History:
- 4” versus 2” technology
- Separating techniques

Marketing profile & Market segmentation

Manufacturing techniques:
- Nickel Bond
- Steel core - Nickel
- Resin Bond
- Metal Sintered
- Diamond selection

Blade characteristics:
- Advantages & disadvantages of the different blade binders & blade geometry’s

Dressing:
- Principles
- Dressing techniques
Cont.

- **Process techniques & Parameters:**
  - Application Characteristics
  - Cutting mode
  - Clamping methods
  - Cooling
  - High cooling flange
  - Cutting through heavy substrates
  - Cutting through into tapes
  - Recommended exposure left

- **Major applications - Material dicing guide:**
  - Recommended Spindle speed
  - Dicing green ceramic

- **Special applications:**

- **Optimizing the cutting process:**

- **Trouble shooting:**
4” Diameter Versus 2” Diameter

- More edge surface
  - More diamonds
- Shallower angle of attack
- Longer life
  - Less blade wear
- Less material damage

More blade surface in kerf during dicing

“Less vibrations”
“Higher feed rate”
Dicing Blade Seminar

K&S - 775
Dicing Blade Seminar

K&S - 980
Peripheral Products

- 966 - Wafer Mounting Stations
- 955 - UV Curing Systems
- 977 - Wafer Cleaning Stations
- 937 - Re Circulating Spindle Water Chiller
- 921 - Closed Loop Filtration System
- 947 - CO2 In-Line injector
- Film Frames and Film Frame Cassettes
Separating Techniques

- Laser Scribe
- Diamond Scribe
- Diamond dicing

Key measurements:
- Edge quality
- Kerf width
- Cut depth

- Stag
- Break line
- Laser Scribe
- Silicon
- Diamond Scribe

125°
Diamond Scribing process

Pyramid Diamond

~ 10°

GaAs wafer

Scribe line

Scribe & break line
Separating Techniques

HARD AL. SUBSTRATE DICED WITH A DIAMOND RESINOID BLADE ON THE K+S 784 SAW.

HARD AL. SUBSTRATE SSCRIBED WITH A LASER BEAM.
Marketing Profile & Market Segmentation
Market Profile

Instrumentation
Optoelectronics & Optics
Sensors & Transducers

Data Processing
Magnetic Heads

Precision
Dicing Systems

Electronics
Active Devices
Passive devices
Packaging
<table>
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<tr>
<th>Market Segmentation</th>
<th>Instrumentation</th>
<th>Electronics</th>
<th>Data Processing</th>
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<td>Optoelectronics &amp; Optics</td>
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<td>- Electro medicine</td>
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<td>- Measurement Instruments</td>
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<td>- Aerospace</td>
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<td>- Signal Fillers</td>
<td>- IC Packaging</td>
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<td>- Automotive</td>
<td>- Facsimile Scan / Print Heads</td>
<td>- Communication &amp; Microwave</td>
<td>- Hybrid Substrate</td>
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<tr>
<td>- Solar Cells</td>
<td>- Optical Components</td>
<td>- Thin Film Print Heads</td>
<td>-</td>
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</table>
Single Diamond Machining Mechanism

- Blade rotation
- Diamond particle
- Material removed
- Substrate
- Chuck saw feed
Advanced Dicing Technologies Ltd.

Blade Seminar

Manufacturing Techniques
Blade Characteristics
Diamond Selection in blade Manufacturing

- Strong, blocky single crystal used in nickel & m. sintered matrices
- Friable, irregular shape coated with nickel alloy used in resin matrices
- Blocky shape
Diamond Selection in blade Manufacturing

CBN - Cubic Boron Nitride (Borozon)
For Grinding and Cutting Ferrous Materials
Standard available Diamonds

**Nickel type blades:**
2 - 4mic., 3 - 6mic., 4 - 8mic., 10mic., 17mic., 30mic., 50mic.

**Resin type blades:**
3mic., 6mic. (3000 mesh), 9mic. (1800 mesh), 15mic. (1200 mesh),
20mic. (1000 mesh), 25mic. (800 mesh), 30mic.(600 mesh),
35mic.(400 mesh), 45mic. (325 mesh), 53mic. (270 mesh)
63mic. (230 mesh), 88mic. (170 mesh), 105mic. (140 mesh)
- For special application going up to 200mic.
- Any new diamond grit can be made

**Metal sintered blades:**
2- 4mic., 3- 6mic., 4- 8mic., 10mic., 17mic., 20mic., 25mic., 30mic.,
45mic., 50mic., 63mic., 70mic., 80mic.,105mic.,
- Any new diamond grit can be made
Nickel Bond - Low Wear blade

- Hard and sharp edges
- Hard Nickel
- Diamond (Blocky)
Resin Bond-self re-sharpening and free cutting blade

High temperatures

Resin

Diamond

Blade wear
Metal Sintered blades

Hard and sharp edges

Bronze binder acting as a heat sink

- Bronze + fillers for a tough or a softer matrix
- Cobalt matrices

Diamond
Advantages & Disadvantages of blade Binders

Resin

**Advantages:**
- Cuts almost any material
- Clean and chip free cuts on hard and brittle materials
- Thick blades up to .100” are available
- No need for long dressing
- A variety of different resin matrixes is available
- Any new diamond grit can be made at low cost

**Disadvantages:**
- Higher blade wear
- The edge geometry is lost sooner
- Relatively lower R.P.M.
- Minimum thickness is .003” depending on diamond grit
Advantages & Disadvantages of blade binders

