

# Business Strategy

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# Graphite Electrodes



Large diameter with higher quality standard.  
We will contribute to support the coming expansion of the EAF and its higher productivity.

Mitsuharu Nobata

General Manager,  
Graphite Electrode Division

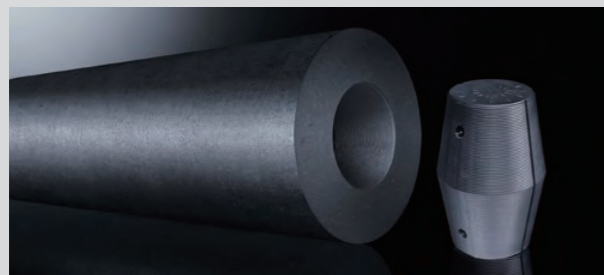


## Roles of Our Products and Their Connections with Society

There are two methods of steel production: The blast furnace method and the EAF method. In the blast furnace method, iron is produced through a process of reducing iron ore, while in the EAF method steel scrap is melted in an EAF and recycled as steel products. Graphite electrodes are used as conductors in an EAF to melt steel scrap at once by arc discharge. The temperature of the electrodes in an EAF exceeds 1,600°C, and graphite electrodes, which can be used under such harsh conditions, are indispensable for EAF steelmaking. We support the stable operation of EAF by supplying electrodes that can withstand high thermal shock and have high strength.



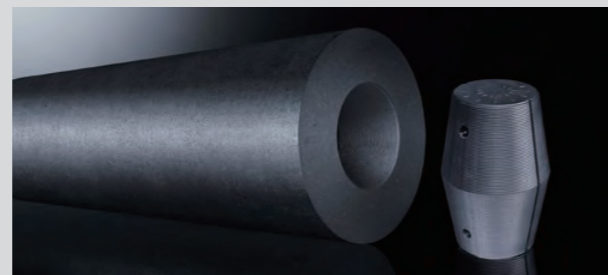
## Main Products



### Graphite Electrodes for DC Furnaces (direct current furnaces)

Size: 22-32 inches (550-800 mm)

Electrodes for DC furnaces, which require 1 column of graphite electrodes. Often used for high-current operations, the allowable current amount increases due to the larger diameter. The largest size diameter currently available is 32 inches.



### Graphite Electrodes for AC Furnaces (alternating current furnaces)

Size: 16-28 inches (400-700 mm)

Electrodes for AC furnaces, which require 3 columns of graphite electrodes. This is the main type of graphite electrode used for EAF, with electrode diameter sizes of 20-28 inches.

## Q What is your current market position and competitive advantage?

**A** The world supply capacity of graphite electrodes, excluding China, is less than 800,000 tons per year. Our supply capacity is approximately 100,000 tons, giving us a 13% share of the global market in 2021, ranking us fourth in the world. We have operational sites at three major demand centers as Asia (Japan), Europe (Germany) and the U.S., This platform allows us to procure raw material, produce, sell and take care of the customer when the electrodes are used, which helps us maintain longer relationships with customers and improve quality to match their needs. The world's best manufacturing technologies are shared among the global production sites, which also support our performance to be outstanding.

## Q How was business performance for the segment in 2022?

**A** In 2022, net sales increased 46.8% from the previous year to 59.630 billion yen and operating income was 8.032 billion yen (operating loss of 400 million yen in the previous year) due to the

recovery of the electrode market, higher selling prices in the second half of the year, and steady sales of large-diameter, high-quality electrodes in the United States, where EAFs are used for 70% of the total steel production.

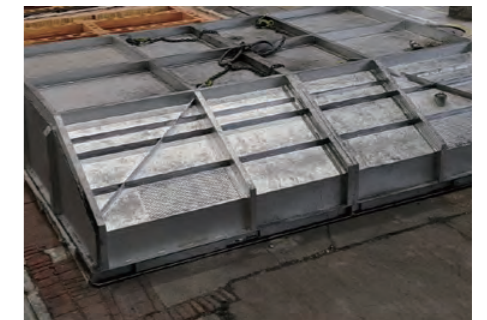
## Q What is your outlook for future market trends and what are your priority measures?

