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GRAPHITE GETS TARIFF PROTECTION

By Paul Harris



The Syrah - Vidalia, Louisiana facility is the first battery-grade natural graphite active anode material supplier in the U.S. supporting the EV industry.

Graphite is starting to receive critical minerals love in the US after the Biden administration placed a 25% tariff on natural graphite from China in May, which comes into effect in 2026, to protect North America's nascent graphite industry. Graphite constitutes about half of the material in a lithium-ion battery, with its supply and processing dominated by China.

The Section 301 tariff was designed to make North American natural graphite companies more cost-competitive with China, stimulate investment in the North American supply chain, and make local material available to the battery supply chain being developed in the US and Canada.

The Biden Administration previously granted original equipment manufacturers (OEMs) a two-year transition period to source battery anode material (BAM) from China while North American production is established. The Administration's decision requires OEMs to commit to offtake agreements with North American graphite producers in the interim in order for their electric vehicles (EVs) to continue qualifying for a US $7,500 tax credit and so that they can source from the domestic supply chain when the two-year exemption from FEOC (Foreign Entity of Concern) requirements expires at the end of 2026.

"This is an important move by the Biden Administration and the US Trade Representative to support the North American graphite industry," said Hugues Jacquemin, CEO of Canadian graphite producer Northern Graphite.

The North American Graphite Alliance (NAGA) also welcomed the tariff decision. "This will help NAGA's natural graphite companies be more cost-competitive with Chi-

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na. We now look forward to hearing from the Administration regarding previously excluded graphite products, which have not been subject to tariffs since 2020," said NAGA spokesperson Erik Olson.

NAGA believes China "abuses" its dominant graphite production capability by supplying more material than the market can absorb, flooding it with cheap, highly subsidized products that drive prices down. "This malicious trade practice makes it challenging for graphite producers to secure the investments necessary to bolster production capacity to the levels needed to meet domestic demand," said Olson.

Syrah Graphite MD Shaun Verner, said the two-year exemption could be counterproductive. "There are impacts of volatility arising on the graphite sourcing approach taken by customers in the near-term, the intensity of customer qualification processes already underway, and non-FEOC graphite supply chain development," he said during the company's June quarter results call.

"The key challenges of the policy change are the uncertain or reduced near-term incentives for US customers to accelerate purchasing from existing non-FEOC graphite supplies, such as ourselves, given the availability and price of Chinese anode material. There's potentially extended timelines ... which can extend timeframes for the qualification and sale of Syrah's products into the US market, a lack of clarity in the level of commitment that OEMs need to demonstrate to the DOE in their transition plans towards non-FEOC graphite supply, and what the consequences are for OEMs prior to 2027 if they fail to satisfy the US Government requirement during that transition period," said Verner.

Pricing conundrum

Opaque mineral pricing and markets dominated by FEOC that maintain low prices have long been recognized as impediments to the developers of Western critical minerals projects from advancing towards production. While the US government is funneling more financial resources to develop critical minerals supply chains, only the Department of Defense directly funds mineral extraction, and its money targets minerals with defense applications. Funding from the Department of Energy focuses on mineral processing and other downstream activities, not extraction.

The main challenge for mineral development is funding and financing, and while banks and other investors are interested in financing critical minerals projects, opaque mineral pricing is an obstacle to reaching agreements.

"The issue for funding critical metals is pricing. ... Most critical minerals are uneconomic if you are an investor. If the government wants the critical minerals to be produced, you need to change the pricing mechanism. But how are you going to make sure the price is high enough to bring other mines into production?" said David Rhodes of MD at Endeavour Financial, an advisor to Perpetua Resources, which has the Stibnite gold-antimony project in Idaho, USA.

"The mining of most critical minerals is very concentrated and the processing of those minerals is extremely concentrated. ... Onshoring or friendshoring comes back to having a commodity price market split between different axis of power," said James Dendle, SVP at Triple Flag Precious Metals.

The Biden administration requires automakers to commit to offtake agreements with North American graphite producers for their EVs to continue qualifying for a $7,500 tax credit and so that they can source from the domestic supply chain when the two-year FEOC exemption expires at the end of 2026.

However, signing offtakes using market reference pricing dictated by China is a non-starter for graphite companies. "When you sign an offtake, you have to agree on the price; otherwise, it is not a contract. The pricing graphite benchmarks are Chinese, as Chinese companies control the market, which is lower than what Western companies can produce. It doesn't make sense for us to enter into a contract at current pricing levels," Jacquemin told SiC & More.

Tariffs and subsidies can address this imbalance but bring other issues, including the government inadvertently being in a position to pick winners and losers in the mineral sector. "The government could implement tariffs or give direct subsidies, but then you have imperfect pricing and questions of how much return you give the investor. It is a very complex discussion. ... Are governments the best people to decide where capital is spent?" said Rhodes.

Dendle agrees. "While I am pleased that companies in

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the portfolio receive free money that we do not have to put in, the market should make the determination as to which companies receive capital in the sector," he said.

The US State Department, through the Minerals Security Partnership, disagrees, believing that the market is moving too slowly. "Market forces alone will not drive the diversification of supply chains quickly enough. We have a huge supply chain vulnerability," said Aaron Fishman, deputy director for the Office of Energy Transformation, Bureau of Energy Resources at the US Department of State.

