### Graphite Grades

<table>
<thead>
<tr>
<th>Density</th>
<th>FS</th>
<th>CTE</th>
<th>Resistivity</th>
<th>Thermal Conductivity</th>
<th>Permeability</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPa</td>
<td>(10^-6/°C)</td>
<td>(µΩcm)</td>
<td>conductivity</td>
<td>(cm²/s)</td>
<td>sizes (mm)</td>
</tr>
<tr>
<td>2191</td>
<td>1.75</td>
<td>44</td>
<td>4.2</td>
<td>1,000</td>
<td>116</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.5</td>
</tr>
<tr>
<td>2020</td>
<td>1.77</td>
<td>45</td>
<td>4.3</td>
<td>1,550</td>
<td>85</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.4</td>
</tr>
<tr>
<td>1,030</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>540x540x1,830</td>
</tr>
<tr>
<td>610</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>ø 610 x1,830</td>
</tr>
<tr>
<td>915</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>ø 915x760</td>
</tr>
<tr>
<td>1,500</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>ø 1,500</td>
</tr>
<tr>
<td>2123</td>
<td>1.84</td>
<td>58</td>
<td>5.5</td>
<td>1,140</td>
<td>112</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.3</td>
</tr>
<tr>
<td>2160</td>
<td>1.86</td>
<td>76</td>
<td>6.0</td>
<td>1,270</td>
<td>102</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.2</td>
</tr>
<tr>
<td>2450</td>
<td>1.86</td>
<td>45</td>
<td>4.5</td>
<td>1,550</td>
<td>85</td>
</tr>
<tr>
<td>6503</td>
<td>1.74</td>
<td>23</td>
<td>3.3</td>
<td>800</td>
<td>200</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 550x550x1,830</td>
</tr>
</tbody>
</table>

### SiC Coating

<table>
<thead>
<tr>
<th>Temperature °C</th>
<th>Density</th>
<th>Open Porosity</th>
<th>RF</th>
<th>CTE</th>
<th>Coating Thickness</th>
<th>Hardness</th>
<th>Young's Modulus</th>
<th>Permeability</th>
</tr>
</thead>
<tbody>
<tr>
<td>1700°</td>
<td>3.2</td>
<td>Impervious</td>
<td>350</td>
<td>4.8</td>
<td>50-250</td>
<td>2280</td>
<td>2950</td>
<td>63</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>µm Knoop</td>
<td></td>
<td></td>
<td>&lt; 10^-4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>gases (H2) and liquids</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Thermal Conductivity (W/m°C)

- Laser Flash
- Hot Plate

### Rigid Carbon Insulation

- ISOLOR® S10
- CALCARB® Rounds & special sizes on request

### Carbon / Carbon Composite

- AM252
- Ring Ø 2,200
- Tube length 3,000

### Purity

- Unpurified
- Purified
- 290 ppm PT: < 20 ppm
- UHP: < 5 ppm
Among all renewable energies photovoltaic benefits from many environment and economic advantages:
- Unlimited renewable source of energy
- Increasingly cost competitive
- Decentralized power source
- Peak power at peak time of usage
- Environment friendly

The sun, an energy available for free...
Photovoltaic systems use cells to convert sunlight directly into electricity. When sunlight strikes a PV cell, electrons are dislodged, creating an electrical current. The most common semiconductor material used in photovoltaic cell is silicon, an element most commonly found in sand. The crystalline silicon technology, which distinguishes monocrystalline, multicrystalline and ribbon sheets processes, represents approx. 90% of the market today.

Thanks to its outstanding properties graphite is the unique and only material to withstand high temperature, corrosion and the severe conditions on the silicon production process.

Other photovoltaic processes are now available on the market such as the thin film technology where modules are constructed by depositing extremely thin layers of photosensitive materials onto glass, plastic or stainless steel.

Mersen is a world leader in isostatic graphite production, and proposes proven solutions to each step of the photovoltaic production chain, from polysilicon feedstock to cells antireflective coating via thin film process. Its range of materials covers graphite, Carbon/Carbon composite as well as insulation materials.