**A** The EAF method can reduce CO<sub>2</sub> emissions to about 1/4 that of the blast furnace method. From the perspective of carbon neutrality, there is a global shift from blast furnaces to EAFs. That said, steel production using the EAF method is expected to increase from the current 500 million tons to 700 million tons by 2030. Demand for electrodes will increase accordingly, especially for large-diameter electrodes used in large furnaces. The large-diameter electrode market demands high quality, in other words, a market where we can demonstrate our competitive advantage. Since these are high value-added products, we intend to raise production capacity of the larger ones to meet strong demand.

## TOPICS

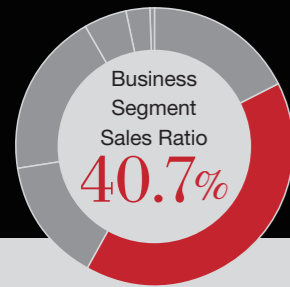
### Efforts to Reduce CO<sub>2</sub> Emissions from Electrode Manufacturing

The baking process carried out in the manufacture of graphite electrodes uses a large amount of fossil fuels. Tokai Carbon is working to reduce CO<sub>2</sub> emissions and save energy by improving the thermal insulation properties of our firing facilities. We are also working to reduce CO<sub>2</sub> emissions by switching fuels and using green electricity for the entire plant.





# Carbon Black



## Roles of Our Products and Their Connections with Society

Carbon black is mainly used for tires. This material, which can make up about 30% of the weight of a tire, supports the safe driving of trucks, buses and passenger cars, which are indispensable for daily life. Due to its characteristic of increasing the strength of rubber, it is used in a variety of other products besides tires, such as rubber hoses, belts, and anti-vibration rubber.

Carbon black is also used as a pigment for coloring. It supports society and our daily lives in familiar ways since it is used for black pigment in plastics, ink for printing newspapers, documents and more.



## Main Products



### SEAST

SEAST is a type of carbon black that is added to rubber to make it stronger and more resistant to wear, improving vehicle fuel efficiency. It is used in the rubber parts of industrial machines and various sizes and models of tire. As a furnace black product for rubber\*, SEAST proudly holds top share on the domestic market.

\* Carbon black produced by the incomplete combustion of heavy oil



### Aqua Black

Aqua Black is used as black ink in inkjet printers. Since carbon black is manufactured from oil, it is difficult to blend with water. We succeeded to modify it to mixable properties using our exclusive surface treatment technology. The technology allows to realize the deep black color, which is unique to carbon materials.

Stable supply to the local needs. We will propel our efforts toward carbon neutrality through our environmental equipment and technologies.

Norikazu Kawabe

General Manager,  
Carbon Black Division



**Q** What is your current market position and competitive advantage?

**A** Tokai Carbon started the production of carbon black for the first time in Japan in 1941. Since then, the technology and know-how that we have cultivated over many years as well as our solid track record have become our major strengths.

Since carbon black has a low bulk density and is lightweight, manufacturing and supplying carbon black at locations where it is in demand will reduce transportation costs and CO<sub>2</sub> emissions. We have three carbon black plants in Japan, three in the U.S., one in Thailand, and one in Canada. Our supply system, which is based on local production for local consumption, is the source of our competitiveness. Besides being a reinforcing material for rubber, carbon black is also used as a pigment for coloring. It is used as a black pigment for plastic such as TV frames and as ink for newspapers. In addition, by applying a special surface treatment to our carbon black, it is used as black ink used in inkjet printers by various manufacturers, supporting society and our lives in familiar ways.