Graphite deals

Automotive companies are starting to move into graphite. Nouveau Monde Graphite achieved a supply agreement with General Motors (GM) under which the company will supply 18,000tpy of its expected phase-2 active anode material from the Matawinie mine and the Bécancour battery material plant in Quebec, Canada to GM upon reaching full production for an initial term of six years. Concurrently, GM committed to invest $150 million into Nouveau Monde to help fund the development. GM will make an initial $25 million equity investment to purchase 12.5 million shares and a further $125 million of equity upon the successful completion of conditions precedent and a positive final investment decision.

"Our collaboration with Nouveau Monde is a milestone for the industry and in our ongoing development of a more sustainable and resilient battery supply chain. From our assembly plants and battery cell plants in the US, to our investments across the supply chain, we are developing a North American EV ecosystem aimed at benefiting consumers, expanding economic opportunity, and creating a competitive advantage for GM," said Jeff Morrison, VP global purchasing and supply chain at GM.

"North America is rich in resources, manufacturing capacity, talents, and innovation. We are leveraging these ingredients to drive a zero-emission future. Today marks a momentous milestone for Nouveau Monde," said Nouveau Monde founder and chief executive Eric Desaulniers.

Natural graphite from the Matawinie mine will be processed at the Bécancour Battery Material Plant into active anode material for batteries.

Nouveau Monde has also agreed on an offtake agreement with Panasonic Energy, which, together with the GM agreement, covers about 85% of the planned active anode material production from the Bécancour battery material plant, some 36,000tpa in total. Panasonic will also invest $25 million in Nouveau Monde. Offtake agreements and investments support NMG's execution plan for its Phase-2 Matawinie Mine and Bécancour Battery Material Plan, marking a significant milestone toward future funding by anchor customers of up to $275 million.

Syrah signed an offtake agreement with Tesla in 2021 for active anode material it will produce from a facility in Vidalia, Louisiana, where production began in February and is ramping up to 11,250tpa. It will process material from its 350,000tpa capacity Balama mine in Mozambique.

Elsewhere in Quebec, Northern Graphite plans to increase its graphite production and add processing capability. It recently updated the resource estimate for its Lac-des-Iles graphite mine in Quebec as it plans to increase output capacity to 25,000tpa to meet rising demand. Lac-des-Iles hosts an indicated resource of 3.29Mt grading 6.4% graphitic carbon, containing about 213,000t of graphite. It also hosts an inferred resource of 1.43Mt grading 7.4% graphitic carbon, containing 106,000t. The company said the resource increase allows it to extend the mine life by at least eight years, and additional drilling could unlock further expansion potential.

"The company acquired Lac-des-Iles with its fully permitted and operational processing plant and tailings facility with a vision of extending the mine life, increasing production, and developing it into a cornerstone asset. The resource and production increases represent the first step in that process, and we look forward to further exploration success and additional expansions in the future," said Jacquemin.

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THE WORD FROM BRAZIL

Franciso Batista

SiC & More is fortunate to have "boots on the street" providing readers with a true perspective of what is occurring in what is one of the world's most important economies. Francisco Batista never disappoints as he reports from the streets of the world's ninth largest economy.

a) Energy: Brazil is facing a more difficult than expected dry season that has pushed energy spot prices from R$ 61.07/MWh to R$ 135/MWh. This price will likely begin to drop by mid-spring (Nov/24) reaching again the floor price (R$ 61.07/MWh) by early 2025. Demand is still weak as a consequence of poor economy activity. On the other hand, long term prices (4+ yrs) have seen some recovery from R$ 135/MWh to R$ 150/MWh. Although rainfall in 2024 is 22% below average (impacting hydro reservoirs) there is excess energy from wind and solar plants that is softening the increase in both spot and long term prices.

b) Macroeconomics: BR Central Bank is now in a holding pattern regarding changes in interest rates due to the latest spikes in inflation indexes. Recent indications by Central Bank (early August) made clear that even an increase in interest rate is back on the radar should the inflation in Brazil keep gaining traction in the upcoming months. Inflation has been impacted by the US dollar exchange rate that jumped from R$ 5.15 (May) to R$ 5.6 (Aug). Even with the recent intensification in the Middle East crisis, the exchange rate in Brazil is currently reflecting almost exclusively the federal government fiscal deficit that is performing even larger than the authorized amount. Running a fiscal deficit without prior authorization from congress is a crime in Brazil so the federal government is having to cut expenses to meet the authorized amount of fiscal deficit for 2024. The cuts are being made mostly on public health, public education, public security, low income housing program, etc., instead of cutting subsidies for corporations, entertainment industry and other low priority uses of federal funds.

FOCUS projections are now:

- Interest Rates: Dec/24: 10.50%; Dec/25: 9.50%
- FX Rate: Dec/24: R$ 5.30; Dec/25: R$ 5.30

There is an overall concern among investors and entrepreneurs about who will replace the current Chairman of the Brazilian Central Bank once its mandate is over (Dec. 31st, 2024). Roberto Campos Neto was nominated for this job by the last administration based on his extensive brilliant curriculum as an economist, being awarded as the world's "Best Central Bank of the Year 2024". Neto has been an extraordinary professional and a beacon of hope by keeping the monetary authority in the right direction and resisting the never ending attempts of the current administration to undermine him and his policies nd pushing him to step down from his office. Once Neto has departed, the new Chairperson will very likely be someone aligned with the current administration's populist approach of big spending, large fiscal deficit and market intervention. If these expectations are fulfilled we can expect even higher fiscal deficits for 2025 and 2026, inflation hikes and the interest rate being forced down by the Central Bank resulting in an exchange rate over R$ 6 per US$ 1.

