MITSUBISHI CHEMICAL GROUP

Heat Resistant Composite Materials
Carbon/Carbon Composite, Carbon/SiC composite

- Ultra-high heat resistance above 1,000°C (inert atmosphere), up to 800°C (in oxygen atmosphere).
- Light weight and High strength by Carbon matrix reinforced with carbon fiber.
- Improvement in weight and mechanical properties from existing heat resistance materials like Ceramics, Isotropic graphite materials.
- Excellent in chemical resistance. Lower outgassing.
- Our C/C, C/Sic products use Pitch based carbon fiber as for materials. Compared with PAN based carbon fiber, Pitch carbon has unique properties like high strength, high thermal conductivity, and low thermal expansion.
- Excellent in Sliding and Abrasion properties, adopted as high-performance Brakes.

Application (Examples)




Comparison (Heat Resistance)

Materials	Heat resistant temperature (°C)
Aluminum (A6061)	150
Steel (SS400)	600
Isotropic graphite material	>1000
C/C	>1000
C/SiC	>1000
Ceramics	>1000

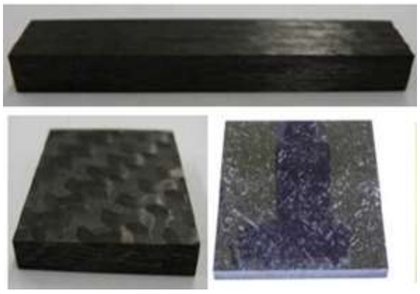
Basic Properties

Item		Unit	Isotropic graphite material	C/C Pitch Carbon Chopped Fiber	C/C Pitch carbon Quasi-isotropic	C/C Pitch Carbon Uni-Direction
Bulk density		g/cm^3	1.8	1.9	1.75	1.75
Flexural strength	(X・Y)	MPa	40	180	200	450
Flexural modulus	(X・Y)	GPa	10	70	100	230
IZOD impact strength		J/cm	0.1	4	>20	>20
Electrical resitance	(X・Y)	μΩ・m	10	<20	<20	<20
	(Z)	μΩ・m		<100	<100	<100
Thermal expansion	(X・Y)	$\times 10^{-6}$/°C	4 ~ 6	-1 ~ 0	-1 ~ 0	-2 ~ 0
	(Z)	$\times 10^{-6}$/°C		6 ~ 8	6 ~ 8	6 ~ 8
Thermal conductivity	(X・Y)	W/m・K	70 ~ 140	70	70	80
	(Z)	W/m・K		10	10	1
Notes				For Brake material	For reference	For Robot hand

Product shape

- ◆ Complex shapes can be molded by using chopped materials for the fibers. Machining enables drilling and finishing with high flatness accuracy.
- ◆ It is also possible to use unidirectional fiber material, and it has excellent rigidity and can be used for long panels. It is possible to manufacture robot hands with high heat resistance that cannot be achieved with ordinary CFRP. Also, by using a unidirectional material, it is possible to increase the thermal conductivity in the fiber direction.

Product shape (examples)



Various shape can be molded by maching

C/C, C SiC (mechanical properties)

	Bulk density	Flexural strength	Flexural modulus	Tensile strength	Compressive strength	Rockwell hardness
	―	(X・Y)	(X・Y)	(X・Y)	(X・Y)	-
	g/cm3	MPa	GPa	MPa	MPa	HRP
C/C	1.9	180	70	110	170	95
C SiC	2.4	150	100	100	500	125

C/C ：As only carbon materials inside, high heat resistant.
：Compared with C SiC, lower specific weight.
C/SiC ：As only carbon and SiC materials inside, high heat resistant.
：Compared with C SiC, excellent in compressive mechanical properties, hardness, low particle

C/C, C SiC (advantage to other materials)

Items	C/C	C/SiC
Metal（A6061、SS400)	Heat resistant, Light weight, High specific modulus	Heat resistant, Light weight, High specific modulus
Isotropic graphite material	High specific modulus Shorter lead time production	High specific modulus Lower particle
Ceramics	Light weight, Equivalent specific modulus, High impact strength	Light weight, Equivalent specific modulus, High impact strength

Possible applications

- ◆ Friction material (Brake), Heat resistance material (Heat shield), Industrial material (Divertor Armor, Crucible for semi conductor)
- ◆ Can replace existing heat resistance materials like Ceramic, Heat resistant alloy, Polyimide

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Printed in Japan April 21, 2023 (MCC)