Benefits of Mersen materials:
- Grade consistency (inert and non-wetting to most chemicals)
- Large diameters available up to 1.5 m in graphite and 2.2 m in Carbon/Carbon composites for the whole range of products
- High purity (less than 5 ppm), which avoids contamination and allows high quality products
- Dedicated high performance solutions to increase lifetime and efficiency
- Mersen materials offer strong benefits...

“Photovoltaic” is the combination of two words: “photo” from Greek origin, which means light, and “voltaic”, from “volt”, the unit used to measure electricity.
All along the photovoltaic production chain, Mersen offers a comprehensive range of high-performance materials and solutions to increase the lifetime and efficiency of photovoltaic systems. Mersen’s materials are designed with high purity (less than 5 ppm), which avoids contamination and ensures long-term reliability.

- **Large size rounds up to dia. 1500 mm in isostatic graphite 2020.**
- **Trays or tubes up to dia. 2200 mm in Carbon/Carbon composite AM252.**
- **Rigid carbon thermal insulation CALCARB® and ISOLOR®**
- **Large sizes up to dia. 1500 mm in isostatic graphite 2020.**
- **Trays or tubes up to dia. 2200 mm in Carbon/Carbon composite AM252.**
- **Large size rounds up to dia. 1500 mm in isostatic graphite 2020.**
- **Trays or tubes up to dia. 2200 mm in Carbon/Carbon composite AM252.**

Benefits of Mersen materials:

- Environment friendly
- Peak power at peak time of usage
- Decentralized power source
- Increasingly cost competitive
- Unlimited renewable source of energy

Among all renewable energies, photovoltaic benefits from many environment and economic advantages:

- **High efficiency** allows high quality products
- **Large diameters available up to 1.5 m in graphite and 2.2 m in Carbon/Carbon composites.**
- **High purity (less than 5 ppm), which avoids contamination and ensures long-term reliability.**
- **Ultra high precision machining** for extremely accurate parts.
- **Isostatic graphite grade 2191 UHP5:** The best combination with high thermal conductivity, high strength & high purity!

Photovoltaic systems use cells to convert sunlight directly into electricity. When sunlight strikes a PV cell, electrons are dislodged, creating an electrical current. Photovoltaic systems are an electrical current source of electricity from solar energy.

The sun, an energy available for free, is the unique and only material to withstand high temperature, corrosion and the severe conditions on the silicon production process. Thanks to its outstanding properties, graphite is the best choice for handling molten silicon.

Mersen offers solutions to reduce chemical reaction with molten silicon, ensuring stable properties and excellent wear performance vs. silicon. We are continuously involved in engineering and development.

Accordingly, Mersen reserves the right to modify, at any time, the technology and product specifications contained herein. Accordingly, Mersen reserves the right to modify, at any time, the technology and product specifications contained herein. Duplication, reproduction or translation of any information contained herein, in whole or in part, is strictly prohibited without prior written consent of Mersen.

Data herein contained are provided for general information purpose only and are not binding. Mersen shall have no liability whatsoever with respect to information contained herein. Duplication, reproduction or translation of any information contained herein, in whole or in part, is strictly prohibited without prior written consent of Mersen.
Our materials are in conformity with the RoHS-Directive (Restriction of the use of certain Hazardous Substances in electrical and electronic equipment). Besides Mersen guarantees the application of the European Community REACH-Regulation (Registration, Evaluation, Authorization and Restriction of Chemical substances) to all its plants located in Europe. We are constantly involved in engineering and development. Accordingly, Mersen reserves the right to modify, at any time, the technology and product specifications contained herein.
Materials

