

FOUNDRY

**ELECTRONICS
& ENERGY**

HEAT TREATMENT

EDM

graphite & carbon specialists

www.tokaicarbon.eu



A pioneer in the carbon industry for more than 80 years, Tokai Carbon Company has been steadily expanding the frontier of technical possibility. In order to generate progress in an increasingly complex and global world, we have developed and diversified the applications of carbon. To satisfy the changing needs of our customers, we have evolved into an all-round carbon product manufacture.

As the combination of corporate globalisation and rapid technical innovation has been changing the face of the world, we have fostered technical improvements and diversification. Directed by a customer-centred management, we are committed to achieving an outstanding role in technology development by increasing the technical power and know-how in the carbon industry.

We would like to further increase our efforts toward cultivating our technological competence comparable with the world, and securing steady growth in our business operations on the basis and originality, as a reliable international enterprise.

Our Parent Company Tokai Carbon Japan



Tanoura Production Plant
Iso-Static and Extruded Materials

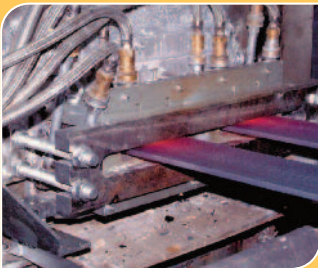
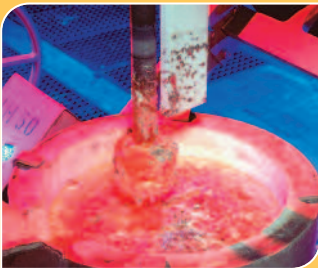
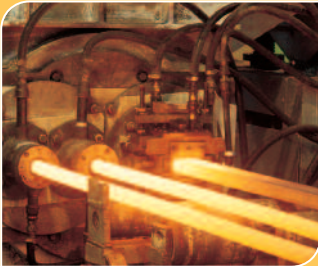


Fuji Research Laboratory
Tokai Carbon's State of the Art R & D Centre

Material Type	Grade	Density (g/cm ³)	Specific Resistance (μΩm)	Young's Modulus (Gpa)	Flexural Strength (Mpa)	Hardness (Shore)	CTE (x10 ⁻⁶ /°C)	Thermal Conductivity (W/mK)
Isotropic Graphite	G077	1.82	12	11	70	66	7.1	100
	G330	1.79	13	9.8	39.2	56	4.8	104
	G347	1.85	11	10.8	49	58	5.5	116
	G348	1.92	10	12.3	63.7	68	5.5	128
	G458	1.86	9.5	11.3	53.9	54	4.4	139
	G520	1.83	12	10.8	63.7	62	5.5	116
	G530	1.82	13	11.3	63.0	64	5.5	104
	G535	1.82	17	10.8	63.7	72	5.5	81
	G540	1.85	15	13.7	88.2	78	5.5	93
Moulded Graphite	G140	1.7	8.5		15.7	25	3.8	145
	G145	1.7	8.5		14.7	23	3.8	145
Extruded Graphite	FE/EE250	1.75	8		24.5	35	3.3	174
	CC28NF	1.4	28		100		0.8	2.6
Tokarec CC Composite	CC27MFP	1.62	22		170		0.8	8
	CC28MF	1.48	26		110		0.8	2.8
	CC28NF	1.48	26		140		0.8	2.8

Typical Impurities Analysis

Grade	Al	B	Ca	Impurity (ppm)		Si	Ti	V	Total Ash
				Fe	Ni				
Standard	0.48	1	74	15	1.7	23	28	7.6	300
S	<0.08	<0.7	<0.04	<0.06	<0.1	<1	<0.09	<0.07	<20
SS	<0.08	0.2	<0.04	<0.04	<0.1	<0.1	<0.09	<0.07	<5



Industries involved with processing molten liquids, in particular metals such as Iron, Aluminium, Copper and Precious metals and glass, use casting and metal treatment techniques that require the use of Graphite materials resistant to attack by the molten liquid. These Graphite materials must also not affect the final composition of the cast metal or deposit. Any hard particles in the melt that could cause problems during any subsequent post machining operations.

