



# CARBON & GRAPHITE SPECIALTIES

High-Value-Added Products that Support  
World's Cutting-Edge Technologies



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 **SEC CARBON**

# Our Carbon & Graphite Specialties that support the increasing sophistication of various industrial fields.

Graphite is highly functional with properties that include heat resistance, electrical conductivity, anti-corrosion and lubricity. It also possesses a wide variety of properties including ease of precision machine processing and lightness.

At SEC CARBON, we utilize these properties to the fullest by processing and manufacturing the graphite by itself, or as a composite material that can be used with resin or metals, into "shapes" desired by the customer.

The various products made in this manner are used in a wide range of fields from key industries to cutting edge fields. Our graphite products have received high acclaim as being necessary product for supporting the increasing sophistication of industry.



## Using NC Lathes and a Large Machining Center, precise machinings are available at the micron level according to customer's specifications

Using state-of-art large machining center and NC lathes, we can process and machine comparatively larger Graphite products with very high precision. We inspect our products using our 3D measuring equipment and high accuracy measuring equipment. In addition, we provide various special impregnation treatments in order to meet our customer's requirement, such as antioxidant treatment.



NC lathes



Special impregnation equipment



3D measuring equipment

## Where are Carbon & Graphite Specialties used ?

### Applications

Graphite is being used in various industries such as semi-conductors and aerospace.



### Electrolysis

Our Graphite is widely used as graphite electrode for melting and refining of magnesium and various non-ferrous metals, while magnesium is used in the rapidly expanding industries, like OA machines, automobiles and aircrafts.



### Ceramic Industries

Our Graphite is widely used by Ceramic industries as sintering trays, crucibles or molds.



### Industrial Furnace

Our Graphite with its excellent electrical/thermal conductivity and good heat resistance is the essential material for Industrial Furnaces as heating elements or structural material.



### Metallurgical Industries

Our Graphite is used for production of magnetic steel sheets and high purity aluminium.

With full understanding of customer's specific needs, we make an utmost efforts to manufacture our Graphite with its very best properties and characteristics.

### 1. Excellent Heat Resistance

Our Graphite can be used in temperatures of up to approximately 3,000°C in inert atmospheres and up to approximately 400°C in oxidizing atmospheres. One of special characteristics of graphite is that mechanical strength increases as the temperature gets higher up until 2,500°C in inert atmospheres.

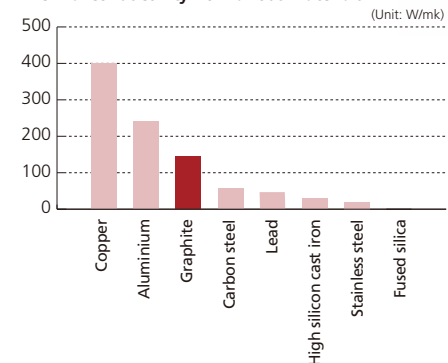
#### Reactivity of our Graphite

Atmosphere	Reaction temperature (Unit: °C)	Reaction product
Air	400	CO <sub>2</sub> , CO
Steam	700	CO <sub>2</sub> , CO
Hydrogen	1,000~1,200	CH <sub>4</sub> gas
Nitrogen	2,000~2,500	C <sub>2</sub> N <sub>2</sub>
Argon	3,000	Graphite sublimation
Vacuum	2,200	Graphite sublimation

### 2. Excellent Electrical / Thermal Conductivity

Our Graphite has the similar values for thermal and electrical conductivity as those for metal.

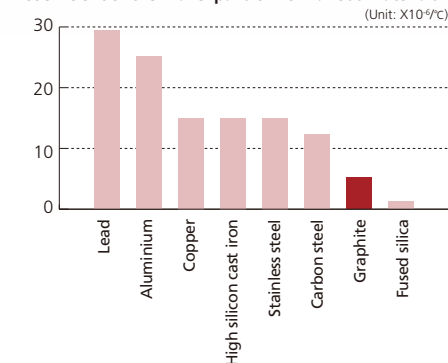
#### Thermal conductivity for various materials



### 3. Low Coefficient of Thermal Expansion

The coefficient of thermal expansion for our Graphite is less than half that for metals such as steel and copper.