Graphite grades

<table>
<thead>
<tr>
<th>Grade</th>
<th>Density (MPa)</th>
<th>FS (MPa)</th>
<th>CTE (10^-6/°C)</th>
<th>Resistivity (µΩcm)</th>
<th>Thermal conductivity (W/m°C)</th>
<th>Permeability (cm²/s)</th>
<th>Standard sizes (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2191</td>
<td>1.75</td>
<td>44</td>
<td>4.2</td>
<td>1,000</td>
<td>116</td>
<td>0.5</td>
<td>540x540x1,830</td>
</tr>
<tr>
<td>2020</td>
<td>1.77</td>
<td>45</td>
<td>4.3</td>
<td>1,550</td>
<td>85</td>
<td>0.4</td>
<td>530x635x1,830</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1,030x1080x325</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Ø 915x760</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Ø 1,500 on request</td>
</tr>
<tr>
<td>2123</td>
<td>1.84</td>
<td>58</td>
<td>5.5</td>
<td>1,140</td>
<td>112</td>
<td>0.3</td>
<td>305x620x915</td>
</tr>
<tr>
<td>2160</td>
<td>1.86</td>
<td>76</td>
<td>6.0</td>
<td>1,270</td>
<td>102</td>
<td>0.2</td>
<td>305x305x915</td>
</tr>
<tr>
<td>2450</td>
<td>1.86</td>
<td>45</td>
<td>4.5</td>
<td>1,550</td>
<td>85</td>
<td>0.04</td>
<td>On request</td>
</tr>
<tr>
<td>6503</td>
<td>1.74</td>
<td>23</td>
<td>3.3</td>
<td>800</td>
<td>200</td>
<td>1</td>
<td>550x550x1,830</td>
</tr>
</tbody>
</table>

Purity

<table>
<thead>
<tr>
<th></th>
<th>Unpurified</th>
<th>PT : &lt; 20 ppm</th>
<th>Purified</th>
<th>UHP : &lt; 5 ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density</td>
<td>290 ppm</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SiC coating

<table>
<thead>
<tr>
<th>T max (°C)</th>
<th>Density (MPa)</th>
<th>Open porosity</th>
<th>RF (MPa)</th>
<th>CTE (10^-6/°C)</th>
<th>Coating thickness</th>
<th>Hardness</th>
<th>Young modulus (GPa)</th>
<th>Permeability (cm²/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1700</td>
<td>3.2</td>
<td>Impervious</td>
<td>350</td>
<td>4.8</td>
<td>50-250 µm</td>
<td>2280</td>
<td>2950</td>
<td>&lt; 10^-4</td>
</tr>
</tbody>
</table>

Rigid carbon insulation

<table>
<thead>
<tr>
<th></th>
<th>Density (MPa)</th>
<th>Thermal conductivity at 400°C (W/m°C)</th>
<th>Thermal conductivity at 2,200°C (W/m°C)</th>
<th>Standard Dimensions (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISOLOR® S10</td>
<td>0.1</td>
<td>2.4</td>
<td>2.2</td>
<td>1,500x1000x40 Rounds &amp; special sizes on request</td>
</tr>
<tr>
<td>CALCARB® CBCF 18-2000</td>
<td>0.18</td>
<td>0.1</td>
<td>1.0</td>
<td></td>
</tr>
</tbody>
</table>

CALCARB® CBCF 18-2000
Thermal Conductivity vs Temperature

Carbon / Carbon composite

<table>
<thead>
<tr>
<th></th>
<th>Density (MPa)</th>
<th>FS (MPa)</th>
<th>Flexural modulus (GPa)</th>
<th>Max sizes (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AM252</td>
<td>1.70</td>
<td>100</td>
<td>10</td>
<td>Ring Ø 2,200 Tube length 3,000</td>
</tr>
</tbody>
</table>
A WORLD EXPERT
in materials and solutions for high temperature processes

A GLOBAL PLAYER
Global expert in materials and solutions for extreme environments as well as in the safety and reliability of electrical equipment. Mersen designs innovative solutions to address its clients' specific needs to enable them to optimize their manufacturing process in sectors such as energy, transportation, electronics, chemical, pharmaceutical and process industries.