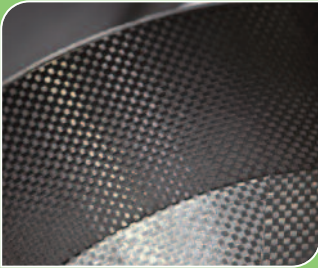
Continuous casting operations demand the use of Graphite for a number of reasons including:

1. a resistance to wetting by the molten metal or glass
2. efficient heat removal and
3. excellent thermal shock resistance

For processing aluminium alloys during such operations as degassing, Graphite shafts and rotors are ideal for the same reasons. Extended life is available with GRAPHOX treated Graphite. Tokai uses a post machining technique that ensures the Graphite parts are completely impregnated during the process.

Application	Extruded/Moulded Graphite	Isotropic Graphite	Tokarec
Continuous Casting			
Grey Iron		G330, G347	
Ductile Iron		G330, G348	
Brasses		G347, G348, G458	
Bronzes		G330, G348	
Copper Nickel		G348	
Nickel Silver		G348	
Precious Metals		G347, G348	
Zinc		G347	
Aluminium Billet & Slab		G330, G347	
General Applications			
Aluminium Degassing	EE250G		
Molten Metal Pumps	EE250G		
Extrusion Run Out Tables	FE250		
Furnace Heating Elements	FE250	G330	CC28NF
Furnace Furniture	EE250	G347	CC28NF
Furnace Linings	FE250, G140		
Boats	FE250	G330	
Sinter Trays	EE250	G347	CC28NF
Crucibles	G140	G348	
Large Crucibles		G530	

G = Graphox



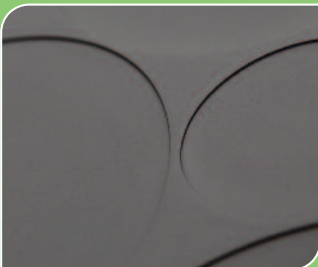
Technologies in the area of “green processes” are constantly being developed and improved and many rely upon Graphite and Carbon products for success. The drive towards no fossil fuel electricity generation, for instance, had led to major advances in industries associated with Fuel Cells and Photovoltaics. Graphite and Carbon products are used somewhere in all these fields and Tokai Carbon has grades suitable for these applications.



The reliance on electrical equipment containing silicon chips is now overwhelming and most would not function without the addition of a silicon chip. However, without the use of high purity Graphite and Carbon products the manufacture of silicon itself would not be possible. The processes involved in the production of silicon, from extraction to purification and casting, use many different types of graphite and carbon parts as well as many “post processes” involving purification, coating and machining. Tokai Carbon has developed a range of products designed to be used in the Silicon Value Chain.



LED lighting is the most rapidly emerging industry and Graphite is an integral part of the process of making the diodes that form the heart of an LED light.



Application	Extruded/Moulded Graphite	Isotropic Graphite	Tokarec
CZ Method Si Crystal pulling			
Heaters		G330S	
Crucibles		G347, G348	CC27MFS
Heat Shields		G330S, G347S	CC27MFS
DSS Method			
Backing Plates & Base Plates		G347, G330	CC28NF
Heating Elements		G347, G330	CC28NF
Siemens Process			
Heaters	FE250S	G330S	
Chucks	FE250S		
Thermal Shields	G140		CC27MFS
Internal and External Shields for STC Reactors	FE250S	SiC coated Graphite	CC27MFS
Quartz Crucible Production			
Electrodes	EE470S	G330	
Moulds	EE470S	G330	
UMG Silicon Production			
Crucibles	EE250, G140	G330	
Moulds	EE250, G140	G330	
LED			
Susceptors	SiC coated Graphite		



