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NEWS FROM THE BEAUTIFUL SURROUNDINGS OF NAVARRO GROUP SiC



Pictured above is the newest and most efficient of Navarro SiC in Leon Province, in Mansilla de la Mulas a village by The Way of Saint James (Camillo de Santiago) that is walked by thousands of pilgrims every year. Navarro produces half of their SiC at this facility surrounded by the lovely countryside.

It is always a pleasure to have an opportunity to visit with Jose Manuel Garcia (Director Commercial Activity) of Navarro. Not only is Navarro one of the world's premier producers of SiC, the Navarro Group is also an expert in hydroelectric production in beautiful countryside plants in Spain.

Despite being a genuine producer of kWh, Navarro is still ruled by two levers. According to Garcia, "One lever is electrical cost and the other is market demand." In other words, when the price of kWh allows for a cost that results in a profit, Navarro will furnace SiC. However, when the price of electricity goes into the stratosphere, Navarro can place the transformers on idle. Of course, either approach depends on the strength of the respective SiC markets.

Navarro, with plants in Cuenca and Leon provinces of Spain, has been producing since 1950 and selling high quality SiC products to a global marketplace including Europe, the Americas, Asia, Africa, and the local Spanish market. Each of Navarro's two furnace plants have the capacity to produce 10,000 metric tons per annum of SiC. More importantly, Navarro's two plants are fully integrated producing high quality SiC for abrasive, refractory, metallurgical, and powders applications.

Considering the lackluster demand for SiC seen across the globe, along with unpredictable kWh costs, Navarro is running at about 70% capacity utilization. Garcia's comments seem to mirror the thoughts of many in the industrial sector, "Demand in general is weak with much of that due to interest rates, energy costs and inflation."

When asked about the cost of raw materials, Garcia reflected that silica sand was stable but petroleum coke was, "more expensive than ever". With prices for Chinese SiC having dropped about 40%, depending on the product and market, Navarro is blessed with having a sterling reputation of quality and service. Garcia indicated, "We have many customers that appreciate Navarro's production and they are willing to pay for the closeness, quality, speed of service, payment terms, and ease of doing business with Navarro."

Since Navarro produces both green and black SiC powder, ***SiC & More*** chatted with Garcia about the clamor surrounding the next generation of SiC products. Garcia commented, "At the moment, single crystal, semiconductors, recrystallisation, etc., have promise over the mid term but our not something that helps in the short term survival mode. All of those opportunities require investment but they could be interesting."

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SYRAH COMMENCES AAM PRODUCTION AT ITS 11.25KTPA VIDALIA FACILITY IN LOUISIANA

Vidalia is the first vertically integrated natural graphite AAM supplier outside China, processing natural graphite from Syrah's Balama Graphite Operation in Mozambique.

Syrah Managing Director and CEO Shaun Verner said, "Commencing production at Vidalia is a huge step forward in Syrah's evolution, with the downstream integration being the culmination of almost seven years of technology development, feasibility, procurement, engineering, construction and commissioning work undertaken by the Syrah team and its service providers. I congratulate Anne Duncan, our VP US Processing Operations, and the Syrah team on the progress to achieve this important milestone with a strong focus on safety, capital cost controls and schedule, with Vidalia has becoming the first integrated AAM facility of its scale built outside China. Syrah expresses its gratitude to the City of Vidalia, the State of Louisiana, the US Department of Energy and the local, state and federal authorities which have supported Syrah in its development of Vidalia. Syrah looks forward to positively contributing to the communities around Vidalia and the Company's stakeholders in the US for many years to come.

"Our 11.25ktpa AAM Vidalia operation is strategic for both Syrah and the North American battery supply chain and is the foundation of our downstream growth strategy. This strategy is supported by strong EV-driven demand globally, recognition of the importance of independent natural graphite AAM critical mineral supply, and differentiation in terms of emissions intensity of production and provenance of supply. The importance of Vidalia is reinforced by China's recent introduction of export controls on natural and synthetic graphite and its products, and US guidance on the definition of foreign entity of concern governing qualification for the Section 30D tax credit for new electric vehicles".