c) Commodities: situation has not changed since last report. China continues to dump everything possible in every market in the world and Brazil is not an exception. Even the Soy imported from Brazil is being returned to the market by Chinese traders as demand remains low in China. Steelmakers in Brazil are postponing investment decision while fighting imports from China through a potential anti-dumping lawsuit.

d) Politics: President Lula was elected in 2022 with vast support from local and international media outlets based on arguments such as saving democracy, reducing poverty and hunger and to stop deforestation among others. So far the new government has not only not delivered any of those commitments but actually proved to be the impersonated contradiction. Forest fires are out of control in the center-west of Brazil, inflation is not only hurting the middle-class but also making the appropriations insufficient to fight hunger, the economy is stagnant due to the gigantic fiscal deficit and last, but not least, Lula has proven to be the opposite of a democratic leader. Since day one this administration has seemingly aligned itself with autocracies around the world and preached sovereign respect for them. Brazil is unquestionably the leading country of South America and as so it has the obligation of making its position crystal clear in support of democracy. What we've seen in the last days was even more disappointing as Lula's party immediately recognized Maduro's questionable victory in Venezuela's presidential election. Lula did not use Brazil's regional influence to force Maduro and the Venezuelan electoral agency to present the votes of the elections. It is now becoming clearer even to most leftists that Lula is not the persecuted "White Knight" rescued from jail to save Brazil but actually just another Marxist populist working on its own personal interests to perpetuate its power.

Quick Note on Rio Grande do Sul disaster: Even though the flooding is long gone the rescue of the state and its victims have made little progress to date. Federal government initial support is fading away just like the media's interest in this subject. Local government is being helped by private initiatives through donations for the affected population as well as for rebuilding basic infrastructure such as roads and bridges. The state's GDP has dropped by 10% and it is forecasted it will take 3 to 4 years to recover from the disaster.

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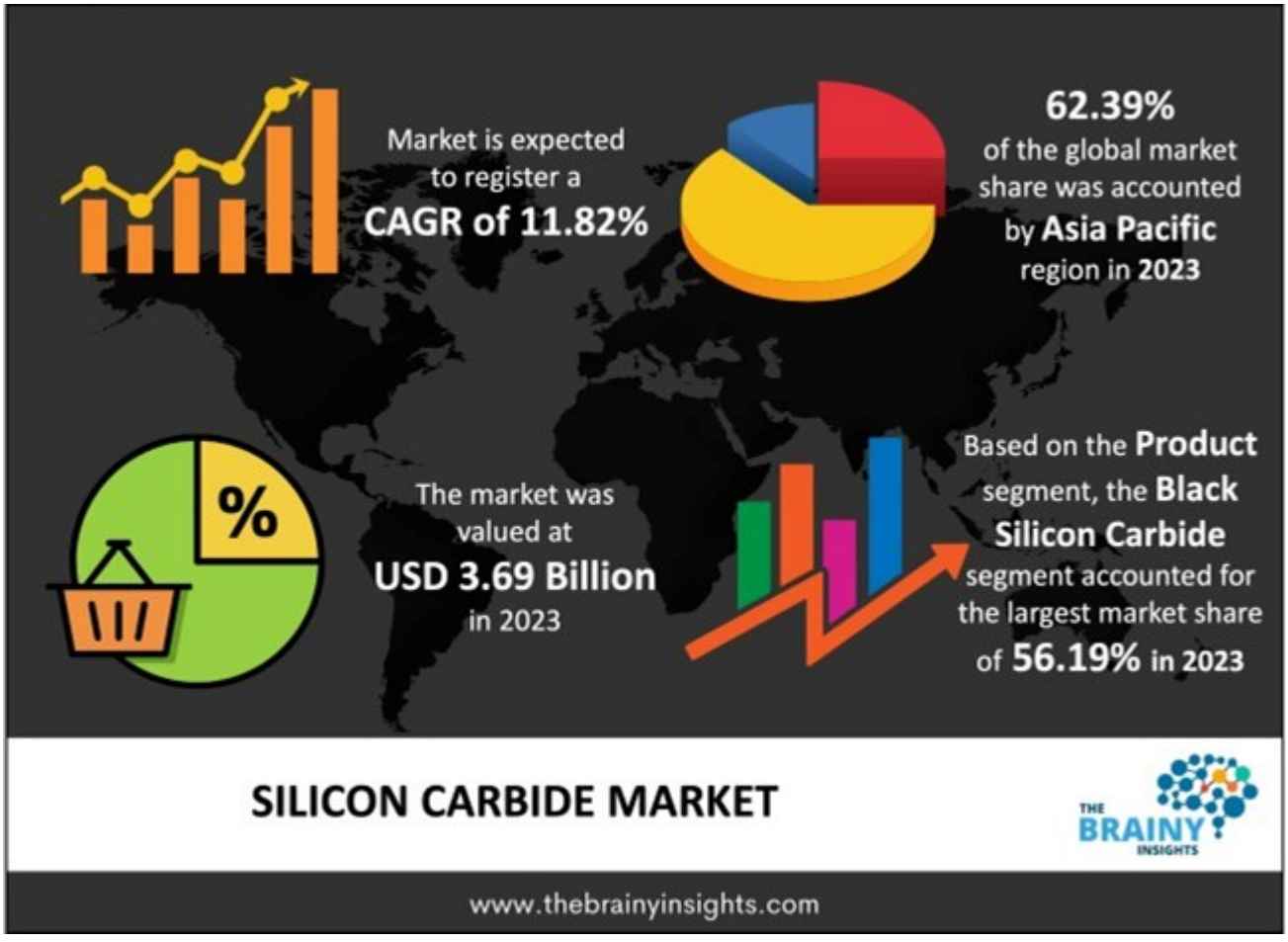
THE BRAINY INSIGHTS & SILICON CARBIDE