**Q** How was business performance for the segment in 2022?

**A** In 2022, sales were strong due to strong demand for aftermarket tires for trucks and buses. In addition, the rise in raw material costs was reflected in the selling prices. As a result, net sales increased 39.2% year on year to 138.484 billion yen and operating income increased 39.8% year on year to 12.282 billion.

**Q** What is your outlook for future market trends and what are your priority measures?

**A** Global demand for carbon black is expected to grow at an annual rate of 4% to 5% through 2025, driven by increased demand for replacement tires and the widespread use of automobiles in emerging countries.

We have been intensively investing in large-scale environmental facilities at our U.S.-based plants for several years with system installation expected to be completed by 2023. As a result, we are now ready to meet the strong demand for carbon black in the U.S. in the future. In Thailand, we are planning to start operation of a new plant in 2025 on a new site owned by the company. We will further improve productivity and quality, reduce environmental impact, and build a sustainable supply system.

## TOPICS

### Promoting the Development of Technologies for a Recycling-oriented Society

We are developing advanced technologies that contribute to carbon neutrality and to reducing environmental impact. Specifically, we will develop materials to extend the life of tires and other rubber products, utilize raw materials other than those derived from fossil fuels, recycle used tires, and recover/reuse energy. This will be achieved through co-creation with customers, business partners, universities, and other research institutions.



# Fine Carbon



## Roles of Our Products and Their Connections with Society

Fine carbon is a carbon product characterized by its denseness, and isotropic graphite, which is manufactured using micron-level fine carbon particles, is a typical fine carbon product.

Isotropic graphite, with its high purity and ability to withstand high temperatures, is used in manufacturing processes of semiconductors, solar cells, airplane engine parts, and various metals.

Since materials of particularly high purity are required in the semiconductor field, demand for fine carbon has been growing along with the development of communication technology, AI, IoT, and other technologies. Also, since semiconductors are quickly evolving, components incorporated in semiconductor manufacturing equipment are subject to stricter conditions. This means that the materials themselves must also evolve. In response, we play a role in co-creating industrial development.

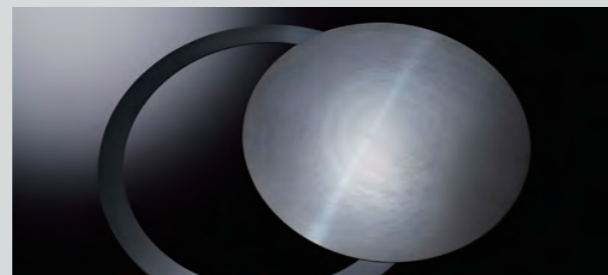


## Main Products



### Isotropic Graphite Material

In contrast with ordinary graphite, which has anisotropic properties, because of its importance in uniformity, fine carbon material is based on isotropic graphite. It is used for electric discharge machining for creating complex-shaped molds, components for high-temperature processing furnaces, nozzles for continuous casting, and many other products.



### Solid Silicon Carbide (SiC)

Manufactured using our unique chemical vapor deposition method, solid SiC is a super high-purity solid silicon carbide manufactured by thickening the SiC coating film, that is normally 100 micron (0.1 mm) thin. With its strength and corrosion resistant properties, it is an ideal material for semiconductor equipment parts.

We will expand the supply of materials that contribute to semiconductor sophistication and productivity improvement to support the higher market demand.

Hideo Shin  
General Manager,  
Fine Carbon Division



#### Q What is your current market position and competitive advantage?

**A** With production bases in Japan, South Korea, China, the U.S., Germany, Italy, and the United Kingdom, which are countries of demand, we are the third largest supplier of isotropic graphite material in the world with an annual supply capacity of 7,000 tons. We have expertise in controlling baking temperatures to achieve stable quality with little variation.

We are the global top supplier of SiC Focus Rings, which were developed and put into production in 2013. Because of its higher strength and lower degree of wear and tear compared to metallic silicon and quartz glass, its use is expanding in increasingly sophisticated semiconductor manufacturing processes. At our bases in Japan, the U.S., and South Korea, where semiconductor device manufacturers and semiconductor equipment manufacturers are concentrated, we have an integrated production system that covers everything from forming to surface CVD-SiC coating to accurately meet customer needs and capture demand.