Source: Syrah Press Release

NAVARRO-CONTINUED FROM FRONT PAGE

Visiting with Jose Garcia is always interesting if not enlightening. His views tend to mirror the opinions of ***SiC & More*** and when a company can stake claim to producing SiC for nearly 70 years they are much more than a survivor. Navarro has proven to be a mainstay on the global SiC stage focused on continuous improvement and customer satisfaction coupled with creating sustainable environmentally sound solutions.

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Pictured above is Navarro's Vadillos SiC plant is surrounded by a pristine mountain landscape.

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A FEW WORDS FROM FRANCISCO BATISTA



Stock photo ©freevectormaps.com

A) Energy: As the end of the rainy season in Brazil approaches (March), along with the reduction of the El Niño effect over the climate, the result is the country received significantly less rainfall in the hydro power reservoir regions. It is expected that southeast region reservoirs (responsible for 70% of water accumulation for hydro generation) will start the dry season with an average level of 55%. Although this is a low level, and a yellow flag is being raised, Brazil's energy matrix has changed a lot in the last five (5) years due to the aggressive growth of solar and wind sources, making the country less dependent on hydro and rainfall. Nevertheless, the market is now repricing upwards the long-term energy contracts (4+ yrs) to R$ 155/MWh ($31/MWh) representing an increase of 29% over prices released in the last report. In terms of energy demand, there has been an increase of 5% in Jan/24 (compared to Jan/23) almost entirely driven by the extreme heat brought by El Niño in various regions of Brazil. There are no signs of an increase in energy demand from the industrial sector.

b) Macroeconomics: Since inflation in Brazil is on a downward path, the Brazilian Central Bank is keeping its plan of making 0.5% cuts on interest rates every month bringing it down to 11.25%. Should no changes be perceived on inflation path then Central Bank predicts to bring the interest rate to 9.00% by the end of 2024 and to 8.50% by the end of 2025. FX rate is stable around R$ 4.95 and FOCUS projections are: R$ 5.06 by Dec/24 and 5.10 by Dec/25. If no other global disturbances appear on the landscape, the main threat to Brazil's economy should be how the current administration handles the fiscal deficit for 2024 and beyond. It is still very unclear what will happen as this administration looks lost when keeping its promises to zero this deficit in 2024.

c) Commodities: Average soft and hard commodity prices have dropped further in recent weeks. Soft commodities will have a very tough year as there is no sign of demand recovery coming from Asia or anywhere else. Meanwhile the El Niño mess in climate has negatively affected soy and corn farming in the center-west of Brazil compromising what would've been a record high grain crop. It is expected a decrease of 3% in overall grain output in Brazil. The favorable FX rate is keeping exporters alive even in the wake of weak prices.

d) Politics: It appears as if President Lula is a disaster when it comes to foreign policy, which does not come as a surprise to many people in Brazil. Lula's tendency to please and support dictatorships around the world along with his reckless declarations over sensitive matters have made him a pariah in the international scene. His obsession in winning a Peace Nobel Prize makes him completely forget internal affairs and focus only on traveling around the world trying to become relevant in some way. Meanwhile Brazil is facing the threat of a fiscal deficit in 2024 which may compromise the country's economy. On top of that, the administration is not advancing an inch in making the remaining needed reforms to provide conditions for the Brazilian economy to grow. The overall outlook for Brazil is concerning.

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ADVANCEMENTS IN SIC PRODUCTION AT SUBLIME, A COMPREHENSIVE UPDATE



Pictured above is a large SiC furnace being cracked after being taken off power and cooled at the Curimbaba Group's Sublime SiC plant in South Africa

Since the Sublime SiC furnace plant was first commissioned, ***SiC & More*** has made it a priority to remain in contact with ownership and management. During the past 22 years, that linkage has never been more important than today when the world's consumers of SiC become increasingly more dependent on China to fulfill their needs. Sublime brings a welcome relief to that dependence with one of the newest furnace plants on earth as well as having quite possibly the most progressive ownership in the metals and minerals business.

