Established in Shenzhen, China, in 1990, FRD manufactures a wide range of products including EMI shielding materials, thermal interface materials, and other related electronic materials. FRD is a registered National Hi-tech Enterprise and holder of ISO9001, ISO16949, QC030002, and OHSAS18001 certifications.

FRD works to satisfy the needs of its customers and excel in speed and flexibility. FRD has long-term business relationships with customers such as Huawei, ZTE, Dell, Cisco, Nokia, ABB, Luminalt, Juniper, DWE, QCM, Microsoft, Lenovo, Xerox, Siemens, France, Phoenix, and Fujitsu, etc.

As a leading manufacturer in its industry, FRD is growing exponentially. We are willing to provide quality products and services to more customers in various industries than our competitors. These industries include networks & telecommunication equipment, consumer electronics, automotive, power supply, lighting, military, aerospace, etc.

In the future, FRD will continue to meet the challenges, grow the FRD brand name, and strive to establish itself as a worldwide technology leader in new materials for all of our manufacturing processes.

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Graphite Film Overview

Graphite films are ideal for providing thermal isolation in flexible electronic devices. They have high thermal conductivity (1500-3000 W/mK) and low thermal expansion. Flexible graphite film is made by intercalating graphite with a hydrocarbon to create a flexible material. This material can be cut to any shape and may be applicable in any surface by high-precision laser cutting and forming processes.

Thermal Diffusion

The heat transfer from a high temperature point to the area around it very fast through graphite, which can decrease the highest temperature of the area and promote the effective heat transfer area.

Performance in a smartphone

<table>
<thead>
<tr>
<th>Temperature at chip</th>
<th>40°C</th>
<th>0°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature at camera</td>
<td>50°C</td>
<td>28°C</td>
</tr>
<tr>
<td>Temperature at battery case</td>
<td>45°C</td>
<td>23°C</td>
</tr>
</tbody>
</table>

Graphite film (With graph) vs. Graphite film (Without graphite)

GR High Thermal Conductivity Graphite Film

Graphite film is made of natural flake graphite which is purified by laser ablation. By using intercalation technology, GRD high thermal conductivity graphite film is a very cost-effective component with high reliability and high efficiency.

Features:
- High thermal conductivity: 1500-3000 W/mK
- Excellent adhesion to metal
- Can be cut to any shape

Applications:
- Chip Mount: Smart Phone, Tablet, Laptop...
- Display: LCD, OLED, LED...
- High power density components: Power Amplifier, Transceiver, Battery...

Typical Properties

<table>
<thead>
<tr>
<th>Feature</th>
<th>Units</th>
<th>GRD 503</th>
<th>GRD 804</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thickness</td>
<td>mm</td>
<td>0.09-0.120</td>
<td>0.087-0.10</td>
</tr>
<tr>
<td>Thermal Conductivity (in-plane)</td>
<td>W/mK</td>
<td>400-500</td>
<td>500-1000</td>
</tr>
<tr>
<td>Thermal Conductivity (through thickness)</td>
<td>W/mK</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>Tensile Strength</td>
<td>Max</td>
<td>4.2-8.2</td>
<td>20-35</td>
</tr>
<tr>
<td>Operating Temp</td>
<td>°C</td>
<td>-40-80</td>
<td>-40-80</td>
</tr>
<tr>
<td>Thermal Damping (0-7)</td>
<td>cm/s</td>
<td>2-5</td>
<td>0-10</td>
</tr>
</tbody>
</table>

FRD Die-Cutting Advantages

Pressing Advantages (Stainless Material):
- Transfer metal material to center (by laser cutting tool)
- Automatically load the work pieces into the tool
- Improve lubrication precision by reduced indice

Pressing Advantages (Rubber Material):
- High accuracy by special technology
- Precise positioning, etching, etc., in one step (non-cutting machine)
- High speed

Envelope Sealing Introduction:
Envelopes sealing utilized the graphite film with adhesive and placed on film to enhance physical properties along with the edges would be flaked along the tool path/position.