GRAPHITE INDIA LIMITED

SPECIALITY DIVISION

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PROFILE

Graphite India Ltd was set-up in the year 1965 with the technical and financial collaboration of erstwhile M/s Great Lakes Carbon Corporation of USA.

The Speciality division is a spin-off of Graphite India's R&D efforts. It caters to the requirements of different types of industry in a variety of applications. The speciality division specializes in catering to customer specific requirements of graphite and carbon products.

RW TUV has accredited Graphite India Ltd plants are ISO 9008 & EMS 14000 certified.

ABOUT GRAPHITE

Synthetic graphite possess many unique and useful properties such as

- High electrical conductivity.
- High thermal conductivity.
- High thermal shock resistance.
- Low co-efficient of thermal expansion.
- Low modulus of elasticity.
- High strength at elevated temperatures.
- Highly inert to chemical attack.
- Relatively pure material.
- Easily and readily machinable.
- Non-wettable by molten metals.

SPECIALTY GRAPHITE GRADE DESCRIPTION

Extruded Graphite Grades

Mini Rods

Graphite India produces fine grain extruded graphite small diameter rods. Diameters range from 3 mm to 65 mm with a maximum particle size of 0.2 mm. Mini rods are manufactured in two grades - GMMR-50 and GMMR. GMMR-50 is used for general applications. GMMR is a denser version of GMMR-50 used for applications requiring higher strengths and lower porosity.

Extruded Graphite Mold

Extruded Graphite Mold is available in Blocks and Rods having the following grades:

- **BC** – BC is baked Carbon (Amorphous) materials available in various shapes & sizes
- **GLM-E –** GLM-E is competitively priced graphite with fine particle size, good uniform structure and is primarily used for general applications.
- **GLM-50 –** GLM-50 is a denser version of GLM-E. It is characterized by higher density and better strength. It finds wider use for general applications.
- **GLM –** It is a denser version of GLM-50 and is characterized by higher density, higher strength and lower porosity. It has a finer structure and can be machined to a fine finish. It can be used for most applications.
- **GLM-S –** It is a still denser version of GLM and is characterized by very low porosity.

Graphite Tubes

GMT – This grade of graphite is produced as tubes for fluxing and other applications.

The above grades exhibit excellent properties like, good thermal conductivity, low electrical specific resistance, low co-efficient of thermal expansion, good chemical inertness and can be easily machined.

AX Treatment – All the above grades can be subjected to special AX treatment to retard oxidation and thereby effectively extending its life.

Heat Exchanger Tubes

Heat Exchanger Tubes are available in all Standard Sites up to a length of 4000 mm. These tubes are manufactured through Extrusion process and exhibit excellent heat transfer, mechanical and chemical properties.

Moulded Mold Products

These are biaxially pressed Carbon & Graphite products.
These grades of graphite have a fine structure and molded using compression presses. They have excellent strength properties and mechanical properties better than extrusion pressed graphite products. They possess good thermal conductivity, low electrical specific resistance, low co-efficient of thermal expansion, and very good machinability.

Grades:
AMOR – Carbon
DXT – Partially Graphitised
XN - Graphitised
DXN – Denser version of XN

Iso-statically Moulded Graphite

Isostatically Processed Graphite comes in fine grain and exhibits good isotropism with homogeneous structure, high density, strength, Low specific resistance, easy machinability , high thermal shock resistance. Typical applications are Semiconductor, Solar, Vaccum Furnace, Continuous Casting, Diamond, Heat Shields, crucibles, EDM.

Machined Components

State-of-the-Art Machining facilities backed by Skilled Workmen and Seasoned Engineering Experts enable GIL to assist customers in Product Design and Cost Reduction Programs. GIL can supply high precision, intricate and delicate graphite parts custom-made for various user industries. Following is the indicative list of graphite products that GIL regularly supplies to customers.

- DEGASSING ROTORS & SHAFTS
- CANISTERS
- EXTRUSION RUN OUT TABLES
- SEALING JIGS
- HEATING ELEMENTS
- PLATES & SLABS
- SINTERING TRAYS
- RINGS
- FURNACE LININGS & COMPONENTS

- SUSCEPTORS
- BOATS
- CRUCIBLES
- MOULDS
- PLUNGERS & PLATES
- CONTINUOUS CASTING DIES
- PRESSURE CASTING DIES
- CONDUCTOR ROLLS
- ELECTROLYTIC ANODES AND CATHODES
- EDM ELECTRODES
- HEATERS FOR OPTICAL FIBER
- GRAPHITE BUSHES , BEARING
- CARBON VANES

GIL also supplies semi-finished products as follows.