SiC & More recently had the pleasure of visiting with Leonardo Curimbaba and Bruno Dallemagne and the interview resulted in the following energizing subject matter:

As the demand for Silicon Carbide (SiC) continues to increase in various industries, Sublime, a player in SiC production, is investing to improve its capacity and quality. In this update, we take a look at Sublime's latest developments, highlighting their capacity enhancements, product portfolio, capital expenditure initiatives and pioneering advancements in their facilities.

Capacity Enhancement and Product Diversification:
Sublime has been relentless in augmenting its SiC production capacity to meet the market demands. With state-of-the-art technologies and streamlined processes, the facility has increased its output while ensuring uncompromised product quality. Furthermore, Sublime has expanded its product range to cater to diverse applications across industries, offering tailored solutions to meet specific customer requirements. A good example is the 60% and 70% briquette products, new development of the company.

Future Marketing Plans and Export Markets:
In alignment with its strategic vision, Sublime is poised to penetrate new markets and fortify its presence in Americas and Europe. The company's forward-looking marketing strategies aim to capitalize on emerging opportunities and establish enduring partnerships worldwide. Through targeted proactive market outreach, Sublime is steadfast in fostering sustainable growth and global expansion.

Capital Expenditure Projects and Progressive Measures:
Sublime continues to invest in cutting-edge infrastructure and new equipment to bolster its operational efficiency and competitiveness. New weighfeeder system, front end loaders, crushing and sizing equipment. The implementation of innovative technologies not only enhances productivity but also reduces energy consumption and environmental footprint. Moreover, Sublime remains committed to upholding the highest standards of safety, quality, and sustainability across all facets of its operations.

The furnace loading system, a Sublime specificity:
One of the features of Sublime's facilities is its furnaces loading system, equipped with conveyors and large mobile equipment. The vision behind this system highlights the intricacies of the conveying process and its central role in optimizing production flows. With seamless material handling and precisely controlled operations, the furnace loading system exemplifies Sublime's unwavering commitment to innovation and operational excellence.

Conclusion:
As SiC continues to advance technologically, Sublime remains true to its mission as a reliable, quality producer. Through a relentless drive for profitability, coupled with visionary leadership and relentless dedication, Sublime remains a reliable supplier of quality SiC.

Stay tuned for more updates and insights from Sublime as they continue to shape the landscape of SiC production and pave the way for a brighter, more sustainable future.

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SiC PRICING FLAT AS THE MALDIVES

SiC Pricing Flat as the Maldives:
The Maldives rank as the flattest country on this planet. In fact, there is a miniscule elevation difference of 5 meters between the lowest and highest points.

Although we aren't measuring the elevation of SiC pricing, we can safely say that, regardless of the SiC product, very little has changed in the way of pricing since November 2023. After dropping by as much as 40%-plus in 18 months, pricing has leveled off.

As mentioned in ***SiC & More*** issue #100, the custom in China is to make efforts to increase pricing during the "heating season", which begins about a month before the Chinese New Year. As China was entering the Year of the Wood Dragon in 2024, Chinese producers attempted to implement price increases during the January and February negotiations. Generally, environmental issues such as the Environmental Police shutting down or curtailing production at high energy consuming industries also enters into the equation during the heating season.

These efforts went for naught in 2024 mainly because most everyone seemed flushed with inventory at the same time the Chinese domestic economy remained soft and prices on commodities dropped. An example is the all-powerful Chinese steel industry that produces more steel than the rest of the world combined. China produced 6.9% less steel in January 2024 compared to the same period in 2023. In other words, the situation wasn't exactly ripe for price increases.

One trader said, "China's silicon carbide industry is probably operating at less than 50% of capacity. You can bet your bottom dollar that the driving force behind the low efficiency is the sluggish Chinese economy. Not only that, demand out of EU and the states is also slow."