#### Q How was business performance for the segment in 2022?

**A** In 2022, while demand for smartphones and PCs declined, demand for power semiconductors such as SiC semiconductors steadily increased, and sales of SiC Focus Rings and products for general industrial applications expanded, resulting in a 26.2% increase in net sales year on year to 49.393 billion yen and a 54.3% increase in operating income year on year to 14.825 billion yen.

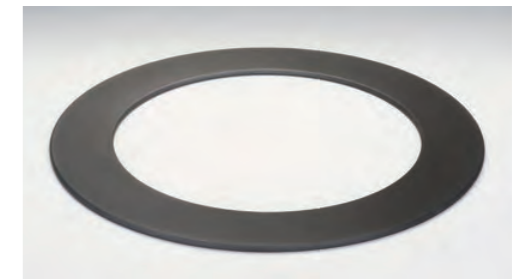
#### Q What is your outlook for future market trends and what are your priority measures?

**A** The semiconductor market is expected to grow further in the medium term due to the spread of IoT, AI, and EVs. Since semiconductor manufacturers are enhancing their production systems and improving the performance of semiconductors and manufacturing processes. Under these circumstances, the proportion of SiC products used in the semiconductor manufacturing process is expected to increase. We plan to increase our SiC production capacity 1.5 times higher in 2025 from the 2022 level to capture the demand.

## TOPICS

### SiC Focus Rings Support the Evolution of Semiconductors

Focus rings are used in the etching process to create grooves in semiconductor circuits using plasmaized gas. The focus ring is placed on the outside of the silicon wafer and is an important component necessary to concentrate the plasma on the wafer and ensure uniform processing. As the number of etching cycles increases and plasma output becomes higher with the miniaturization of semiconductors and the move toward three-dimensional design (stacking), there has been a shift to solid SiC rings that have higher plasma resistance.





# Smelting and Lining



With the aim of realizing a sustainable society, we will expand the use of products that reduce environmental impact.

**Takashi Masaki** General Manager, Smelting and Lining Division



## Roles of Our Products and Their Connections with Society

Our Smelting and Lining business consists of three main products: Cathodes, carbon electrodes, and blast furnace blocks.

Cathodes are used in electrolytic furnaces for smelting aluminum. Through the supply of cathodes, we contribute to the stable production of aluminum. Aluminum is lightweight, highly recyclable, and widely used in industries for automobiles, airplanes, trains, and beverage cans.

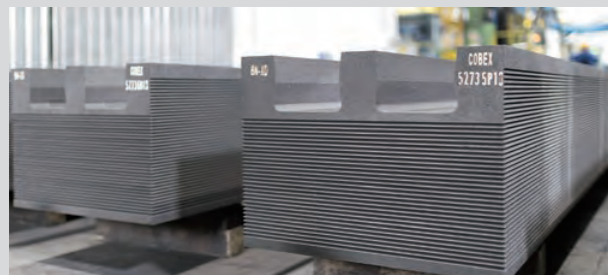
Carbon electrodes are used to produce metallurgical grade silicon, a material used in semiconductors, and support the production of semiconductors, for which demand is expected to grow further.

Furnace linings are installed as refractory materials in blast furnaces used to produce steel for automobiles and other products.

In this way, we contribute to the development of society by supplying key components that are indispensable for the production of each material.



## Main Products



### Cathodes

Cathodes are used in electrolytic furnaces for smelting aluminum. These products possess excellent thermal conductivity, electrical characteristics, and mechanical characteristics. Using coke as raw material, general-purpose carbon cathodes are heat-treated at 1,000°C and high-end graphitized cathodes at 2,500°C or higher.