SiC & More **recently reached out to Avinash Dhanwani of *The Brainy Insights* regarding the Market & Research Report that had recently been generated regarding the global SiC market and how it pertains to higher end applications. The following summary from *The Brainy Insights* gives readers a taste of the incredible potential for SiC over the next decade and beyond.**

The global Silicon Carbide market generated USD 3.69 billion revenue in 2023 and is projected to grow at a CAGR of 11.82% from 2024 to 2033. The market is expected to reach USD 11.28 billion by 2033. The expansion in production within both ferrous and non-ferrous industries is poised to fuel the demand for refractory materials, driving the demand for the silicon carbide industry. Furthermore, the rising adoption of silicon carbide devices in radio-frequency operations and cellular base stations and supportive government policies advocating for using renewable energy sources in power generation are projected to push market development over the forecast years.

Market Introduction:

Silicon Carbide (SiC) is a versatile semiconductor material consisting of silicon (Si) and carbon (C). It is known for its unique properties, including high hardness, thermal conductivity, and chemical inertness. SiC has a wide bandgap, which makes it highly suitable for high-power, high-temperature applications. SiC is a semiconductor material in electronic devices, offering advantages over traditional silicon-based devices. Its wide bandgap allows SiC devices to operate at higher temperatures and voltages with lower leakage currents, improving efficiency and performance. SiC-based devices are used in power electronics, radio-frequency (RF) amplifiers and high-temperature sensors. Moreover, SiC has excellent mechanical properties, making it useful in abrasive and cutting applications. Because of its high thermal stability and hardness, SiC is employed in manufacturing abrasives, cutting tools, and refractory materials.



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Recent Development

- **In March 2024:** Infineon embarks on a groundbreaking journey in power systems and energy conversion by unveiling its latest innovation: the next iteration of SiC (silicon carbide) MOSFET trench technology. Introducing the new CoolSiC MOSFET 650 V and 1200 V Generation 2, this advancement enhances key performance metrics, including reserve charges and energies, by as much as 20% when contrasted with its predecessor. Notably, these enhancements are achieved without compromising quality or reliability levels, fostering higher overall energy efficiency and making significant strides towards decarbonization.

- **In January 2024:** Infineon Technologies AG, a renowned semiconductor giant in power systems and IoT, and Wolfspeed, Inc., a global frontrunner in silicon carbide technology, have declared the expansion of their existing agreement of 150mm silicon carbide (SiC) wafer supply, initially established in February 2018. This prolonged collaboration encompasses a multi-year capacity reservation agreement, bolstering Infineon's overall supply chain resilience, particularly in response to the escalating demand for silicon carbide semiconductor products across automotive, solar, EV applications, and energy storage systems.

- **In February 2023:** Microchip Technology Inc., a prominent supplier of intelligent, interconnected, and secure embedded control solutions, has unveiled intentions to inject USD 880 million into expanding and extending its SiC and Si production capabilities at its Colorado Springs (Colorado, USA) manufacturing plant over the forthcoming years. A key facet of this expansion initiative involves enhancing and modernizing its 50-acre, 580,000 sq. ft Colorado Springs campus to bolster SiC manufacturing. This augmentation strives to satisfy the burgeoning demand in the grid infrastructure, automotive, renewable energy, e-mobility, aerospace, and defence sectors.

Market Dynamics

Drivers

Demand from the Power Electronics Industry - Silicon Carbide is extensively used to manufacture power electronic devices due to its superior properties such as high thermal conductivity, high breakdown voltage, and low power losses. The growing demand for power electronics in applications such as electric vehicles (EVs), renewable energy systems, and industrial automation is propelling the growth of the SiC market.

Advantages over Silicon (Si) Semiconductors - Compared to traditional silicon-based semiconductors, SiC offers higher energy efficiency and faster switching capabilities, reducing power consumption and increasing system performance. As industries strive for more energy-efficient solutions, the adoption of SiC-based devices is increasing, driving market growth.

Rising Adoption in the Automotive Sector - The automotive market is shifting towards electric and hybrid vehicles to comply with stringent emission norms and reduce reliance on fossil fuels. SiC-based power electronics enable higher efficiency and longer driving ranges in electric vehicles, thus driving their adoption in the automotive sector.

Restraints

High Manufacturing Cost - One significant restraint on the widespread adoption of SiC devices is the relatively high manufacturing cost compared to traditional silicon-based semiconductors. The complex manufacturing processes of producing SiC wafers and devices contribute to higher production costs, limiting their affordability and scalability for certain applications.

Limited Availability of High-Quality SiC Wafers - The availability of high-quality SiC wafers, essential for manufacturing high-performance devices, remains limited. Producing large-diameter, high-purity SiC wafers with low defects is technically challenging and expensive. This shortage of quality substrates hampers the mass production of SiC devices and affects market growth.

Opportunities

Expansion of Renewable Energy Infrastructure - With the increasing emphasis on renewable power sources such as wind and solar power, there is a growing need for silicon carbide-based power conversion systems. Silicon carbide devices offer more efficiency and dependability in renewable energy applications, driving their adoption in inverters, converters, and energy storage systems.