Another source commented, "Export prices on most of the Chinese silicon carbide products are the lowest they have been since early 2021."

End-use market prices always lag raw material purchases from China by around 3-6 months depending on the amount of inventory processors carry in their warehouses. This means that end-use market prices are also about to stabilize or begin to resemble the Maldives.

A processor added, "End-users probably shouldn't be waiting for additional price erosion during the second half of this year unless most processors are sitting on excess inventory and start to get anxious."

Finally, one of our more reliable sources said, "You got to love these pricing cycles. The sales price on about half of what a SiC producer pulls out of the furnace is losing money at current prices. This will last for a while then you will see production across the SiC landscape curtailed and inventories along the supply chain reduced to a minimum just in time for a surge in demand forcing prices upward."

GLOBAL SIC PRODUCTION OVERVIEW

From purely a tonnage point of view, the Chinese continue to dominate the world's SiC production scene. After consulting with several colleagues in the industry, ***SiC & More*** believes that China will be operating at approximately 45% capacity utilization in 2024. That estimate is based on capacity of 1,459,000 n/t and operating tonnage of 663,000. The province of Gansu continues to lead the other provinces with an estimated 2024 production of 298,000 n/t.

According to ***SiC & More's*** estimates, China will produce nearly 66% of the world's SiC in 2024. Other major players believed to be producing in excess of 50,000 n/t per year include Fiven in Barbacena, Brazil and Volzhsky in Volgograd, Russia.

With global capacity of approximately 2,106,00 n/t and anticipated production of 1,007,000 n/t, the world's SiC consumers can expect just shy of 48% capacity utilization. With China's economy soft and most of the rest of the world experiencing sluggish turnover, capacity utilization is unlikely to improve much during 2024.

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BFA, MgO & MORE

In issue #100 of ***SiC & More***, a processor said, "I have been through these roller coaster rides more times than I care to remember. When demand and pricing went to the moon in 2022, you had to know what went up was going to come down. Well, here we are. Stagnant demand, too much inventory, hot competition, and over supply."

Not much has changed since late last year. The end-use markets are soft and pricing is flat at best. At the same time, although kWh pricing has improved, the cost of raw materials in China remains unusually high. In the case of aluminum oxide, bauxite is the key ingredient and the price remains inflated due to ongoing issues with raw ore mining. The situation has created a shortage of high-grade bauxite and dedicating the raw material to the production of alumina powder apparently took precedent over aluminum oxide.

In addition, during 2023 another rather unusual development took place. The cost to produce white fused aluminum oxide was essentially the same price as producing BFA, which has only occurred on a handful of occasions over the years. With end-use market pricing being higher for WFA compared to BFA, several key producers in China converted their production to WFA.

Since BFA smelters in China have only been operating at 30-35% capacity utilization, the conversion had little or no impact on the price of BFA. In short, there isn't a shortage of either WFA or BFA.

As noted in issue #100, a slowing Chinese economy has contributed to the oversupply and eroding prices. With domestic demand depressed, many expect the Chinese to devalue their currency in an effort to prop up exports. Needless to say, that is always a strategy resting in the Chinese government's quiver.

MgO pricing remains flat but that's a good thing after the roller coaster angst of the last several years. The price on both fused and DBM remain at near 10-year lows. As long as China's economy is soft and the rest of the world's metals and minerals activities are sluggish, this situation is not expected to change much in Q2 2024.

ZAPORIZHABRASIVE, MORE THAN A SiC PRODUCER



Pictured above is a brown fused aluminum oxide ingot being removed from the furnace for cooling and processing.

The fact that ZAK also produces and sells high quality brown fused aluminum oxide (BFA) often gets lost in the shuffle, which is a tremendous oversight. ZAK's sales of BFA and SiC are actually split evenly as the Ukraine's only producer of both products furnaces and processes about 20,000 tons per year of BFA; 15,000 in 2023 and 21,000 in 2022. The company produces both refractory and abrasive grains for the EU countries with emphasis on Germany, Italy, Czech, Poland and also to Turkey. Watch for additional information regarding ZAK's BFA production in future issues of SiC & More.

