NanoFoil® can be used to bond **ceramic and brittle non-ceramic** (silicon or carbon) sputtering targets. For this process, the solder is pre-applied to the target and backing plate and machined flat. Then the NanoFoil is placed between the pre-coated surfaces, pressure is applied, and the foil is activated, melting the solder and creating the bond.

Below are the incoming requirements for the standard NanoBond® process. The standard backing plate material used is copper unless otherwise stated. Bonding to other backing plate materials, such as aluminum, molybdenum, and stainless steel is also possible.

**Ceramics to which solder is applied with the aid of a heated ultrasonic wand:**
- AlMgB$_{14}$+TiB$_2$
- Aluminum oxide (Al$_2$O$_3$)
- Aluminum-zinc oxide (AZO)
- Boron carbide (B4C)
- Borosilicate glass
- Carbon-graphite
- Hafnium oxide
- Indium-tin oxide (ITO)
- Silicon
- Silicon carbide (SiC)
- Silicon dioxide (SiO$_2$)
- Titanium carbide (TiC)
- Titanium nitride (TiN)
- Zinc oxide (ZnO)

**Incoming requirements for standard products**

<table>
<thead>
<tr>
<th>Target Material</th>
<th>Bond Area (upper limits)</th>
<th>Target Thickness (lower limit)</th>
<th>Backing Plate Thickness (lower limit)</th>
<th>Target Flatness</th>
<th>Backing Plate Flatness</th>
<th>Target / BP Accumulative Flatness</th>
<th>Target Surface Roughness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other materials not listed below</td>
<td>length ≤ 1067mm (42”) width ≤ 559mm (22”) diam ≤ 559mm (22”)</td>
<td>≥ 6mm (0.24”)</td>
<td>≥ 8mm (0.31”)</td>
<td>Better than 0.002mm/10mm</td>
<td>Better than 0.01mm/10mm</td>
<td>Better than 0.01mm/10mm</td>
<td>&gt; 0.5µm (20µin)</td>
</tr>
<tr>
<td>Borosilicate silicon dioxide</td>
<td>length ≤ 1067mm (42”) width ≤ 559mm (22”) diam ≤ 559mm (22”)</td>
<td>≥ 6mm (0.24”)</td>
<td>≥ 11mm (0.43”)</td>
<td>Better than 0.002mm/10mm</td>
<td>Better than 0.01mm/10mm</td>
<td>Better than 0.01mm/10mm</td>
<td>&gt; 0.5µm (20µin)</td>
</tr>
<tr>
<td>Carbon graphite</td>
<td>length ≤ 1067mm (42”) width ≤ 559mm (22”) diam ≤ 559mm (22”)</td>
<td>≥ 6mm (0.24”)</td>
<td>≥ 8mm (0.31”)</td>
<td>Better than 0.005mm/10mm</td>
<td>Better than 0.01mm/10mm</td>
<td>Better than 0.013mm/10mm</td>
<td>&gt; 0.5µm (20µin)</td>
</tr>
<tr>
<td>Silicon bonded to copper</td>
<td>length ≤ 1067mm (42”) width ≤ 559mm (22”) diam ≤ 559mm (22”)</td>
<td>≥ 6mm (0.24”)</td>
<td>≥ 11mm (0.43”)</td>
<td>Better than 0.002mm/10mm</td>
<td>Better than 0.01mm/10mm</td>
<td>Better than 0.01mm/10mm</td>
<td>&gt; 0.25µm (10µin)</td>
</tr>
<tr>
<td>Silicon bonded to molybdenum</td>
<td>length ≤ 1067mm (42”) width ≤ 559mm (22”) diam ≤ 559mm (22”)</td>
<td>≥ 6mm (0.24”)</td>
<td>≥ 6mm (0.24”)</td>
<td>Better than 0.002mm/10mm</td>
<td>Better than 0.01mm/10mm</td>
<td>Better than 0.01mm/10mm</td>
<td>&gt; 0.25µm (10µin)</td>
</tr>
</tbody>
</table>

*Larger bond areas are possible, please contact one of Indium Corporation’s Technical Support Engineers for more information.*
**NanoBond® of Ceramic & Metal Sputtering Targets**

NanoFoil® can be used to bond **metal and metal/ceramic** sputtering targets. For this process, the solder is pre-applied to the target and backing plate and machined flat. Then the NanoFoil is placed between the pre-coated surfaces, pressure is applied, and the foil is activated, melting the solder and creating the bond.

Below are the incoming requirements for the standard NanoBond® process. The standard backing plate material used is copper. Bonding to other backing plate materials, such as aluminum, molybdenum, and stainless steel is also possible.

### Metals to which solder is applied with the aid of flux
- Cobalt
- Copper
- Copper-silver alloys
- Nickel
- Nickel-iron alloys
- Platinum
- Ruthenium

### Metals to which solder is applied with the aid of mechanical agitation
- Aluminum
- Aluminum-copper
- Aluminum-silicon
- Aluminum-neodymium
- Other aluminum alloys

### Metals to which solder is applied with the aid of ultrasound
- Aluminum-titanium alloys
- Chromium™
- Iron-cobalt
- Manganese
- Manganese-iridium
- Molybdenum
- Nickel-chrome
- Nickel-titanium
- Niobium
- Stainless steel
- Tantalum
- Titanium
- Titanium-niobium
- Tungsten
- Tungsten-titanium

### Metals to which no solder is applied
- Copper-gallium
- Copper-indium-gallium
- Indium
- Indium-sodium
- Tin

*Standard procedure is to grit blast surfaces of these materials to a Ra roughness = 2.5µm (100µ”) prior to solder application.

**Chromium has an incoming surface roughness requirement of Ra > 0.5µm (20µ”), since grit blasting chromium is hazardous.

### Incoming requirements for standard products

<table>
<thead>
<tr>
<th>Target Material</th>
<th>Bond Area (upper limits)**</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>length ≤ 1067mm (42&quot;)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Target Thickness (lower limit)</th>
<th>Backing Plate Thickness (lower limit)</th>
<th>Target Flatness</th>
<th>Backing Plate (BP) Flatness</th>
<th>Target/BP Accumulative Flatness</th>
</tr>
</thead>
<tbody>
<tr>
<td>All metals listed above</td>
<td>≥ 2.5mm (0.1&quot;)</td>
<td>≥ 6mm (0.24&quot;)</td>
<td>Better than 0.01mm/10mm (0.001&quot;/1&quot;)</td>
<td>Better than 0.01mm/10mm (0.001&quot;/1&quot;)</td>
<td>Better than 0.015mm/10mm (0.0015&quot;/1&quot;)</td>
</tr>
</tbody>
</table>

* ***Larger Bond Areas are possible, please contact one of Indium Corporation’s Technical Support Engineers for more information.

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This Application Note is provided for general information only. It is not intended, and shall not be construed, to warrant or guarantee the performance of the products described which are sold subject exclusively to written warranties and limitations thereof included in product packaging and invoices.

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