- CARBON RODS
- MACHINED RODS
- MACHINED MINIRODS & TUBES
- GRAPHITE BLOCKS (SAW CUT, PLANE FINISH, MILL FINISH)

Carbon Graphite / Bricks

Carbon and Graphite bricks are used as lining materials for acidic and caustic chemicals where ceramic or synthetic plastic is not suitable.
The main advantages are withstandibility against chemical attack, high temperature and sudden temperature changes. For example, Alkaline solutions and Hydrofluoric acid are immensely important on chemical technology but they need carbon-containing materials for lining their storage tanks. Typical applications are Baths, Reaction Vessels, Boilers, Floor covering etc.

Carbon-Carbon Composites/Brake Discs:

Carbon-Carbon composites find application in various fields.

TYPICAL PROPERTIES OF GRAPHITE MINIRODS

SIZE 6 mm TO 65mm			
Grade		GMMR-50	GMMR
Max Particle Size,	mm	0.25	0.25
Apparent Density,	g/cc	1.66	1.74
Hardness Rockwell,	"R"	40	55
Porosity,	%	18	12
Electrical Resistivity,	micro Ohm-m	10	10
Modulus of Rupture,	N/mm^2	22	28
Tensile Strength,	N/mm^2	13	16
Compressive Strength,	N/mm^2	30	38
Modulus of Elasticity,	10^{-3} N/mm^2	11	19
Thermal Conductivity,	W/m ^oC	160	180
Coefficient of Thermal Expansion,	10^{-7} ^oC	6.9	7

NOMINAL SIZES OF UNMACHINED GRAPHITE MINI RODS

S. No.	Inches		Millimeters	
	Dia	Length	Dia	Length
1	1/4	12	6	300
2	3/8	12	10	300
3	1/2	12, 24	13	300, 610
4	5/8	12, 24	16	300, 610
5	3/4	12, 24	19	300, 610
6	1	12, 24, 36, 48	25	300, 610, 915, 1220
7	1.14	12, 24, 36, 48	32	300, 610, 915, 1220
8	1.12	12, 24, 36, 48	38	300, 610, 915, 1220
9	1.34	12, 24, 36, 48	45	300, 610, 915, 1220
10	2	12, 24, 36, 48	50	300, 610, 915, 1220
11	2.5	12, 24, 36, 48	65	300, 610, 915, 1220

*** LENGTH UPTO 4000 MM AVAILABLE AS PER REQUIREMENT**

PRODUCT QUALITY SPECIFICATION FOR GRAPHITE MOLD STOCKS

GRADE □ / PROPERTIES □		GLM E	GLM C	GLM 50	GLM	GLM S
AD gm/cc (Min)		1.57	1.6	1.67	1.74	1.78
Rockwell Hardness 'R' (min)		35	35	45	55	55
Porosity %(max)		28	28	25	20	18
Resistivity micro-ohm cm (Max)	WG	950	950	850	850	700
	AG	1300	1300	1300	1300	1200
MOR Kg/cm2 (Min)	WG	70	70	160	180	210
	AG	50	44	120	125	130
CCS Kg/cm2(Min)	WG	120	120	260	300	370
	AG	100	100	220	260	310
MOE Kg/mm2 (Min)	WG	700	600	900	1100	1300
	AG	400	340	550	600	700
Thermal Cond. K.Cal/h.moC (Min)	WG	100	90	140	160	200
	AG	60	50	90	120	150
CTE oCx10-7 (Max)	WG	12	12	16	18	22
	AG	30	32	32	38	45
Tensile Strength Kg/cm2 (min)	WG	40	40	110	125	150
	AG	30	25	70	80	90

