAGR of 33.02% during the forecast period 2023-2032. The growth in the silicon carbide (SiC) market for electric vehicles (EVs) is expected to be driven by the superior properties of silicon carbide (SiC) material as compared to silicon, growth in the demand for electric vehicles, and increasing investment toward enhancing SiC manufacturing capacity.

Market Lifecycle Stage

The silicon carbide (SiC) market for electric vehicles (EVs) is in a growth phase. The silicon carbide (SiC) market for electric vehicles is experiencing rapid growth and transformation, driven by the compelling advantages that SiC technology offers to the electric mobility sector. SiC, a semiconductor material with superior properties compared to traditional silicon, is revolutionizing the power electronics landscape in EVs. Silicon carbide (SiC) technology's integration into EV power electronics is revolutionizing vehicle performance, enabling faster acceleration, extended range, and efficient energy usage, ultimately enhancing the overall EV driving experience. Silicon carbide (SiC)'s high-frequency capabilities are vital for high-power, fast-charging stations, accelerating the expansion of charging infrastructure and reducing charging times for electric vehicles. Collaborations between electric vehicle manufacturers,

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semiconductor companies, and research institutions are driving innovation in SiC technology, resulting in continuous advancements and cost reductions. However, silicon carbide currently comes at a higher cost compared to traditional silicon-based components, impacting its widespread adoption. Scaling up silicon carbide (SiC) production to meet the growing demand from the EV market remains a challenge, requiring further investments in manufacturing capabilities and supply chain optimization. Therefore, addressing cost challenges and expanding manufacturing capabilities is expected to be crucial for companies in realizing silicon carbide (SiC)'s full potential in shaping the electric vehicle landscape.

Impact

The silicon carbide (SiC) market for electric vehicles (EVs) is driven by several factors, such as the benefits of silicon carbide (SiC) material over silicon, growing electric vehicle sales, and growing investment toward encouraging SiC manufacturing capacity by the SiC manufacturers.

Silicon carbide (SiC) manufacturers are partnering with other key stakeholders and investing significantly toward the development of improved silicon carbide (SiC) materials with enhanced properties to mitigate the growing need for advanced power electronics in electric vehicles. With growing efforts by electric vehicle original equipment manufacturers (OEMs) toward improving their electric vehicle offerings, the silicon carbide (SiC) market for electric vehicles (EVs) is expected to grow significantly during the forecast years.

Market Segmentation:

Segmentation 1: by Application

Traction Inverter

On-Board Charger (OBC)

DC-DC Converter

The traction inverter application type segment is poised to assert its dominance in the silicon carbide (SiC) market for electric vehicles. As the automotive landscape pivots toward sustainability and efficiency, the traction inverter segment emerges as a focal

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point for innovation. SiC-equipped traction inverters hold the promise of better energy efficiency, extended driving ranges, and optimized battery utilization, addressing pivotal concerns in the EV ecosystem.

Segmentation 2: by Vehicle Type

Passenger Vehicles

Commercial Vehicles

Based on vehicle type, the passenger vehicle segment accounted for a majority stake in the silicon carbide (SiC) market for electric vehicles (EVs) in 2022. Production and sales of passenger electric vehicles are anticipated to be higher than that of commercial vehicles, as more users are rapidly adopting EVs and replacing their IC engine vehicles with EVs due to their cost efficiency and various government subsidies, among others.

Segmentation 3: by Propulsion Type

Battery Electric Vehicles (BEVs)

Hybrid Electric Vehicles (HEVs) and Plug-in Hybrid Electric Vehicles (PHEVs)

Of the two defined propulsion categories, the battery electric vehicles (BEVs) category dominated the silicon carbide (SiC) market for electric vehicles (EVs) in 2022. The advantages of silicon carbide (SiC) power semiconductors over silicon power semiconductors, such as significant reduction in power losses, are driving the usage of materials in BEVs. The developments of EV components with the integration of SiC and the use of such components in advanced new BEV models are expected to support the market growth.

Segmentation 4: by Product

SiC MOSFETs

SiC Diodes

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Based on products, the silicon carbide (SiC) market for electric vehicles has been categorized into SiC MOSFETs and SiC diodes. Of the two product categories, the SiC MOSFETs segment dominated the global silicon carbide (SiC) market for electric vehicles (EVs) in 2022. SiC MOSFETs product type is widely used in the silicon carbide (SiC) market for electric vehicles. The unique characteristics of SiC, including high breakdown voltage, low on-resistance, and superior thermal conductivity, translate into MOSFETs that excel in high-power, high-temperature environments. This makes them particularly well-suited for the rigorous demands of EV power electronics.

Segmentation 5: by Voltage

Up to 800V

More than 800V

Based on voltage, the up to 800 V voltage segment offers a well-balanced solution that caters to the requirements of modern electric vehicles. This voltage range enables EV manufacturers to design compact and lightweight power electronics systems, which are essential for enhancing vehicle range and overall performance. Furthermore, the up to 800 V voltage type allows for effective integration of SiC components, resulting in reduced switching losses and increased overall efficiency.

Segmentation 6: by Region

North America

Europe

U.K.