### Carbon Electrodes

Used as electrical current conductors in submerged electric furnaces (melting furnaces) for production of metallurgical grade silicon, a material used in semiconductors, ferroalloys, phosphorus, lead, nickel, and copper.

### Q What is your current market position and competitive advantage?

**A** The company has manufacturing facilities in Poland and France, sales and service bases in China, and headquarters functions in Germany. We are the global top supplier of high quality cathode and blast furnace blocks while second for carbon electrodes. Based on technologies and know-how accumulated through research and development, we supply products with stable quality that is not affected by raw material characteristics.

Cathodes, carbon electrodes and furnace linings are manufactured using the same equipment and following the same heat treatment process. Therefore, what to produce is switchable that helps to optimize the product mix according to the demand of each product. This kind of product line is unique, which is one of our strengths.

In addition, each product requires significant investment and various manufacturing know-how. Since they are essential components for customers' production, changing suppliers entails risks. That said, the entrance barrier for this business is extremely high.

### Q How was business performance for the segment in 2022?

**A** In 2022, shipments of furnace lining decreased due to the impact of the Ukrainian crisis while sales of cathodes and carbon electrodes remained firm. We also made efforts for adjusting sales prices to cover cost increases and to maximize production output. As a result, net sales increased 31.2% year on year to 65.203 billion yen, however, operating income decreased 30.1% to 1.345 billion due to the recording of goodwill amortization and other expenses.

### Q What is your outlook for future market trends and what are your priority measures?

**A** Aluminum, which is lightweight and highly recyclable, is attracting increasing attention from the viewpoint of reducing the environmental impact of automobiles, such as improving fuel efficiency. Global demand for aluminum is expected to grow at an annual rate of 3 to 4%. With the expected increase in aluminum production and expansion of electrolytic furnaces, we will capture the growing demand for cathodes. In the China market, we have been rolling out the RuC®, a strategic product that reduces environmental impact, from 2022 and working on to spread it over.

## TOPICS

### RuC® - a strategic cathode product

When installing a regular cathode in an electrolytic furnace, the customer must cast a steel bar for conductivity. RuC®, a product that we began supplying in 2017, is a cathode that incorporates a connector rod, which is a rod-shaped material for conducting electricity. This eliminates the need for customers to install the conductor. Furthermore, since the connector rod is made of copper, it has excellent electrical characteristics. Therefore, it is possible to reduce the power consumption of aluminum smelting by approximately 3%. We will contribute to the reduction of environmental impact by spreading RuC® in order to make it an industrial standard.



# Industrial Furnaces and Related Products



Contribute to our customer's higher growth, higher quality and the stable production, as a top brand supplier.

**Akihiko Sato** President, Tokai Konetsu Kogyo Co., Ltd.



## Roles of Our Products and Their Connections with Society

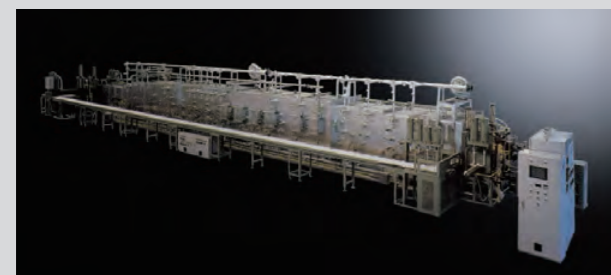
Many components such as MLCCs (Multi-Layer Ceramic Capacitors), lithium-ion batteries, and glass are used in smartphones and cars.

Industrial furnaces are used for heating, sintering, melting, and heat treatment at predetermined temperatures in the production of ceramics, electronic components, secondary battery materials, metals, glass, and powders. Based on the technology and know-how cultivated over many years, the temperature (1,000 to 1,500°C), ambient gas (nitrogen, hydrogen, etc.), pressure, etc. are set according to the material. We supply industrial furnaces capable of manufacturing large quantities of parts with stable quality. EREMA heating elements installed and used in industrial furnaces were the first to be sold commercially in Japan in 1927 and now we are the biggest producer of silicon carbide heating elements in the industry.