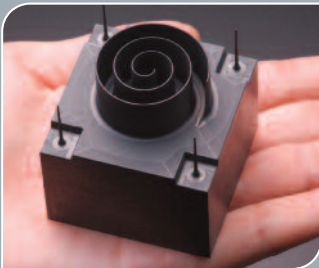
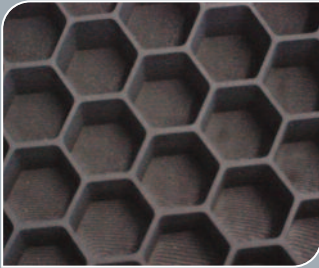
There are many sectors of industry that use thermal processing in their production cycle. Many of these rely on furnaces that are electrically heated and hence need materials that have high thermal stability and high electrical loading capability. They also need to be resistant to aggressive media, thermal shock and be chemically pure so as not to deposit any unwanted elements during thermal processing. The use of Graphite parts offer the user the possibility to work at temperatures that are beyond the capability of metal and ceramic elements. These are usually not used above 2000°C whereas graphite is capable of withstanding temperatures up to 3000°C.

Graphite is easily machined and so complex shapes can be made to suit the requirement of the furnace. Tokai's CC composite, Tokarec, has been developed as a high strength to weight ratio material suitable for many applications including carrier trays, structural parts and heater elements. The material has excellent shock and chemical resistance whilst having a low CTE and high purity.

The properties of Tokai's Graphite's and CC composite, Tokarec, makes them the ideal materials of choice for components used in furnace applications including Vacuum and Inert Atmosphere. Tokai Carbon's extruded Graphite's are consistent and not dependant on grain orientation.

Application	Extruded/Moulded Graphite	Isotropic Graphite	Tokarec
Vacuum Furnaces			
Heating Elements	FE250	G330	CC28NF
Furnace Furniture	EE250	G347	CC28NF
Furnace Linings	FE250		
Boats	FE250	G330	
Sinter Trays	EE250	G347	CC28NF
Crucibles	G140	G348	
Large Crucibles		G530	
Silicon Steel Production			
Conveyor Rolls	FE250T	G330T	
Carbon Fibre Production			
Furnace Structure			CC28NF
Heating Elements	FE250		

T = Treated



Tokai's HK Range For EDM

Tokai introduced its range of Iso-Static materials to the market place in the early 1980's, the New materials were named HK (Hoden Kako) which is the Japanese description for Electrical Discharge Machining. We at Tokai Carbon have fast become one of the leading suppliers of Iso-Static EDM Graphite's in the world. Throughout the technical growth of EDM applications Tokai has always been a creator of new and innovative materials to push and challenge the boundaries of EDM applications.

Our aim is to develop new materials to match the demand of new tools steels and exotic materials. We are always striving to manufacture new materials that can be seen as cost effective solutions for the modern toolmakers throughout the world.

We aim to prove that not all Graphite's are the same quality although they appear to be the same colour. Tokai's range of EDM Graphite's offer;

- High Speed and Low Wear Properties.
- Consistent Surface Finishing capabilities.
- A variety of grade choices to offer Cost Effective EDM solutions.
- Technical support to end users to achieve the best results from the EDM process

Our Machining Capabilities

Tokai Carbon Europe Ltd has invested heavily in state of the art technology to enable us to produce finished components for all Graphite and Carbon applications. Our vision is to be innovative and quality led in the manufacture and design of all our machined and base products.

HK-1: General Grade

Application: Ideal for rough machining of large surface areas, i.e. drop forging dies.

Surface Finish: 3.2 μ m Ra, 30VDI

Density (g/cm ³)	Specific Resistance ($\mu\Omega$ m)	Flexural Strength MPa	Hardness (Shore)	Ave. Grain Size (μ m)
1,85	11	50	58	11

HK-10: Performance Grade

Application: Ideal for rough machining of large surface areas, i.e. drop forging dies.