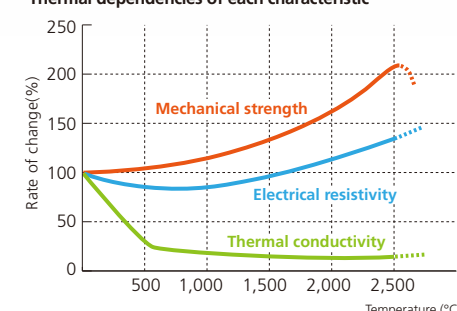
#### Coefficient of thermal expansion for various materials



### 4. Excellent Thermal Shock Resistance

Our Graphite is extremely resistant to the appearance of cracks and fractures even when exposed to sudden heating or cooling.

#### Thermal dependencies of each characteristic



### 5. Excellent Chemical Resistance

Our Graphite shows outstanding corrosion resistance against various chemicals.

#### Corrosion resistance of graphite

<b>Acids</b> (Chlorine, sulfuric acid, etc.)	Excellent
<b>Alkalis</b> (Caustic soda, ammonia water, etc.)	Excellent
<b>Hydrocarbons</b> (Benzene, toluene, etc.)	Excellent



# Carbon and Graphite Materials

Delivering optimum specialty carbon products with solid technological strengths and cost accommodation.

SEC CARBON has available various carbon and graphite materials that can be used in a variety of industrial fields including the chemical industry, the electrochemistry industry, the machine industry, and the metallurgy industry.

## ● Extruded material

Product grade	Size (mm)		Maximum grain size (mm)	Bulk density (g/cm <sup>3</sup> )	Electrical resistivity (μΩm)	Bending strength (MPa)	Hardness (HS)	Thermal conductivity (W/mk)	Coefficient of thermal expansion (10 <sup>-7</sup> /°C)	Ash content (%)	Usage examples	
	Diameter or Thickness × Width	Length										
Rectangular	PSG-11	500×450	3,300	2.3	1.64	9.0	19	40	150	4.4	0.15	
		670×450	1,800-3,000									
	PSG-12	500×450	2,000	2.3	1.74	7.5	27	43	170	4.4	0.15	
		670×450	3,000									
	PSG-13	670×450	3,000	2.3	1.80	7.0	29	46	190	4.4	0.15	
	PSG-322	650×500	2,440	2.5	1.72	5.3	18	26	210	1.0	0.03	 <p>Heating elements, boats, trays, sliding plates, electrolytic electrodes, molds, jigs, various architectural materials</p>
		670×450	3,170									
	PSG-332	650×500	2,440	2.5	1.75	4.7	21	26	240	1.0	0.03	
670×450		3,170										
PSG-333	650×500	2,440	6.0	1.74	4.6	20	26	240	1.0	0.03		
	670×450	3,170										
PSG-324	670×450	2,650	12.0	1.72	5.3	14	26	210	1.0	0.05		
Block	PSK-CB	-	-	12.0	1.60	45	14	50	10	5.5	1.0	
Brick	PSK-GB	-	-	12.0	1.63	12	32	130	4.5	0.3		
Circular	MSG	φ20·φ30·φ40	1,000	2.3	1.74	7.5	27	43	170	4.4	0.15	 <p>Heating elements, crucibles, rolls, dies, tubes, electrolytic electrodes, bearings, stationary boards, furnace materials</p> 
		φ50·φ60·φ70	1,500									
		φ80·φ90·φ100										
		φ200·φ225·φ250										
		φ300·φ350·φ400										
	MSG-12	φ450	1,800	2.3	1.77	7.5	28	45	180	4.4	0.15	
		φ500·φ600	1,800	2.3	1.76	7.5	27	41	180	4.4	0.15	
	GS-G	φ175·φ200·φ250	1,500	2.5	1.65	6.5	12	28	180	1.0	0.1	
		φ300	1,800	2.5	1.72	5.0	15	28	200	1.0	0.1	
		φ350	1,800	6.0	1.72	5.0	15	28	200	1.0	0.1	
		φ400	1,800	12.0	1.71	5.0	14	32	200	1.0	0.1	
		φ450·φ500	1,800-2,400	22.0	1.70	5.0	13	32	200	0.9	0.1	
		φ550·φ600·φ700·φ750	2,400-2,700	22.0	1.69	5.0	12	32	200	0.9	0.1	
	NS-G	φ100·φ115·φ125	1,500	1.0	1.82	3.6	30	30	250	0.7	0.1	
		φ150·φ175·φ200	1,500-1,800	2.5	1.82	3.6	30	30	250	0.7	0.1	
		φ250·φ280·φ290·φ300	1,800	2.5	1.82	3.5	30	30	250	0.7	0.1	
φ350·φ375		1,800	2.5	1.82	3.5	28	30	250	0.7	0.1		