In this way, we contribute to society by supplying equipment and products essential for the manufacture of electronic components and lithium-ion batteries.

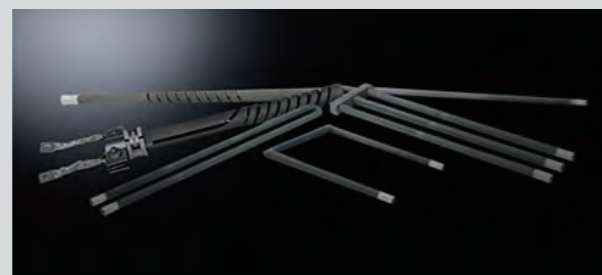


## Main Products



### Industrial Furnaces

MLCCs and lithium-ion battery materials are inserted into industrial furnaces for heat treatment. We custom design and manufacture our industrial furnaces taking into account heat treatment conditions and material insertion methods to meet customer needs.



### EREMA Heating Elements

EREMA heating elements are heating elements composed of high-purity SiC (silicon carbide). Since the heat dissipation per unit area is very large, the temperature can be raised up to 1,600°C. It is an environmentally-friendly heat source that does not create air or noise pollution.

### Q What is your current market position and competitive advantage?

**A** Over the years, we have honed our technology by supplying major electronic component manufacturers in Japan. As the performance of electronic components and battery materials evolve significantly, we respond quickly to customer needs, building a track record of performance and trust. Even for large-scale industrial furnaces that process large quantities of parts, we have achieved the performance to precisely control the temperature and atmosphere gas in the furnace that lead to customers' stable production and quality.

Since baking of electronic components and lithium-ion batteries is an important process in the customer's production, industrial furnaces are an industry with high barriers to entry where trust formed by an excellent track-record is important. The Tokai Carbon Group supplies industrial furnaces and EREMA heating elements to manufacturers around the world, mainly in Japan, China, and Korea, and has established "Tokai" as a leading industrial furnace brand name with 50% share of the global market for industrial furnaces designed for MLCC sintering and 30% share of the global market for heating elements.

### Q How was business performance for the segment in 2022?

**A** In 2022, although demand in the energy-related sector remained firm, net sales decreased 9.7% year on year to 16.272 billion yen due to the impact of the lockdown in China and the slowdown in the electronic component-related industry. Operating income decreased 17.1% year on year to 4.475 billion yen.

### Q What is your outlook for future market trends and what are your priority measures?

**A** The MLCC market is expected to grow at an annual rate of approximately 10% and the lithium-ion battery market at an annual rate of 20-30% backed by a growth in 5G base stations, EVs with its electrification. There should be a series of capital investment coming on line from our customers.

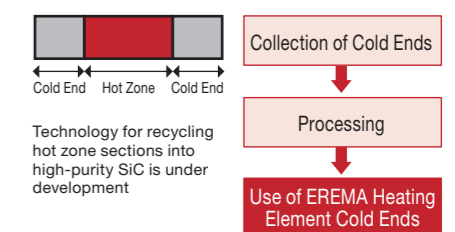
Under these circumstances, we are expanding our production capacity for industrial furnace and EREMA heating elements. Expansion for industrial furnaces production in Shiga plant, Japan will be completed in January 2023. Expansion for heating elements production in Sendai Plant, Japan will be completed in 2025 bringing the capacity up to 1.6 times larger than the current level.

## TOPICS

### Promoting initiatives to reduce CO<sub>2</sub> emissions

For industrial furnaces, we are working to improve technologies to effectively utilize the energy input during heat treatment in order to save energy. As for EREMA heating elements, we have developed and introduced environmentally-friendly products and launched an initiative to collect and recycle used products from 2023. In terms of production, we are introducing forms of renewable energy such as solar power that contributes to our energy saving and high efficiency production.