Surface Finish: 2.5 μ m Ra, 28VDI

Density (g/cm ³)	Specific Resistance ($\mu\Omega$ m)	Flexural Strength MPa	Hardness (Shore)	Ave. Grain Size (μ m)
1,84	12	52	54	9

HK-15: Performance Grade

Application: Ideal for general mould tool applications where low wear and speed is needed.

Surface Finish: 2.2 μ m Ra, 27VDI

Density (g/cm ³)	Specific Resistance ($\mu\Omega$ m)	Flexural Strength MPa	Hardness (Shore)	Ave. Grain Size (μ m)
1,83	12,5	54	62	7

HK-20: High Performance Grade

Application: Ideal for general mould tool applications where low wear and high definition and surface finishes are required.

Surface Finish: 1.6 μ m Ra, 24VDI

Density (g/cm ³)	Specific Resistance ($\mu\Omega$ m)	Flexural Strength MPa	Hardness (Shore)	Ave. Grain Size (μ m)
1,86	12	66	60	6

HK-2: Precision Grade

Application: Ideal for high quality finishing of small to medium die-casting tools, high definition mould and press tools.

Surface Finish: 1.26 μ m Ra, 22VDI

Density (g/cm ³)	Specific Resistance ($\mu\Omega$ m)	Flexural Strength MPa	Hardness (Shore)	Ave. Grain Size (μ m)
1,82	13,5	64	64	7

HK-75: High Precision Grade

Application: Ideal where high quality surface finishes and low edge wear are required for technical plastic moulds and tools.

Surface Finish: 1.0 μ m Ra, 20VDI

Density (g/cm ³)	Specific Resistance ($\mu\Omega$ m)	Flexural Strength MPa	Hardness (Shore)	Ave. Grain Size (μ m)
1,82	16,5	66	72	4

HK-3: High Precision Grade

Application: Superior grade of graphite for ultra-high definition, excellent edge wear resistance and mechanical properties.

Surface Finish: 0.63 μ m Ra, 16VDI

Density (g/cm ³)	Specific Resistance ($\mu\Omega$ m)	Flexural Strength MPa	Hardness (Shore)	Ave. Grain Size (μ m)
1,84	15,5	88	78	2

HK-6: Ultra High Precision Grade

Application: Unique grade of ultra-fine graphite, incorporating high strength, low wear characteristics and excellent properties for high quality surface finishing.

Surface Finish: 0.63 μ m Ra, 16VDI

Density (g/cm ³)	Specific Resistance ($\mu\Omega$ m)	Flexural Strength MPa	Hardness (Shore)	Ave. Grain Size (μ m)
1,86	12	85	68	3

Note: Copper Impregnated materials HK-2C and HK-3C are also available.

All properties are typical values and are not to be used for specification limits. All information was correct at the time of writing.

Tokai Carbon Europe Ltd

Roway Lane, Oldbury
West Midlands B69 3EJ
United Kingdom
Tel: +44 (0)121 552 5577
Fax: +44 (0)121 552 6748
Email: sales@tokaicarbon.eu
Website: www.tokaicarbon.eu

Tokai Carbon Deutschland GmbH

Industriepark 25
D-53567 Buchholz-Mendt
Tel: +49 (0) 26 83 / 97 83 - 0
Fax: +49 (0) 26 83 / 97 83 - 99
e-mail: info@tokaicarbon.de
Website: www.tokaicarbon.de

Tokai Carbon Italia SRL

Via Cagliari, 40
20060 Trezzano Rosa (Mi)
Italy
E-Mail: roberto.attuati@tokaicarbonitalia.it
Tel: +39 02 90969190
Fax: +39 02 90968851

Svensk Specialgrafit AB

Kardanvägen 40
S-461 38 Trollhättan
Sweden
Email: anders.noren@specialgrafit.com
Tel: +46 520 81185
Fax: +46 520 479270

