**Cu-AlN & Al-AlN Substrates**

With excellent reliability and heat cycle toughness

<table>
<thead>
<tr>
<th>Cu-AlN AMB</th>
<th>Advantages of DOWA’s substrates:</th>
<th>Al-AlN ALMIC®</th>
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<tbody>
<tr>
<td><strong>High ceramic bending strength</strong></td>
<td>500 MPa @ 0.635 mm AlN</td>
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<td>650 MPa @ 0.635 mm AlN</td>
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<tr>
<td><strong>High thermal conductivity</strong></td>
<td>AlN ceramic (Typ. 170 – 190 W/mK @ 20 °C)</td>
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<td><strong>Very high partial discharge properties</strong></td>
<td>Typ. PD ≤ 10 pC @ 9kVrms; 0.635 mm AlN</td>
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<td><strong>Low substrate bow</strong></td>
<td>Metallization during batch process</td>
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<td><strong>Excellent bonding area</strong></td>
<td>Cu-ceramic &gt; 95%</td>
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<td>Al-ceramic &gt; 97%</td>
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<tr>
<td><strong>High heat cycle toughness</strong></td>
<td>&gt; 1,000 cycles @ -40/+125 °C</td>
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<td>&gt; 3,000 cycles @ -40/+125 °C</td>
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<td><strong>Very good wire bonding</strong></td>
<td>Al-Al-wire bonding</td>
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<td><strong>Reduced weight</strong></td>
<td>Lighter than DCB- or AMB substrates</td>
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</table>
**Cu-AlN & Al-AlN Substrates**

**Abbreviations**

ALMIC: Direct bonded aluminum (DAB). Starting materials for ALMIC substrates are 0.2, 0.3 or 0.4 mm thick aluminum foils, that are directly bonded to the top and bottom side of the ceramic substrate.

DBC: Direct bonded copper. Starting material for DBC substrates are 0.2, 0.3 or 0.4 mm thick copper foils, that are directly bonded to the top and bottom side of the ceramic substrate.

AMB: Active metal brazed copper. Starting material for AMB substrates are 0.2, 0.3 or 0.4 mm thick copper foils, that are brazed to the top and bottom side of the ceramic substrate.

**Features**

AlN substrates are dedicated to traction, automotive and wind power applications.

**Remarks**

Please note that physical properties are typical values. Customization is always available on customer's request.

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**Heat cycle toughness (H/C)**

- **Cu-Al2O3 (DBC):** > 30
- **Cu-Al2O3 (AMB):** > 50
- **Cu-AlN (AMB):** 300
- **3 steps Cu-AlN (AMB):** 1.000
- **Al-AlN (ALMIC®):** 3.000

**Test method:**

- Check micro cracks on ceramics
- Heat pattern of a cycle

**Bending strength initial (*) and after 370 °C (•) Cu 0.3/0.15**

- **Cu-Al2O3 (DBC):** 450
- **Cu-Al2O3 (AMB):** 350
- **Cu-AlN (AMB):** 220
- **3 steps Cu-AlN (AMB):** 650
- **Al-AlN (ALMIC®):** 620

**Test method:**

- Bending test (C.H.S 0.5 mm/Min)
- Heat pattern

**Product line-up**

- **ALMIC®**
  - **Standard Cu-AlN substrate:** AlN: 0.635 mm, H/C toughness 300
  - **Three steps Cu-AlN substrate:** AlN: 0.635 mm, H/C toughness 1.000
  - **Al-thin Al2O3 ALMIC®:** Al2O3: 0.35–0.38 mm, H/C toughness > 3.000

**Ongoing development**

- **Integrated substrate**
  - H/C toughness > 3.000

This development offers enhanced reliability and heat release ability and saves manufacturing costs.

Dedicated applications: Power modules for HEVs, EVs, trains and industrial drives.