### Started recycling the cold ends of used EREMA heating elements





## Friction Materials

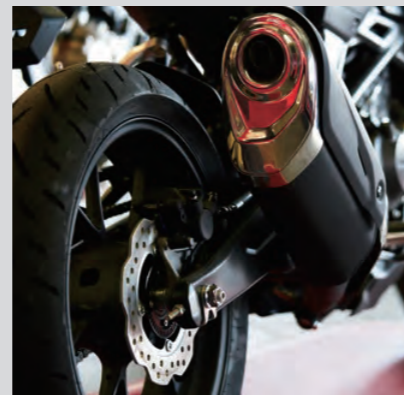


### Roles of Our Products and Their Connections with Society

To “stop things that move” and “transfer power”, friction materials are used in brakes and clutches of motorcycles, construction machinery, agricultural machinery, machine tools and robots.

Sintered metal friction materials, our main products, are manufactured by sintering and processing a mixture of graphite, copper, etc. They are highly durable and are incorporated into brakes and clutches for large motorcycles and special vehicles (cranes, mining wheel loaders, combine harvesters, tractors, etc.). In addition, resin-based friction materials are used in control parts of machine tools and industrial robots.

We simplify packaging and utilize returnable containers to reduce environmental impact when delivering our goods. In manufacturing, we are working to reduce CO<sub>2</sub> emissions by switching to carbon-free power at our plants.



Direct match to the needs.  
Our product will generate the new market.

Hirofumi Masuda  
General Manager,  
Friction Materials  
Division

**Q** What is your current market position and competitive advantage?

**A** We develop and propose products that match the detailed needs of our customers. Our technology and know-how built over a long history makes that possible. It was 1949 when Tokai was the first to produce sintered metal friction materials for motorcycles in Japan. Today, we dominant 60% share in friction materials used for large motorcycles in Japan.

**Q** How was business performance for the segment in 2022?

**A** In 2022, despite a slowdown in the Chinese construction machinery market and supply

chain disruptions, sales increased 5.4% from the previous year to 9.362 billion yen due to firm demand for major applications.

**Q** What is your outlook for future market trends and what are your priority measures?

**A** In addition to expanding sales of sintered metal friction materials and resin-based friction materials, which are our main products, we will also work to develop the market for off-road vehicles, including four wheeler buggies, which are gaining popularity mainly in the U.S. On the production side, we are promoting the automation of manufacturing and utilizing AI for material formulation for further product development.

## Anode Materials/Others



### Roles of Our Products and Their Connections with Society

Lithium-ion batteries are found in mobile phones, hybrid cars, and EVs. Graphite is used for the anodes of these batteries. Our advanced graphite manufacturing technology allows us to produce and supply high-quality, low-cost anode materials with less CO<sub>2</sub> emissions during production.

### Looking back on 2022 and priority measures for the future

In 2022, sales of anode materials decreased 35.1% from the previous year to 1.888 billion yen due to sluggish sales of EVs in which our products are used and intensified competition caused by the emergence of new companies.

On the other hand, since efforts toward local production for local consumption of EV components are spreading in Europe and the U.S., local production of anode materials for lithium-ion batteries is being encouraged. With heat treatment manufacturing facilities in Europe and the U.S., we are well positioned for growth opportunities to utilize Japanese anode material production technology in regions of demand. Currently, the production technology for anode materials is being transferred from Japan to our base in France under the umbrella of Tokai COBEX. The production capacity will be enlarged according to the market expansion.

### TOPICS

#### How lithium-ion batteries made using graphite work

Rechargeable lithium-ion batteries for repeated use can be charged and discharged by taking in and releasing lithium ions by using the movement of lithium ions in the anode material. This design utilizes the structure and chemical stability of graphite, and has a larger battery capacity and operating voltage than other rechargeable batteries. It is smaller and lighter as well. It can withstand additional charging when it is not fully discharged.