\*Values given for the coefficient of thermal expansion were measured in a temperature range between 200 and 400°C. The above values are representative characteristics and are not guaranteed values.

# Fine Powder

High purity and fineness with wide variations

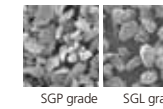
Fine Powder is a high purity graphite powder uniquely developed by SEC CARBON.

In order to support our customers to select best suitable materials, we offer a wide-ranging particle size and purity.



Artificial Graphite Powder

Artificial Graphite Powder that realizes stable quality by utilizing original advanced graphitizing technology.



Natural Graphite Powder

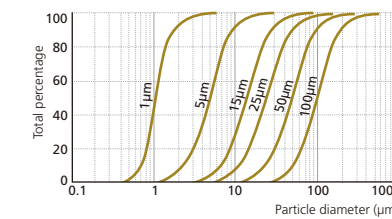
A high purity natural graphite powder that realizes high purity despite using natural graphite as the raw material.



Carbon Powder

A carbon powder that boasts high quality, made by finely and uniformly pulverizing select raw materials.

### ● Particle distribution (representative example)



### ● Element analysis examples of impurities

Grade	Element (Unit: ppm)				
	Al	Ca	Fe	Si	Ti
SGP	20	50	100	30	10
SGO	20	30	60	20	5
SNO	15	30	60	30	40
SGX	0.1	0.5	0.2	0.1	0.1

### Packing

Depending on the particle size, 5kg, 10kg, 15kg, and 20kg packings are available.



! SEC Fine Powder is an extremely chemically stable material (CAS NO. 7782-42-5, 7440-44-0) and is not classified as a hazardous material. Before use, please read the "Material Safety Data Sheet" and use the product correctly.

### ● SG Series High Purity Artificial Graphite

Particle size from 1 micron to 100 microns is available. Variety of grades is also available ranging from high purity to super-high purity.

Grade	Characteristics	Ash content (%)	Purity (%)	Real density (g/cm <sup>3</sup> )	Interlayer spacing (nm)
SGP	Graphite powder manufactured by processing select artificial graphite material using original, advanced graphitizing processing and high purity processing. Possesses outstanding electrical conductivity and lubricity.	0.03	99.97	2.24	0.3362
SGO	Highly oriented, high purity graphite powder identical to natural graphite crystals, manufactured using a proprietary process. Outstanding electrical conductivity, lubricity and heat resistance.	0.02	99.98	2.25	0.3360
SGX	Ultra high purity graphite powder with ash content of less than 10ppm, refined using high purity processing technology.	10ppm	99.999	2.25	0.3360
SGL	Graphite powder that uses lump coke as a raw material and has undergone advanced graphitizing processing. In addition to electrical conductivity and lubricity, it also possesses outstanding wear resistance.	0.25	99.75	2.20	0.3370

### ● SN Series High Purity Natural Graphite

High purity equivalent to that of artificial graphite.

SNO	Graphite powder manufactured by processing select natural graphite using a proprietary special refining process. In addition to a purity equivalent to artificial graphite, this powder possess highly superior electrical conductivity and lubricity.	0.03	99.97	2.26	0.3355
SNE	Graphite powder processed using a special slicing process and possesses outstanding electrical conductivity.	0.03	99.97	2.26	0.3355

### ● SC Series High Quality Carbon

Ideal material for friction moderators and general lubricant applications. Also is being used as raw material for specialty graphite products.

