VITRIFIED BACK GRINDING WHEEL (NANO POL)

Technology
- Wafer surface roughness and die strength can be improved
- Grinding stress and wafer edge chipping can be reduced
- Diamond at the tip can be distributed consistently
- Porosity, pore shape and pore size control can be adjusted
- Possible to grind Si wafer up to 17μm (Ultra thin wafer)
- Outstanding grinding ability for TSV and normal (for finger print) compound wafer

Si Wafer Grinding Wheel

Compound Material (Finger Print Strip) & Compound Molded Wafer (TSV/Fan-Out) Grinding Wheel

<table>
<thead>
<tr>
<th>Material</th>
<th>Wheel Spec.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pure Compound (Ex. EMC)</td>
<td>#800 ~ #2000 VSP3, #800 ~ #2000 VSP5</td>
</tr>
<tr>
<td>Compound + Silicon Chip</td>
<td>Z1 #800 VSP3 + Z2 #5000 VSP3, Z1 #800 VSP3 + Z2 #5000 VSP3</td>
</tr>
<tr>
<td>Compound + Silicon Chip + Copper/Via</td>
<td>Z1 #800 VSP3 + Z2 #5000 VSP3, Z1 #800 VSP3 + Z2 #5000 VSP3</td>
</tr>
<tr>
<td>Compound + Silicon Chip + Polymide + Solder</td>
<td>Z1 #800 VSP3 + #3000 VSP5, Z1 #800 VSP3 + #3000 VSP5</td>
</tr>
</tbody>
</table>
Advantages

1) Rough grinding (Z1)
   1. Vitrified bond (#400~800)
      ① Higher feed rate for better UPH.
      ② Low and consistent grinding current and longer wheel life time
   2. Resin bond (#325~600)
      ① Less edge chipping and grinding damage on thin wafer
      ② Excellent grinding ability without compromising wheel life time

2) Fine grinding (Z2)
   1. Resin bond ( #2000 ~ #4000 )
      ① Easy grinding with low and consistent grinding current
      ② Considerably longer life time than competitor’s
      ③ #3000~#4000 : Superior surface roughness and minimized sawing mark

Specifications

<table>
<thead>
<tr>
<th>Applications</th>
<th>D</th>
<th>W</th>
<th>X</th>
<th>Mesh size</th>
<th>Bond name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rough grinding</td>
<td>Ø200 ~ Ø204</td>
<td>2~4</td>
<td>5~7</td>
<td>#270</td>
<td>VA</td>
</tr>
<tr>
<td></td>
<td>Ø250</td>
<td></td>
<td></td>
<td>#325</td>
<td>VCL</td>
</tr>
<tr>
<td></td>
<td>Ø300 ~ Ø304</td>
<td></td>
<td></td>
<td>#400</td>
<td>RB</td>
</tr>
<tr>
<td>Fine grinding</td>
<td></td>
<td></td>
<td></td>
<td>#600</td>
<td>RS</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>#800</td>
<td>REC</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>#1200</td>
<td>AOC</td>
</tr>
<tr>
<td>Resin</td>
<td>BG01</td>
<td></td>
<td></td>
<td>#1500</td>
<td>SWR</td>
</tr>
<tr>
<td>Vitrified</td>
<td>BG02</td>
<td></td>
<td></td>
<td>#2000</td>
<td>SWA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>#3000</td>
<td>SWC</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>#4000</td>
<td>SWE</td>
</tr>
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</table>

Bond type          | Machine, S/K type | Dimensions |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Resin</td>
<td>DISCO</td>
<td>D</td>
</tr>
<tr>
<td></td>
<td>OKAMOTO</td>
<td>O</td>
</tr>
<tr>
<td>Vitrified</td>
<td>TSK</td>
<td>T</td>
</tr>
</tbody>
</table>