Emerging Applications in 5G and IoT - The expansion of IoT devices and the developments in 5G networks require high-performance semiconductors capable of handling high frequencies and power levels. SiC-based RF devices offer superior performance, enabling faster data transmission and higher bandwidths in 5G infrastructure and IoT applications.

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Challenges

Yield Rates and Process Consistency - Achieving high yield rates and consistent quality in SiC device manufacturing poses challenges due to material variability, defects, and process inconsistencies. Variations in material properties and processing conditions can lead to increased production costs and lower yields.

Packaging and Thermal Management - Efficient packaging and thermal management solutions are essential for SiC devices to ensure reliability and performance under high-temperature and high-power operating conditions. Developing cost-effective packaging techniques and thermal management solutions remains a challenge.

Regional segmentation analysis

The regions analyzed for the market include North America, Europe, South America, Asia Pacific, the Middle East, and Africa. Asia Pacific emerged as the most prominent global Silicon Carbide market, with a 62.39% market revenue share in 2023.

Asia Pacific, particularly economies like Taiwan, Japan, China, and South Korea, serves as a global manufacturing hub for semiconductor materials and devices. These countries have well-established semiconductor industries with advanced fabrication facilities capable of producing SiC wafers and devices at scale. Most importantly, Asian countries have invested significantly in research and development (R&D) initiatives focused on SiC technology. Government support, academic collaborations, and partnerships between industry players have facilitated the development of cutting-edge SiC materials, processes, and devices. Furthermore, Asian companies possess extensive semiconductor manufacturing and materials science expertise, enabling them to develop and commercialize innovative SiC products. They have access to skilled engineers, scientists, and technicians with specialized knowledge in SiC technology, contributing to the region's dominance in the market. Additionally, Asia Pacific is home to key industries driving the demand for SiC devices, including automotive, consumer electronics, telecommunications, and industrial automation. The region's rapid industrialization, urbanization, and growing middle-class population have fueled demand for energy-efficient and high-performance electronic systems, boosting the adoption of SiC technology.

Asia Pacific Region Silicon Carbide Market Share in 2023 - 62.39%

Product Segment Analysis

The product segment is divided into black silicon carbide and green silicon carbide. The black silicon carbide segment dominated the market, with a share of around 56.19% in 2023. Black SiC is the most commonly produced form of SiC due to its abundance and cost-effectiveness. It is created by the carbothermal reduction of petroleum coke and silica sand in electric resistance furnaces. The availability of raw materials and relatively simple manufacturing process contribute to its dominance in the market. Furthermore, black SiC typically exhibits high purity levels and consistent quality, making it suitable for various industrial applications. It is available in various particle sizes and shapes, allowing manufacturers to tailor its properties to meet specific application requirements. Moreover, black SiC finds widespread use in abrasive and refractory applications due to its excellent hardness, abrasion resistance, and thermal conductivity. It is used in abrasive blasting, grinding wheels, cutting tools, and refractory materials for furnaces and kilns. The versatility of black SiC makes it a preferred choice across diverse industries such as automotive, aerospace, metallurgy, and ceramics.

Device Segment Analysis

The device segment is classified into SiC discrete, SiC bare die and SiC module. The SiC discrete segment dominated the market, with a share of around 45.83% in 2023. SiC discrete devices offer superior performance compared to traditional silicon-based devices. They have higher breakdown voltages, lower on-resistance, faster switching speeds, and better thermal conductivity. These characteristics make SiC discrete devices highly suitable for high-power and high-frequency applications in automotive, power electronics, and renewable energy industries. In addition, SiC discrete devices have lower switching losses and reduced conduction losses compared to silicon-based devices. As a result, they offer more energy efficiency and contribute to energy savings in various applications such as electric vehicles, solar inverters, and industrial motor drives. Operating at higher temperatures without performance degradation further enhances their efficiency. Besides, SiC discrete devices enable the design of more compact and lightweight electronic systems due to their higher power density and efficiency. This miniaturization is particularly beneficial for applications where space constraints are a concern, such as automotive powertrains, renewable energy inverters, and portable electronics.

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Fiven ASA Joins Kymera International

Fiven ASA, the world's leading producer of silicon carbide (SiC), has been acquired by Kymera International, marking a significant development in the specialty materials industry.

Kymera International is a U.S. owned, leading global developer and manufacturer of advanced specialty materials and high-performance surface coatings. With a rich history that can be traced back to the 1800s through various acquisitions, Kymera has established itself as a key player in the materials industry. Its global footprint is extensive, with manufacturing facilities in the U.S., Canada, Australia, Europe, the U.K., and Asia. With this acquisition, Kymera is expanding into the growing silicon carbide market, complementing its existing portfolio of specialty materials, and further diversifying its product offerings.

Fiven has a rich history and established leadership in the silicon carbide industry. With decades of experience, Fiven has built a reputation for excellence in SiC production and innovation. It offers a full portfolio of silicon carbide products, catering to a wide range of industries, including abrasives, metallurgy, refractories, technical ceramics, and high purity SiC (99,999%). This comprehensive product range positions Fiven as a one-stop solution for diverse SiC needs.

A key focus for Fiven has always been its commitment to research and development. The group has consistently invested in developing new products and improving existing ones, particularly in emerging markets such as power electronics and semiconductor applications. This focus on innovation aligns well with Kymera's commitment to advancing materials technology across various industries.