WG -> With Grain ; AG -> Across Grain

NOMINAL SIZES OF UNMACHINED GRAPHITE RODS

Sl. No.	Inches		Millimeters	
	Dia	Length	Dia	Length
1	3	72	75	1800
2	4	72	100	1800
3	5	72	125	1800
4	6	72	150	1800
5	7	72	175	1800
6	8	72	200	1800
7	9	72	225	1800
8	10	72	250	1800
9	11	72	275	1800
10	12	72	300	1800
11	14	72	350	1800
12	16	72	400	1800
13	18	72	450	1800
14	20	72	500	1800
15	22	72	550	1800
16	24	72	600	1800
17	28	72	700	1800
18	30	72	750	1800

NOMINAL SIZES OF UNMACHINED GRAPHITE BLOCKS

Sl. No.	Inches		Millimeters	
	Section	Length	Section	Length
1	16 x 16	72	400 x 400	1800
2	20 x 20	72	500 x 500	1800
3	22 x 22	72	550 x 550	1800
4	24 x 24	72	600 x 600	1800
5	15 x 36	72	375 x 900	1800

*** LENGTH UPTO 4000 MM AVAILABLE AS PER REQUIREMENT**

TYPICAL PROPERTIES OF GRAPHITE TUBE

Properties			GMT
Max Particle size,	mm		0.25
Apparent Density,	g/cc		1.66
Porosity,	%		18
Electrical Resistivity,	micro Ohm-m	WG	8
Modulus of rupture,	N/mm^2	WG	22
Tensile Strength,	N/mm^2	WG	13
CCS,	N/mm^2	WG	32
Modulus of elasticity,	10^{-3} N/mm^2	WG	11
Thermal Conductivity,	W/m ^oC	AG	67
Coefficient of thermal expansion,	10^{-7} ^oC	WG	10

HEAT EXCHANGER TUBES – STANDARD SIZE

Sl. No.	Dia in mm.	Length in mm
1	32 OD x 22 ID	1800
2	38 OD x 25 ID	1800
3	50 OD x 13 ID	1800, 2400, 2740
4	50 OD x 38 ID	2740
5	75 OD x 19 ID	1800, 2400

*** LENGTH UPTO 4000 MM AVAILABLE AS PER REQUIREMENT**

MOLDED GRAPHITE

Molding is a discontinuous forming process in which the mold is filled with the material to be molded and is subsequently compacted by a ram to the desired height of the artifact. Very often one works simultaneously with upper and lower rams, since an ejection device is needed anyway in order to release the shape from the mould.

Molding is mostly used for small-dimensioned fine-grained carbon and graphite parts, and may be automated in the case of large quantities of the same shape. When the shrinkage in volume, due to subsequent thermal treatment, is properly taken into account, many parts may be manufactured in one step- either pressed to final size or at least to near net shape, so that a subsequent machining process may be partially or even completely omitted.

Molding generates a much less distinctive anisotropy than extrusion. It also calls for very sophisticated tooling when more complicated parts have to be produced.

Receipe	Grade	Industry	Application
B525	**Amor**	**Mechanical**	**Steam Seals, Water Turbine Rings, Pump Turbine Rings, Contactless Seals, Carbon Vanes**
B513	**XN**	**Mechanical / Powder Metallurgy**	**Discs, Plates, Sintering Trays, Bearings, Guide Rings, Piston Rings, Seperating Slides, Carbon Vanes, Stripping Components**
B 527	**XN**	**Mechanical / Powder Metallurgy**	**Discs, Plates, Sintering Trays, Bearings, Guide Rings, Piston Rings, Seperating Slides, Carbon Vanes, Stripping Components**
B520	**DXT**	**Mechanical**	**Bearings, Guide Rings, Piston Rings, Seperating Slides, Carbon Vanes, Stripping Components, Sliding Ring Seals,Steam Seals, Water Turbine Rings, Pump Turbine Rings, Contacless Seals, Contact Seals, Plywood Dryers Bearings, Cast Housing Bearings**
B527	**DXN**	**Metallurgy / Non-Ferrous**	**Melting Crucibles, Moulds, Continous Casting Dies, Tap Hole Blocks, Spouts**
3238 G	**Amor**	**Glass**	**Porous Carbon for production of Hollow and Crystal Glass**