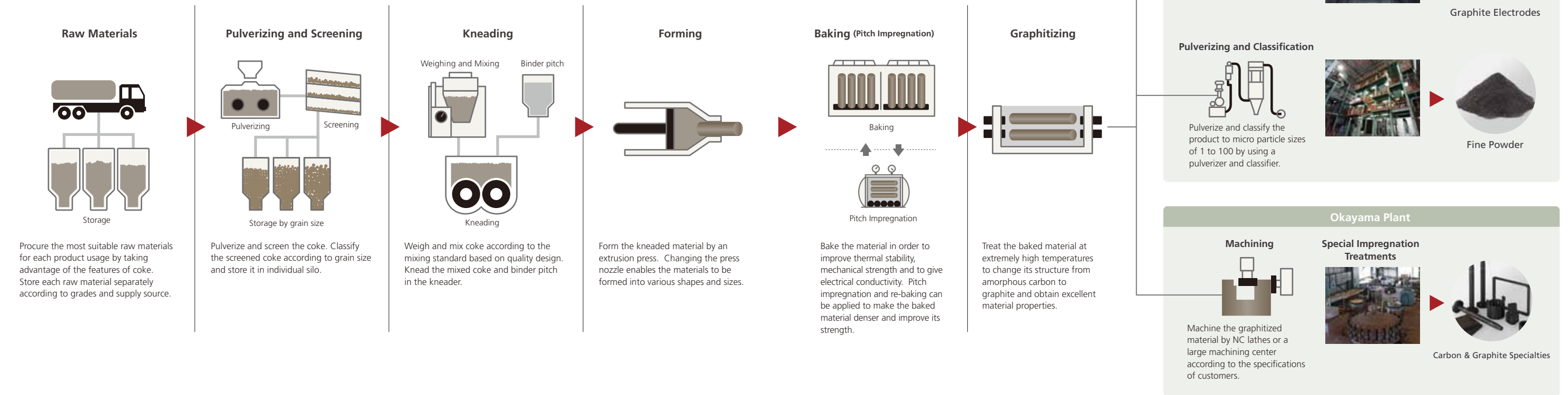
SCN	High chemical reactivity and carbon material with appropriate slide properties.	0.10	99.90	2.14	0.3375
SCL	Carbon material ideal for sliding material that requires wear resistance.	0.40	99.60	2.05	0.3384

# Contribution to Industries with Highly-Functional Products Produced by Unique Technology and Production System

All of our products are manufactured under our integrated production process and strict quality control.

One of the advantages of SEC CARBON is the production system that assures stable supply of high quality products. Kyoto Plant is our base of integrated production, while Okayama Plant is specialized for machining and special impregnation treatments of Carbon & Graphite specialties.

At Kyoto Plant, a new production line dedicated for SK-B was commissioned in 2011. Continuously enhancing the production system, our company is aiming to spread the SEC CARBON brand further.



## Highly reliable SEC CARBON products are born from continuously evolving manufacturing and processing systems.

Two plants support the high level manufacturing process at SEC CARBON. Our Kyoto Plant in Fukuchiyama City, Kyoto is our hub plant that is equipped with large-scale manufacturing facilities that are the top of the class in the industry. Our products, such as the "SK-B, Graphitized Cathode Blocks for Aluminium Smelting", "Graphite Electrodes", "Carbon & Graphite specialties", and "Fine Powder" are produced at Kyoto Plant. The Okayama Plant located in eastern Okayama is responsible for machining and special impregnation treatment of "Carbon & Graphite specialties". At Okayama Plant a variety of products with different processing precision, shape, and properties are being produced.



Centralized control room



Graphitization furnace

### Kyoto Plant (ISO9001/ISO14001 accredited)

A hub plant located in the Osadano Industrial Park in Fukuchiyama City, Kyoto, is responsible for both manufacturing and R&D for SEC CARBON. Befitting a hub plant, the Kyoto Plant has been awarded ISO9001 certification, a quality management system that is proof of a reliable manufacturer, as well as ISO14001 certification for its environmental management system.



SEC CARBON Kyoto Plant has obtained ISO 9001 QMS certification and ISO 14001 EMS certification.



JQA-0379 Kyoto Plant  
JQA-EM0678 Kyoto Plant

### Okayama Plant

Facing the Seto Inland Sea, Okayama Plant is responsible for the machining and special impregnation treatment of Carbon & Graphite specialties. The plant also houses processing machinery for NC lathes as well as a large machining center in order to provide high precision processing in order to best match customer's specific needs.