Environmental responsibility is another area in which Fiven has shown leadership. It has been actively working towards sustainable production methods and developing products that contribute to environmental solutions. This commitment to sustainability is expected to continue and strengthen under Kymera's ownership.

For Fiven's existing customers, this acquisition brings assurance of continuity. Operations will continue at production facilities in Norway, Belgium, and Brazil, ensuring that customers can expect the same high level of service, quality, and expertise they have relied on from Fiven.

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Application Segment Analysis

The application segment includes automotive, aerospace, electrical & electronics, healthcare, military & defense, steel and others. The electrical & electronics segment dominated the market, with a share of around 27.61% in 2023. SiC offers significant advantages over traditional silicon-based semiconductors in power electronics applications. SiC-based devices, such as MOSFETs, Schottky diodes, and JFETs, exhibit lower conduction and switching losses, higher breakdown voltages, and faster switching speeds. These attributes make them ideal for high-efficiency power conversion and control in various electrical and electronic applications. Most importantly, the automotive industry is experiencing a rapid transition towards electrification to lower emissions and improve fuel efficiency. SiC-based power electronics play a crucial role in electric and hybrid vehicles by enabling higher efficiency, longer driving ranges, and faster charging times. As the demand for EVs and HEVs continues to grow globally, the adoption of SiC technology in automotive powertrain systems is expected to surge, driving market growth. SiC devices are also extensively used in renewable energy systems such as solar inverters, wind turbines, and grid-tied energy storage systems. SiC-based inverters and converters offer higher efficiency and reliability than conventional silicon-based solutions, making them well-suited for converting and managing power from renewable energy sources. The increasing implementation of wind and solar power projects worldwide drives the demand for SiC devices in the renewable energy sector.

For more information about the SiC report or about market research by The Brainy Insights, please contact Avinash Dhanwani at avinash@thebrainyinsights.com



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SiC in a Holding Pattern



Pictured above is a furnace being loaded with raw materials at the Sublime SiC furnace plant in South Africa.

Most readers have experienced the anticipation of landing at an airport only to find themselves informed by the pilot that, due to weather or some other unexpected circumstance, the flight has been placed in a holding pattern. One definition of a holding pattern is, "temporarily unable to act because you are waiting for something to happen or to be decided".

Since the first of the year, SiC pricing has been mostly flat. In fact, in issue #101 ***SiC & More*** described pricing as flat as the Maldives and in #102 stated as flat as Tuvalu. That's darn flat.

However, during mid-July prices strengthened by $15-20 per ton. When asked why prices had moved upward a trader commented, "It's not really due to supply and demand as much as it is government intervention and a stronger Yuan."

Another trader added, "The steel industry in China is surprisingly slow and that is affecting SiC demand. Not just for alloying but also refractory grades and to some degree downstream abrasives. Truth be told, I suspect the Chinese steel industry is weaker than they are reporting. As a result, SiC production has been curtailed."

Chinese SiC furnace plants are operating at less than 50% of capacity. Much of that is attributed to a slow Chinese economy but also to sluggish demand out of EU and North and South America. In addition, demand for SiC also appears to be flat in Korea and Japan.

It's difficult to predict where prices will go during Q4 2024, but suffice it to say, there is currently more than enough supply of all grades of SiC and that's with furnace plants in EU, China, Vietnam, Romania, and Brazil operating at less than full capacity.

A processor added, "Demand for refractory and abrasive SiC grades is soft and I don't expect a turnaround before year-end unless China's central government plunges some big money and interesting incentives into their economy."

A quote from a trader in issue #102 seems to be applicable for the balance of 2024, "China will attempt to export their way out of the economic predicament they find themselves. The problem for China is that countries like the U.S. have started to resist those efforts with tariffs or increased tariffs. I expect to see sideways pricing with efforts to implement increases. There could be some softening but I think that will depend more on other country's economies than on Chinese export efforts."

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ZAPORIZHABRASIVE OVERHAULING FURNACE & MORE



Pictured above is a ZAK - Ukraine Brown Fused Aluminum Oxide Ingot.

The invasion of Ukraine by Russian forces began in February 2022. Since that time, many thousands have been killed and millions of Ukrainians have been reported as leaving the country not to mention the billions of dollars' worth of damage. Despite the conditions, work at Zaporizhabrasive (ZAK) continues and ***SiC & More*** has been providing updates throughout the conflict.

Most recently, ZAK management dedicated significant capital to overhauling the No. 1 furnace dedicated to smelting aluminum oxide. As of this publication, capital repairs were about 80% complete. In addition to the capital investment, ZAK implemented several new technical solutions that will significantly increase production efficiency.

The upgrades include:

1) Improvements in the furnace loading system, which will allow nearly the entire process to be automated. This upgrade is expected to improve product quality and increase productivity. In addition, furnace loading will be reduced by 40%, energy savings could exceed 3%, and the time needed to maintain auxiliary equipment will be significantly reduced.

2) Energy efficient ventilation equipment was installed. The Italian-made fans will allow for a 25% savings in electricity while improving air quality. The project's payback is an astonishing seven months and total savings over the next decade will exceed $600k.

The inaugural melting and production of the first ton of aluminum oxide since the furnace upgrade is planned for September 2024. Thanks to these innovations, ZAK is expecting a significant increase in the quality of its products as well as increased cost efficiencies.