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METALS INDUSTRY UPDATE



iStock photo

GLOBAL STEEL UPDATE

For the most part, global raw steel production in January 2024 is identical to the same period in 2023. China continues to lead the way with 77.2 m/mt but January 2024 was about 7% less than January 2023. Other results for January were a bit more encouraging with India at 12.5 m/mt up 7.3%; Japan 7.3 m/mt up 0.6%; U.S. 6.8 m/mt even; Russia 6.2 m/mt up 1.2%. China still produces more raw steel than the rest of the world combined.

CATERPILLAR

2023 sales at Caterpillar totaled $67.8 billion, which represented a 13% increase over the $59.4 billion in 2022. Operating profit for the year was 19.3%, which was up from 13.3% in 2022. Source: Caterpillar press release

MACHINE TOOLS

The Association for Manufacturing Technology tracks new orders of machine tools as an indicator of future manufacturing activity. During December 2023, an unexpected rise in orders placed the full-year volume at about $4.9 billion, which also improved outlooks for 2024. Although the $4.9 billion in 2023 was 11.2% lower than 2022, the yearly total was better than most predictions.

US MANUFACTURED GOODS

In January 2024, transportation equipment fell by 16.2% compared to December 2023. Overall, new durable goods orders dropped by 6.1% compared to December.

IRON ORE

Iron ore dropped again and is now at its lowest level since late October 2023. Most recently it softened from $129.00 m/t to $125.00 m/t.

US STEEL

Pittsburgh-based US Steel Corporation recently announced a Q4 2023 net loss of $80 million. For the full year, US Steel reported net earnings of $895 million, which was a 65% reduction from 2022's $2.5 billion.

GENERAL ELECTRIC

During January 2024, GE's renewable energy business unit announced that they would supply approximately 700 wind turbines for SunZia Wind's project in central New Mexico. The New Mexico location is expected to be the largest onshore wind energy project in the Western Hemisphere generating 3.5 gigawatts of electricity per annum.

US VEHICLE SALES

2023 light vehicle sales in the U.S. came in at 15.5 million units. Electrified vehicles and hybrids made up 17% of that total. The 15.5 million is the best result since 2019 and it also exceeded the 2022 total of 13.9 million.

CLEVELAND CLIFFS

Cleveland-Cliffs recorded $22 billion in revenue for 2023 compared to $23 billion in 2022. 2023 also represented record steel shipments of 16.4 million tons.

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AN UPDATE FROM THE UKRAINE



Pictured above is a partial view of the Zaporizhabrasive plant in Ukraine.

Over the past several years, ***SiC & More*** has made it a point to keep tabs on Zaporizhabrasive (ZAK) and to inform readers of the resolve being displayed by the owners, management, and employees of a company caught in the middle of a war zone.

In issue #100 of ***SiC & More***, the customer service group at Zaporizhabrasive (ZAK) provided a list of overstock SiC and Al2O3 products that could be made available to readers. In issue #99, Oleksandr Shkola, Deputy Chairman of the Board on Technical Issues, described to ***SiC & More*** a recent capital expenditure project that included Genton equipment to improve feeding and mixing of SiC charge materials for the furnace. Shkola told ***SiC & More***, "The main advantage of the new equipment compared to the old one, is to improve the quality of mixing charge materials and high dosing accuracy." In addition, "High quality mixing of all materials and exact adherence to the recipe is the basis of process stability and obtaining the necessary indicators." Mr. Shkola indicated that the new system virtually eliminated human error in the technological process of mixing components for furnacing SiC and only technical people have access to process equipment.