Dimensions:
- D: Diameter
- W: Width
- X: Depth
### Performance Data

#### Performance comparison : Z1

<table>
<thead>
<tr>
<th>Specification</th>
<th>Bond type</th>
<th>Mesh size</th>
<th>Machine</th>
<th>Grinding ability</th>
<th>Life time</th>
<th>Roughness [Rmax, μm]</th>
<th>EHWA : RSL</th>
<th>Competitor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grinder type</td>
<td>Porous structured resin</td>
<td>#400 - #600</td>
<td>DISCO 8760</td>
<td>Around 12 - 13</td>
<td>Around : 18K</td>
<td>Around 3 - 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grinder type</td>
<td>Porous structured resin</td>
<td>#320</td>
<td>TSK PG300</td>
<td>9 - 10A</td>
<td>Around 12K</td>
<td>Around 4 - 5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Performance comparison : Z2

<table>
<thead>
<tr>
<th>Specification</th>
<th>Bond type</th>
<th>Mesh size</th>
<th>Machine</th>
<th>Grinding performance</th>
<th>Life time</th>
<th>Roughness [Ra, nm]</th>
<th>EHWA : SWD</th>
<th>Competitor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grinder type</td>
<td>Wear resistant porous structured resin</td>
<td>#2000 - #3000</td>
<td>DISCO 8760</td>
<td>Around 12 - 13A</td>
<td>Around : 18K</td>
<td>Around 7 - 8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grinder type</td>
<td>Porous structured resin</td>
<td>#2000</td>
<td>TSK PG300</td>
<td>9 - 10A</td>
<td>Around 12K</td>
<td>Around 7 - 8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Wafer edge shape for ultra thin wafer

- X40, after rough grinding until 90μm left
- EHWA DIAMOND IND. CO., LTD
- 374, Nambu-daero, Osan-si, Gyeonggi-do, 18145, Korea
- TEL: (82-31)370-9000
- FAX: (82-31)374-9235
- SALES DEPT.: TEL: (82-31)370-9220
- FAX: (82-31)374-9079
- HOMPAGE: www.ehwadia.co.kr
- E-MAIL: semi@ehwadia.co.kr
DRY POLISHING WHEEL (DP)

Wool Felt + ZrO2 (250 nm)

Work Piece & Grinding

Silicon Wafer

- Z1: EHWA BACK GRINDING WHEEL
- Z2: EHWA BACK GRINDING WHEEL
- Z3: EHWA DP-350D

Roughness Result (EHWA)

**WAFER ROUGHNESS TEST (Field test)**
- Sampling Interval: 1.0um
- Objective: 20X
- Cutoff Filter: 80.00 (um)
- Machine: MIP2000+

**TOTAL ROUGHNESS AVERAGE**
Ra Average = 1.64 Å

**WAFER ROUGHNESS TEST (In house test)**
- Ra: 1.17nm
- Rq: 1.48nm
- Rt: 11.97nm
- Machine: Wyko NT3300
- Method: Optical 3D Surface
**GDP WHEEL**

**Test Condition**

**EHWA GDP(Sample1) Wheel Test**
- Processed Material
  - Silicon Wafer Size: 12 inch
  - BG Tape Type: Lintec P-7180(180um)
  - Machine Type: DGP 8761(NN2412) & DFM2800
  - Quantity: Dummy Wafer x10 pcs

**Wheel Type**
- Z1: EHWA BACK GRINDING WHEEL
- Z2: EHWA BACK GRINDING WHEEL
- Z3: EHWA-GDP 450D-26T-130H

**Roughness Result (EHWA)**

Damage depth

[ TEM magnification: X 12000 ]

Carbon tape for TEM
Pt coating for TEM
Etched surface

Width of recess

Depth: 6.5um
**MICRO BLADE**

**Advantages**
- High precision thin blade with superior cutting efficiency
- Maintains free cutting action at high RPM and fast feed rates
- Eliminate chipping during the sawing operation

**Applications**
- Sawing of packages such as QFN, FBGA, CSP, MCP, POP, PBGA
- Sawing and grooving of Ferrite, Ceramics, Glass, Quartz, Sapphire