ZAK's annual capacity of aluminum oxide is about 22,000 metric tons with their high quality brown fused dedicated to both the refractory and abrasive markets. ZAK is also well known for producing over 20,000 metric tons per year of high quality SiC.

SiC & More will continue to reach out to its colleagues at ZAK and report on their progress as they make it their mission to remain a viable business supplying value added products to its customers while fighting adversity.

The Global 500

According to *Fortune* (August/September 2204 issue), the Top 10 companies in the world based on revenues are as follows:

1. WALMART
2. AMAZON.COM
3. STATE GRID
4. SAUDI ARAMCO
5. SINOPEC GROUP
6. CHINA NATIONAL PETROLEUM
7. APPLE
8. UNITEDHEALTH GROUP
9. BERKSHIRE HATHAWAY
10. CVS HEALTH

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METALS INDUSTRY UPDATE

CHINA

China's export growth unexpectedly slowed in July, signaling a cooling of the global demand that's been helping prop up the nation's otherwise wavering economy. This is especially bad news for Beijing, seeing as domestic consumers have been tightening their purse strings. Meanwhile, imports expanded 7.2%, narrowing a trade surplus to $84.65 billion from the previous month.

$2 BILLION FOR EV

The Department of Energy (DOE) selected 11 manufacturing locations to share $2 billion in funds for retooling, retrofitting, and retraining in order to support electric vehicle projects. General Motors' Lansing Assembly plant was one of those chosen and will add the DOE funds to the $12 billion the automaker has dedicated to grow its North American EV supply chain.

DECLINE OF ICE VEHICLES

An article by Tim Levin puts into perspective the future of the electric vehicle industry as compared to the internal combustion engine (ICE). According to the research firm BloombergNEF (BNEF), sales of ICE vehicles peaked globally in 2017 and have been in decline ever since. In addition, the BNEF forecasts that oil demand for road transportation will peak in 2027. By 2027, plug-in vehicles across all segments will help displace 4 million barrels of oil each day, which is about the annual oil consumption in Japan.

US RAW STEEL PRODUCTION

First week of August YTD raw steel production is reflective of about 1.3% growth compared to the same period in 2023.

RIO TINTO

PERTH, Australia–(BUSINESS WIRE)– Rio Tinto today celebrates the shipment of 4 billion tonnes of iron ore from the Pilbara in Western Australia to China. The shipment was loaded at Dampier Port on 19th July, bound for China Baowu Steel Group, the world's top steel producer. This milestone comes 51 years after the first shipment of almost 22,000 tonnes of Pilbara iron ore was sent from Dampier Port to China's Shanghai No.1 Steel Mill, which has since become part of China Baowu.

Over more than half a century, China has grown to become Rio Tinto's largest customer with about 250 million tonnes of iron ore shipped each year. Four billion tonnes is enough iron ore to produce the steel needed for about 45,000 Sydney Harbour Bridges, or more than 23,000 Beijing National Stadiums (Bird's Nest).

Rio Tinto partnered with China for the country's first ever investment in a foreign mining project, and its largest ever foreign investment at the time, by forming the Channar joint venture in 1987. That JV in Western Australia laid the foundation for many projects to follow, and for decades of mutual growth and prosperity between Rio Tinto, China and Australia. Western Range, Rio Tinto's newest mine, is the latest joint venture partnership with China Baowu. Production from the mine is expected to commence in 2025, with an annual capacity of 25 million tonnes of iron ore.

Rio Tinto Iron Ore chief executive Simon Trott said, "China has been a critical partner for Rio Tinto and for Australia's mining industry for more than five decades."China's strong demand for high-quality minerals such as iron ore has generated substantial opportunities for investment and trade between the two countries.

"Every time I visit China and see the skyscrapers, the high-speed rail, and all the infrastructure that has helped improve the lives of 1.4 billion people, it makes me proud to think that most of what I see contains steel that was made with Rio Tinto iron ore.
"We look forward to continuing our relationship with China well into the future as we continue to deepen our strategic partnership."

STELLANTIS

Stellantis recently announced that a total of 2,450 workers would be laid off indefinitely from the Warren Truck Assembly facility. The Warren plant will adjust to one shift when the company discontinues the Ram 1500 Classic. An updated 2025 Ram 1500 will be produced but it will be assembled at the Sterling Heights, Michigan facility. The Warren plant currently has 3,900 workers. Layoffs are expected in early October 2024. Workers being laid off will receive 52 weeks of supplemental unemployment benefits from Stellantis, 52 weeks of transition assistance, and two years of healthcare coverage.

ENDEAVOR BUSINESS MEDIA

A morsel from Market Moves Strategy regarding Ruchir Sharma's book, *What Went Wrong With Capitalism*: "Over the past 20 years, Sharma says, U.S. agencies have rolled out an average of 3,000 new regulations per year but withdrawn just 20. Not 20 annually – 20 over the course of two decades." Creating and sustaining business under the weight of thousands of regulations is truly a daunting task.

CATERPILLAR

Cat recently reported that its adjusted operating profit set a record for its second quarter despite a sales decline compare to the same period a year ago. The adjustment covers losses on divesture of two "non-

U.S. entities", leaving operating profit at $3.7 billion. The result was stronger than expected. Caterpillar reported that operating profit of 20.9% offset the decline in second quarter sales.

Sales for Q2 were $16.7 billion compared to $17.2 billion during the same time frame a year ago.