China

Asia-Pacific and Japan (AP&J)

Rest-of-the-World (RoW)

The demand within the silicon carbide (SiC) market for electric vehicles varies according

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to various geographical regions. China is expected to dominate the global silicon carbide (SiC) market for electric vehicles as the region has witnessed significant growth in the electric vehicle industry, driven by supportive government policies, increasing environmental concerns, and advancements in technology. China's government support, research investments, and partnerships with silicon carbide (SiC) manufacturers have accelerated the development and implementation of this cutting-edge technology within the electric vehicle ecosystem. Moreover, China's well-established supply chain infrastructure and robust manufacturing capabilities provide a competitive edge in SiC production, contributing to cost reductions and scalability.

Recent Developments in the Silicon Carbide (SiC) Market for Electric Vehicles (EVs)

In June 2023, Infineon Technologies launched 1200 V CoolSiC MOSFETs in TO263-7 for automotive applications. In on-board charging (OBC) and DC-DC applications, the automotive-grade silicon carbide (SiC) MOSFET generation delivers great power density and efficiency, permits bi-directional charging, and dramatically lowers system cost.

In April 2023, Wolfspeed, Inc. announced that it would provide silicon carbide devices to power future Mercedes-Benz electric vehicle (EV) platforms, enabling higher powertrain efficiency. The next-generation powertrain systems for numerous Mercedes-Benz vehicle lines would include semiconductors from Wolfspeed, Inc.

In March 2023, Mitsubishi Electric announced that it would be investing $1.87 billion in the coming five years to boost the production capacity of silicon carbide (SiC) power semiconductors. The investment would be used to construct a new wafer plant.

In February 2023, Microchip Technology Inc. announced that it would be investing $880 million in the upcoming years in order to increase its SiC and silicon production capacity.

In January 2023, Wolfspeed, Inc. and ZF established a strategic alliance to enhance silicon carbide systems and devices for mobility, industry, and energy applications. This agreement would entail the establishment of a collaborative innovation lab. The cooperation also includes a sizable investment by ZF to enable the development of the largest and most sophisticated 200mm silicon carbide device fab in the world in Ensdorf, Germany.

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In August 2022, Onsemi inaugurated its new silicon carbide (SiC) production facility in New Hampshire, U.S. The new facility would increase the company's SiC production capacity, which would help in catering to the growing demand.

Demand - Drivers and Limitations

The following are the demand drivers for the silicon carbide (SiC) market for electric vehicles (EVs):

Superior Properties of Silicon Carbide Compared to Silicon

Growth in the Demand for Electric Vehicles

Increasing Investment toward Enhancing SiC Manufacturing Capacity

The following are the challenges for the silicon carbide (SiC) market for electric vehicles (EVs):

Higher Manufacturing Cost Associated with SiC Semiconductors

Limitation of Producing Large-Diameter SiC Wafers

How can this report add value to an organization?

Product/Innovation Strategy: Globally, the leading and emerging silicon carbide (SiC) manufacturers are continuously working to make their SiC offerings more power-efficient than ever. High SiC device cost and low yield are among some of the major concerns among the silicon carbide (SiC) manufacturers in the silicon carbide (SiC) industry for electric vehicles (EVs). The players operating in the silicon carbide (SiC) market for electric vehicles (EVs) have been working on the development of improved silicon carbide (SiC) to mitigate the growing challenges associated with yield numbers and device costs.

Growth/Marketing Strategy: The silicon carbide (SiC) market for electric vehicles (EVs) has been growing at a rapid pace. The market offers enormous opportunities for

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existing and emerging market players. Some of the strategies covered in this segment are product launches, partnerships, collaborations, business expansions, and investments. The strategies preferred by companies to maintain and strengthen their market position primarily include market developments and partnerships, collaborations, acquisitions, and joint ventures.

Competitive Strategy: The key players in the silicon carbide (SiC) market for electric vehicles (EVs) analyzed and profiled in the study include silicon carbide (SiC) manufacturers that design, develop and market silicon carbide (SiC) materials for electric vehicles (EVs). Moreover, a detailed competitive benchmarking of the players operating in the silicon carbide (SiC) market for electric vehicles (EVs) has been done to help the reader understand the ways in which players stack against each other, presenting a clear market landscape. Additionally, comprehensive competitive strategies such as partnerships, agreements, and collaborations will aid the reader in understanding the untapped revenue pockets in the market.

Key Market Players and Competition Synopsis

The companies that are profiled have been selected based on inputs gathered from primary experts and analyzing company coverage, product portfolio, and market penetration.

The global silicon carbide (SiC) market for electric vehicles (EVs) is highly consolidated, where the top two manufacturers alone accounted for around 70% of the market share in 2022, while the remaining companies operating in the market captured around 30% of the market share.

Key Companies Profiled:

Wolfspeed, Inc.

Infineon Technologies

Onsemi

Coherent Corp. (previously known as II-VI Incorporated)

STMicroelectronics

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Robert Bosch GmbH

ROHM CO., LTD.

Microchip Technology Inc.

Mitsubishi Electric

Alpha and Omega Semiconductor

Toshiba Corporation

Littelfuse, Inc

GeneSiC Semiconductor

Fuji Electric Co. Ltd.

WeEn Semiconductors

Solitron Devices, Inc.

Companies that are not a part of the aforementioned pool have been well represented across different sections of the report (wherever applicable).

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