A full line of thick film materials for AlN substrates

COOL YOUR CIRCUITS TO THE CORE

Next generation electronic packaging requires excellent thermal stability and heat dissipation to achieve maximum performance. High frequency and high power applications, combined with higher density interconnects, demand the use of materials that provide adequate thermal management within the circuit.

A new, complete system of thick film materials specifically designed for aluminum nitride (AlN) substrates is commercially available from DuPont.

Now, designers can take advantage of the benefits of AlN substrates for applications requiring high thermal dissipation—at a much lower cost than traditional thin film metallization AlN systems.

FEATURES
- Complete gold and silver-based systems
- Excellent heat dissipation properties
- Cost-effective, high-volume capabilities
- Demonstrated reliability in harsh environments
- Consistent performance

TYPICAL APPLICATIONS
- Automotive
- Telecommunication systems
- Optoelectronics
- Military
- Alternative to beryllium oxide (BeO) applications

EXCELLENT THERMAL PERFORMANCE

Ceramic substrates have many times the thermal conductivity of organic PWB materials. Better heat dissipation simplifies thermal design and significantly improves circuit life and reliability. Additionally, aluminum nitride substrates have long been known to be safer to handle than BeO.

Thick printed (150 µm) silver compositions are a cost-effective alternative to direct bond copper due to less complicated processing.

A patented reaction bond system is designed to reduce gassing and blistering that is common with AlN substrates, resulting in excellent aged adhesion (1000 hr/150°C > 20 N) and better appearance. The system is designed to be more flexible with accommodating the coefficient of thermal expansion (TCE) mismatch.

TCE of AlN is well-matched to Si and GaAs

Source: Tummala, ASM Handbook, DuPont Data
MECHANICAL PROPERTIES COMPARISON

Table 1

<table>
<thead>
<tr>
<th>Property</th>
<th>AlN</th>
<th>BeO</th>
<th>Al2O3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dielectric Constant</td>
<td>8.9</td>
<td>6.7</td>
<td>9.8</td>
</tr>
<tr>
<td>Dielectric Loss</td>
<td>0.0001</td>
<td>0.0003</td>
<td>0.0002</td>
</tr>
<tr>
<td>Resistivity (Ohm-cm)</td>
<td>&gt;10^14</td>
<td>&gt;10^14</td>
<td>&gt;10^14</td>
</tr>
<tr>
<td>Thermal Cond. (W/mK)</td>
<td>170-200</td>
<td>260</td>
<td>36</td>
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<tr>
<td>CTE (ppm/C)</td>
<td>4.6</td>
<td>8.5</td>
<td>8.2</td>
</tr>
<tr>
<td>Density (g/cm^3)</td>
<td>3.30</td>
<td>3.85</td>
<td>2.89</td>
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<tr>
<td>Bending Strength (mPa)</td>
<td>290</td>
<td>230</td>
<td>380</td>
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<tr>
<td>Hardness (GPa)</td>
<td>11.8</td>
<td>9.8</td>
<td>14.1</td>
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<tr>
<td>Young's Mod (GPa)</td>
<td>331</td>
<td>345</td>
<td>372</td>
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COMPLETE THICK FILM MATERIAL SYSTEM

DuPont offers a complete system of thick film materials designed to take advantage of the excellent thermal properties of AlN (see Table 2). The thick film material performance is consistent across different substrates from major vendors.

Additional technical information is available in the AlN Material System Selector Guide.

Table 2. Thick Film Materials for Aluminum Nitride

<table>
<thead>
<tr>
<th>Product</th>
<th>AlN44</th>
<th>AlN11</th>
<th>AlN21</th>
<th>AlN23</th>
<th>AlN33</th>
<th>AlN71</th>
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<tbody>
<tr>
<td>Chemistry</td>
<td>Diel</td>
<td>Ag</td>
<td>Ag/Pt 100:1</td>
<td>Ag/Pt 3:1</td>
<td>Ag/Pd 10:1</td>
<td>Au</td>
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<tr>
<td>Solderable</td>
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<tr>
<td>62/36/2</td>
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<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>N/A</td>
</tr>
<tr>
<td>10/88/2</td>
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<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>N/A</td>
</tr>
<tr>
<td>Plateable</td>
<td>N/A</td>
<td>X</td>
<td>X</td>
<td>NT</td>
<td>X</td>
<td>N/A</td>
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<tr>
<td>Brazable</td>
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<td>X</td>
<td>X</td>
<td>NT</td>
<td>X</td>
<td>No</td>
</tr>
<tr>
<td>Wirebondable</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Au</td>
<td>N/A</td>
<td>X</td>
<td>X</td>
<td>N/A</td>
<td>NT</td>
<td>X</td>
</tr>
<tr>
<td>Al</td>
<td>N/A</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NT</td>
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</tr>
</tbody>
</table>
DUPONT THICK FILM MATERIAL SYSTEM FOR AlN SUBSTRATES

FOR MORE INFORMATION ON DUPONT THICK FILM MATERIAL SYSTEM FOR AlN SUBSTRATES OR OTHER DUPONT MICROCIRCUIT MATERIALS, PLEASE CONTACT YOUR LOCAL REPRESENTATIVE:

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