**Available Product Spec and Bond Series**

<table>
<thead>
<tr>
<th>Out Diameter</th>
<th>Minimum Thickness (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Metal Bond</td>
</tr>
<tr>
<td>52–60 mm (2.5 inch)</td>
<td>0.10</td>
</tr>
<tr>
<td>75–78 mm (3 inch)</td>
<td>0.15</td>
</tr>
<tr>
<td>100–115 mm (4 inch)</td>
<td>0.15</td>
</tr>
<tr>
<td>120–130 mm (5 inch)</td>
<td>0.20</td>
</tr>
</tbody>
</table>
**Elements of Blade Structure**

<table>
<thead>
<tr>
<th>Resin type</th>
<th>Hardness</th>
<th>Metal type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glass / Quartz / Ceramic</td>
<td>LTCC</td>
<td>FBGA / CSP / LED</td>
</tr>
<tr>
<td></td>
<td></td>
<td>QFN</td>
</tr>
<tr>
<td></td>
<td>CABGA</td>
<td>LED / MLF</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Electroforming type</th>
<th>Metal (Ni)</th>
<th>Hardness (Metal, Resin)</th>
<th>Si, GaAs, and PKG (Tape-CSP) cutting</th>
</tr>
</thead>
</table>

**EHWA New Blade**

- No diamond exposure of blade surface type
- Excellent cutting quality at Cu burr, Chipping and shape maintaining
- Superior blade life time and hardness than conventional blade

**Cutting surface of the PKG**

[Conventional Quality]

[Improved Quality]
Electroformed Micro Blade

Features

- High accuracy
- Ultra-thin hub-less blade (~50um) vs Metal bond micro blade (>100um)
- Cutting any hard materials (ex Ceramic package, LTCC, HTCC)
- Advantages of cutting PKG with high abrasive content
- High yield long life time

Bonding Strength

- High bonding strength — long life time
- No pore in Ni bond microstructure

Specification

- Thickness: >50um
- Outer diameter: >54mm
- Diamond concentration: 25-100con
DICING BLADE

Advantages

- High accuracy, super thin blade developed by EHWA’s cutting
- Minimized chipping and superior consistency in quality through stringent particle
- Size distribution control
- Improve productivity by high feed speed
- Providing an optimized solution to the customers

Si Wafer Dicing Mechanism

Wafer Top Side: Wet Cutting with Coolant
In general, fine diamond grit leads to small top side chipping.

Wafer Back Side: Dry Cutting without Coolant
In general, coarse diamond grit minimizes back size chipping due to its cutting ability and less load imposed on each grit.

Developing New Bond

Application
Si and Compound semiconductor

Features
Small top and backside chipping
Improve productivity by high feed speed

Top chipping  Side & back chipping
Application

Application which requires thin kerf & long life time.
- Ceramic package (HTCC, LTCC)
- LED package
- PCB
- Etc.

Ceramic Package Cutting

Chipping Size: 10~20μm (Max 27μm)
METAL EDGE GRINDING WHEEL

Advantages

- Various groove shapes can be designed.
- Grinded with uniform chamfer width (excellent rigidity)
- Strong groove shape retention.
- Product 1ea enables multi-stage grinding (rough / fine grinding)

Application

- LCD & OLED Panel, glass edge grinding

Available Product Spec.

<table>
<thead>
<tr>
<th>Type</th>
<th>Diameter</th>
<th>Thickness</th>
<th>Grit Size</th>
<th>Groove</th>
</tr>
</thead>
<tbody>
<tr>
<td>MD-DW</td>
<td>Ø5～Ø50</td>
<td>5～20mm</td>
<td>#325～#2000</td>
<td>Metal</td>
</tr>
<tr>
<td>MD-1FF6Y</td>
<td>Ø50～Ø200</td>
<td>5～80mm</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Performance Data

<table>
<thead>
<tr>
<th>Application</th>
<th>Edge Strength</th>
<th>Life Time</th>
<th>Chipping Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>15° Panel grinding</td>
<td>120～130 (Mpa)</td>
<td>100 (cell/groove)</td>
<td>&lt; 30μm</td>
</tr>
</tbody>
</table>