TYPICAL PROPERTIES OF MOLDED MOLD GRAPHITE RODS AND BLOCKS

Grade	Size (mm)	Density gm/cc	Porosity (open) %	Brinnel H 10/100	Comp Str N/mm^2	Bend Str N/mm^2	L-CTE,10^{-6} /K	Heat Cond. W/mk	Ash %	SPR ohm.mm^2/m	Hardness shore (^s)
Amor	75x300	1.62	18	24	110	40	4.5 - 5.5	30	<1.5	50-60	
	75x300	1.58-1.63	17-20	18-23	75	25			<=1.25	60-75	
	98x300	1.58 - 1.63	17-20	18-23	75	25			<=1.25	60-75	
	98x280	1.62	17	24	100	32	4-5	25	<=0.5	50-60	
	118x300	1.62	18	24	110	40	4.5 - 5.5	30	<1.5	50-60	
	145X300	1.45-1.55	22-28	11-12	35-45	12-16		45-55	0.8	70-90	
XN	120x460	1.75	14-16	11-13	53-60	25-28	3.5 - 4.5	90-100	<0.1	14-20	40-43
	340x550										
	350x280x550										
DXT	62x260	1.8-1.85	10	27	125	42	4.5 - 5.5	50	<=0.5	32-38	72
	75x300										
	40x110										
	54x110										
	145x300										
	230x300										
DXN	32x140	1.81-1.85	10-13	13-17	65-75	27-32	3.5 - 4.5	95	<0.1	13-18	
	180x340	1.84	11	14	68	35	4-5	110	<0.1	12-16	47
	230x340										
	350x280x550										
	280x340										

PRODUCTION FACILITY

Vertical Machining Centre – Mitsubishi Controlled

X Axis : 2000mm
Y Axis : 900mm
Z Axis : 800mm
Spindle speed : 10000 Rpm
Accuracy : 0.015
Repeatability : 0.01

Block cutting machine – VFD Controlled

Max. Length of Block accommodated on table : 2000mm
Max. Width of Block accommodated on table : 1000mm
Max. Height of Block accommodated on table : 1000mm
Accuracy : 0.2 in 1000mm
Repeatability : 0.2mm

CNC Turning Centre – Fanuc Controlled

Max. Turning Diameter : 400mm
Distance Between Centre : 1000mm
Accuracy : 0.015
Repeatability : +/- 0.003

Slice Cutting Machine – VFD/ Servo Controlled

Max. Length of Block accommodated on table : 2000mm
Max. Width of Block accommodated on table : 1000mm
Max. Height of Block accommodated on table : 800mm
Accuracy : 0.15 in 1000mm
Repeatability : 0.2mm

APPLICATION OF GRAPHITE

Aluminium Industry

- Graphite Fluxing Tubes
- Graphite Impeller Systems for Aluminium Degassing
- Casting Rings for Hot Top Casting or for Gas Slip System
- Graphite Plates and Rolls For Aluminium Extrusion Presses

Metallurgical Industry

- Graphite Plates and Trays for Sintering
- Graphite Boats for Heat Treatment of Powder
- Graphite Crucible for Sintering Furnaces
- Furnace Components and Heating Elements

Steel Industry

- Graphite Heating Rods and Contacts for Steel Degassing

Non-Ferrous Metal Industry

- Graphite Dies for Continuous Casting
- Graphite Rods and Contacts for Resistance Furnace
- Graphite Tubes for Thermocouples
- Stirring Rods, Plugs and Spouts
- Graphite Crucibles for Precious Metals and Dental Alloys
- Graphite Boats and Moulds for Ingots

Chemical Industry

- Carbon Bricks for Chemical Resistant Linings
- Carbon and Graphite Tubes and Nozzles
- Graphite Electrodes for Electrochemistry
- Carbon and Graphite Rings, Seals and Bushes

Glass Industry, Glassfiber-Production, Quartz

- Porous Carbon for Wet blowing Process
- Vacuum Lifters for Automatic Glass Production
- Graphite Insert for Take-Out System
- Graphite Components for Float Glass Process
- Graphite Rolls for Glassfiber Production
- Graphite Rods and Tubes for Quartz Production

Mechanical Engineering Industry

- Bearings and Seals for Pumps – Submersible Pumps
- Bearings for Plywood Dryers
- Rings and Seals for Steam Joints in Paper-Machines
- Turbine Rings for Hydro-Power Stations
- Rings and Vanes for Compressors
- Semi finished Materials for Mechanical Applications