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SiCBras



SiCBras Furnace

Eliciting updates from SiCBras has historically been a tad difficult. As a matter of fact, the last extensive report regarding SiCBras took place in December 2016 when Saint-Gobain was planning to buy a 50% stake in the Paraguay SiC furnace plant owned by SiCBras (see issue #66).

SiCBras SiC furnacing has since returned to Brazil by way of Simoes Filho-Bahia in Brazil. SiCBras is now part of the Granha Liga Group but still concentrating on the production of high quality SiC products. ***SiC & More*** typically attributes 15,000 tons per year to SiCBras production capabilities with capacity utilization of about 12,000 tons.

According to the SiCBras website, they produce #1 grade SiC for refractory, ceramic and abrasive applications as well metallurgical SiC for the ferrous metals industry.

Granha Group was founded in 1998 and is involved in the production of manganese ferroalloys and, with over 60,000 tons per year of capacity, is positioned among the largest Brazilian producers. Production facilities can be found in Minas Gerais and Mato Grosso.

BFA, MgO & MORE

Although we will elaborate a bit, a trader put it best, “It’s a quiet marketplace.”

Prices on Al2O3 and MgO have been slowly increasing since early 2024 and that is due to a combination of factors including kWh pricing and the consolidation of the Chinese mining sector. Since issue #102, prices are up on both products by about $15 metric ton depending on quality.

Although prices on both DBM and MgO have increased in recent months, prices are still well below what one would call historical levels. Most experts will simply point to the stagnant Chinese ferrous metals business when asked about MgO demand. Global raw steel output fell 5.6% in July compared to June and is down 4.7% when compared to July 2023. Year over year results indicate that China’s steelmakers are down nearly 9%. To put that in perspective, if China ends the year down 9%, the lost output alone will reflect the amount of raw steel being produced in the U.S. in a single year.

Regarding Al2O3, prices have also increased a bit and that is due mainly to the price of bauxite. Bauxite is the key raw material input for producing BFA and ongoing issues with raw ore mining have continued to prop up the price of BFA. A trader added, “I don’t expect to see many changes during 2024. Aluminum oxide pricing will be stable with possibly some small upticks or downdrafts.”

In issue #102 a processor had this outlook on the pricing, “Let’s avoid the rocket ship to the moon like in 2022 and then the subsequent freefall in pricing.”

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CHINA EV’s

China auto sales were down 5% in July 2024 compared to the same period in 2023 but exports were up almost 20% as Chinese EV manufacturers continue to expand into global markets with electrics and plug-in hybrids (“new energy vehicles”).

IRON ORE

Iron ore recently dropped to a range of $100-102 metric ton, which is the lowest price index since April 2024. Many believe, however, that China’s building strategy will help boost steel demand in the near future.

GLOBAL RAW STEEL PRODUCTION

Worldwide steel output fell to 152.8 million metric tons in July, which was 5.6% less than June and 4.7% less than the same period in 2023. China’s production was down 9% year over year 2024 compared to 2023.

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DIGGING THROUGH THE ARCHIVES

This is the fourth segment regarding the production of SiC taken from the dusty but irreplaceable archives of ***SiC & More.*** This series is dedicated to providing details about the processing of a large U-shaped furnace using furnace plastics to capture the byproduct gasses.

COOKING THE FURNACE: When processing a large furnace, operators use mechanical equipment to reduce the manpower required in what traditionally has been a labor-intensive operation. The reduction in manpower is accomplished in much the same way that was previously mentioned when building a furnace.

Once the furnace is built, the raw material has to be heated to produce the chemical reaction that results in SiC. The energy source is AC electrical current. The circuit consists of a transformer, a busbar system, electrodes, and the graphite conductor in the furnace itself. When the power is turned on, the cooking process begins and will, more than likely, proceed for up to 10 days. The total energy consumed during a typical furnace run is about 1,800,000 to 2,100,000 kWh. The average power input during the furnace run is from 9,000 to 10,000 kW.

THE COOLING PROCESS: A furnace run is typically over when the energy consumed reaches the desired level. The furnace must then be cooled before the removal of SiC can begin. As soon as the production of byproduct gases concludes, the plastic cover used to collect the gases is removed. The outside layer of the furnace is cooled by spraying it with water. When a layer is sufficiently cooled, it is removed by raking with a six foot long bladed attached to a large backhoe. The next layer is then cooled and raked. This process continues until all of the unreacted material is removed and the SiC furnace roll is exposed. Cooling is necessary to prevent very fine dry dust escaping into the atmosphere. The water used to spray the furnace also helps to seal any remaining gases, thus preventing undesirable odors and air pollution.

CRACKING THE FURNACE: The exposed furnace roll is “U” shaped and is approximately 10’-12’ high, 125’ long, and 10’-12’ wide at the outside. The color of the roll is usually black although several producers have been known to dedicate furnaces to cooking green SiC.

The roll is raked one more time to remove any excess crust or unreacted material. The top half of the roll is then removed (cracked) using a grapple attachment on a large backhoe. The SiC from the top half of the roll is set aside. The graphite core is now removed. The original graphite core has increased in size due to the decomposition of some of the SiC into graphite. The graphite is then removed by a smaller backhoe and final cleanup takes place. Large endloaders with fork attachments are used to remove the bottom half of the SiC roll and transport it, along with the top half previously removed, to the processing area. The furnace bed is cleaned and prepared for the construction of the next furnace.

In issue #104 ***SiC & More*** will continue the series by describing the processing of SiC



Digging– stock photo

Silicon Carbide & More

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