MITSUBISHI CHEMICAL GROUP

MITSUBISHI CHEMICAL CORPORATION

DIALEAD™

# Carbon / Carbon Composites

## Introduction

- C/C Composite (**Carbon Fiber reinforced Carbon Matrix Composites**) is composed of carbon only, and it has excellent features like toughness, high strength and modulus. Also, it can be used in such high temperature as more than 1000℃ conditions.
- Compared with CFRP, it has advantage in heat resistance, chemical resistance, and thermal stability.

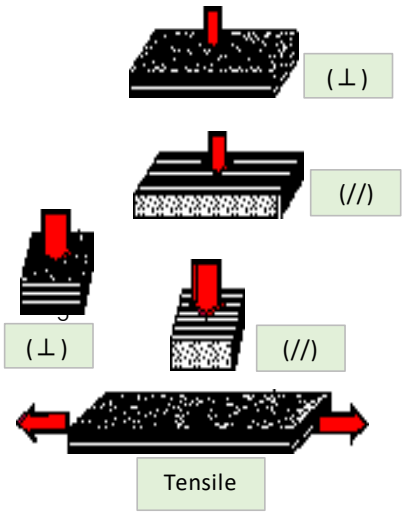
## Possible Applications

- Friction material : Airplane、Formula 1, MotoGP brake, clutch
- High Temperature material : Aerospace、Heat shield
- Industrial material : Hot press mold, Divertor Armor, Bolt, Nut, Crucible for semi conductor

## Typical Characteristics

| | | | |
|---|---|---|---|
| Flexural Strength | (//) | MPa | 180 |
| Flexural Modulus | (//) | GPa | 70 |
| Flexural Strength | (⊥) | MPa | 180 |
| Flexural Modulus | (⊥) | GPa | 70 |
| Compression Strength | (//) | MPa | 200 |
| Compression Strength | (⊥) | MPa | 160 |
| Tensile Strength | | MPa | 110 |
| ILSS | | MPa | 22 |
| Rockwell Hardness | | HRP | 95 |
| Bulk Density | | g/cm3 | 2 |
| Porosity | | Vol% | 9 |
| Thermal conductivity | (//) | W/mK | 90 |
| Thermal conductivity | (⊥) | W/mK | 12 |
| Coefficient of thermal expansion (RT～700℃ | (//) | ×E(-6)/℃ | -1~0 |
| | (⊥) | ×E(-6)/℃ | 6~8 |

Courtesy of Moriwaki Engineering Co., Ltd.




- Mitsubishi Chemical provides tailored products based on the customer's design and requirement.

# CMC（Ceramic Matrix Composite）

## Introduction

- **CMC is composed of C/C Composite and Ceramic, and it has an integrated characteristics of C/C and Ceramic (SiC).**

## Features

- **Lightweight : Specific gravity about 1/3 that of iron**
- **High Strength, High Modulus**
- **High impact resistance, Tough compared with ceramics**
- **Hardness**
- **Low Coefficient of thermal expansion**
- **Thermal conductivity**
- **High heat Resistance （Under inert atmosphere～1300℃）**
- **Low wear and High μ(coefficient of friction) : can be used as brake disc of automotive.**
- **As brake disc, it has excellent performance in rainy conditions.**

| Carbon Fiber type | | Pitch | PAN |
|---|---|---|---|
| | | CMC | CMC |
| Bulk density | [g/cm3] | 2.3 | 2.4 |
| Flexural Strength | [MPa] | 140 | 55 |
| Flexural Modulus | [GPa] | 60 | 30 |
| Tensile Strength | [MPa] | 75 | 25 |
| Thermal Conductivity | [W/mK] | 80 | 40 |

＊This information can be used for material selection only.

Ceramic Matrix Composite Brake

Φ330mm Disk
・Cast Iron： 9kg
・CMC ： 3kg
Weight Reduction
Δ6kg×4discs ＝Δ24kg/car