More recently, ***SiC & More*** was told by Mr. Shkola that ZAK had reconstructed a stationary furnace that would reduce the technological cost of SiC production by as much as 10%. This represents a significant shift in furnace technology for ZAK but with comparative advantages over the mobile furnace.

Mr. Shkola continued, "The smelting of SiC is currently carried out in self-propelled (mobile) furnaces. The size of the key space of the furnace is 14.4 x 2.6 x 2.15 m while the size of the core is 14.4 x 0.5 x 0.5 m respectively, and the charge layer, which participates in the process of silicon carbide formation and thermal insulation, is 1.05 m on both sides of the furnace and 0.95 m at the bottom."

"With this design of the furnace, the temperature in the contact zone of the charge with the side shields is 500-1000 degrees C, with refractory bricks at the bottom of the furnace 750 degrees C and in the upper part of the furnace 500 degrees C, which indicates a low heat capacity of the furnace and a high level of thermal losses."

The conversation continued, "Due to structural defects of the furnace, the integrity of the core is violated during its transportation from the loading area to the smelting area, which leads to an increase in the resistance of the core, its uneven heating and, as a result, increased redistribution of silicon carbide and power losses. In addition, to compensate for heat losses while under power, the process is forced to be carried out with increased power, which leads to overheating of the core zone, redistribution of silicon carbide and the formation of an excess amount of core material."

In other words, to decrease the negative impact of the factors mentioned above during the furnacing of SiC, ZAK decided to build an experimental stationary furnace. The technology change will solve several technical issues, optimize the use of kWh, increase the quality of products, and prevent the loss of raw materials during transportation.

Mr. Shkola added, We will be able to reduce the technological cost of SiC by 5-10%, increase productivity by 15%, and reduce electricity costs by 10%"

Even while operating under duress and in a time of uncertainty, ZAK's leadership continues to find ways to make high level operating improvements and strengthen the company as they propel the organization into the future.

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DIGGING THROUGH THE ARCHIVES: PRODUCING SiC

This is the second segment regarding the production of SiC from the dusty but irreplaceable archives of ***SiC & More***. This series is dedicated to providing more details about raw materials, new mix, recycled materials, furnace construction, and mobile equipment.

The raw materials used for producing SiC are typically silica sand and petroleum coke along with graphite. The sand and coke are the basic materials and are mixed together to form what is commonly known as "new mix", which is the major furnacing component. In a large furnace, the charge consists of 3,000-3,500 tons of new and re-cycled mix. The graphite is used to construct the "core", which is the conductor that completes the electrical circuit and acts as the heating element.

The sand and coke are dumped by an endloader into their respective bins at the mixing station. The mixing station crushes the coke and conveys both materials to an automated electronic batching system where they are accurately proportioned and dropped into a pug mill for thorough mixing. Once the sand and coke are loaded into bins, the balance of the operation is automated and controlled from a central control room. The new mix is then stockpiled for use in building new furnaces.

After a furnace run is completed, about two-thirds of the material is unreacted and must be removed to expose the SiC roll. This unreacted material has served as insulation during the furnace run and makes the furnace more efficient. The unreacted material is analyzed in the laboratory and, if necessary, the chemistry is adjusted by adding more coke and re-mixed. It might also be necessary to screen the material to remove large pieces before it can be reused.

About 3,000-3,500 tons of new and recycled mix are required to charge a furnace. The initial step is to construct the furnace bottom on top of the furnace bed. The bottom consists mostly of new mix and serves as the base for the graphite core. After the graphite core is completed, it is covered by more mew mix. After completion of these three phases, the walls and top of the furnace are completed using recycled material.

In the more progressive and environmentally progressive large furnace operations, the last step is to cover the furnace with a large sheet of plastic to collect the by-product gasses. This plastic is connected to the gas collection piping and is held down with recycled material piled around the edges. The furnace is then energized and the "cooking" or "smelting" practice begins.

In issue #102 of ***SiC & More***, readers will learn more about the mobile equipment necessary to produce SiC as well as the processing protocol.

Silicon Carbide & More

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