Nickel

**Advantages:**
- Very low blade wear (Some time it is a disadvantage)
- Maintaining the edge geometry
- Very good on accurate applications (Magnetic heads)
- Very thin blades can be made - .0006” (0.0152mm)

**Disadvantages:**
- Max thickness .018” - .020” (0.45 - 0.50mm)  
  *(Can go thicker with Steel Core blades)*
- Long dressing procedure
- High cost of new diamond grits (New plating set-up)
- Can not cut very hard and brittle materials (Overloading)
- Side wear on singulation type application due to min. radial wear. (BGA & similar applications)
Advantages & Disadvantages of blade binders

Nickel

New blade

Corners wear

Side wear
Advantages & Disadvantages of blade binders

Hard bond – shorter life

Soft bond – longer life
Advantages & Disadvantages of blade binders

M. Sintered

Advantages:
• Lower wear than Resinoid
• Maintaining the edge geometry much longer compare to resin
• Can be lapped to very precise thicknesses
• Very thick blades can be made (Way over .020”)
• Stable matrix (Stress free)
• Many different matrices can be made (Softer or harder)
• Any new diamond grit can be made at low cost

Disadvantages:
• Longer dressing compare to Resinoid
• Minimum thickness limitations (New thin product is developed down to 0.030mm)
• Relatively lower R.P.M.
Blade Matrix Characteristics
Blade Characteristics

.025” thick Glass Plate diced with Resinoid blade
Blade Characteristics

Glass Tubes diced with resinoid Blade
Blade Characteristics

.025” thick Hard Al. (99.6%) diced with Resinoid Blade
Blade Geometry

Special edge geometry’s (By grinding)
**Blade Geometry**

**Nickel & Metal Sintered**

**Examples:**

- 4.256” O.D. x 54 Slots
- 4.600” O.D. x 60 Slots
- 4.600” O.D. x 16 Slots
- 4.600” O.D. x 8 Slots
- 2.188” & 2.250” O.D. x 72 Slots
- 2.188” & 2.250” O.D. x 16 Slots
- 2.188” & 2.250” O.D. x 8 Slots

Other O.D. blades x different Slot geometry’s are available

**Resinoid blades can also be made with Slots**
Serrated Blades

Advantages:
- Less contact between the edge and the substrate
- Less load during the dicing
- Better coolant
- Longer life

Disadvantages:
- Wider kerf
Blade Characteristics

.5” Thick Optical prism diced with a Resinoid Blade
Special Grooved Blade - SPG

- Minimizes load and blade wear during the dicing process
- Min. thickness .012"
- Can be used with a high cooling flange set or with standard flanges
Wear Comparison Between Standard & SPG blades

A - Standard blade / 125mic. grit.
B - Standard blade / 125mic. grit with higher diamond conc.
C - Standard blade / 200mic. grit.
D - Special grooved blade with 125mic. grit.

The best performing blade, least wear and flattest slope curve.

[Blade geometry - 4.6” O.D. x 020” thick]
Diamond Combination & Reinforcement in Resin Blades

Fiberglass / Graphite mesh reinforcement

Chip free

Coarse grit

Fine grit

Fine grit

Chip free

Fine grit

Coarse grit

.002”-.003” .004” min. .002”-.003”

~.002”

.008” min.

.002”-.003” .004” min. .002”-.003”
E Series
Extended Life Resin Blades for QFN

- Low cost versus cut length ration
- Blade life up to ten times longer than standard resins
- Optimized to provide excellent cut quality for the most severe dicing challenges
T-Series
Extended Life Resin Blades for QFN

More meters of dicing at 100mm/sec

QFN Application

<table>
<thead>
<tr>
<th>Matrix Type</th>
<th>Wear um/meter</th>
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</thead>
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<tr>
<td>RFP 30 mm/sec</td>
<td>15</td>
</tr>
<tr>
<td>E03 50 mm/sec</td>
<td>10</td>
</tr>
<tr>
<td>E01 70 mm/sec</td>
<td>5</td>
</tr>
<tr>
<td>E06 100 mm/sec</td>
<td>0</td>
</tr>
<tr>
<td>T04 100 mm/sec</td>
<td>0</td>
</tr>
</tbody>
</table>
5” Technology

Designed for thick substrates where a large exposure is needed

**Blades available:**
- Nickel serrated - 5.0” O.D. x 3.5” I.D.
  - 5.0” O.D. x 3.0” I.D.
- Resinoid - 5.0” O.D. x 3.5” I.D.
  - 5.0” O.D. x 3.0” I.D.
- M. Sintered - 5.0” O.D. x 3.5” I.D.
  - 5.0” O.D. x 3.0” I.D.
Blade Characteristics

Green Ceramic diced with Nickel Serrated blade

.6” thick substrate (M.L.C.) diced with a 5” Nickel serrated blade
Blade Characteristics

Heavy Glass bar diced with 5” Resinoid blade
Blade Characteristics

1/2” Ceramic tube diced with 5” Resinoid blade
The Effect of Blade & Dicing Parameters on Cut Quality & Throughput

- Cut quality
- Throughput
- Blade wear

Blade & Process Parameters

- Cut depth
- Feed rate
- Spindle RPM
- Blade thickness
- Diamond grit / %
- Blade exposure

Soft Phenolic Resin
Medium Metal Sintered
Hard Nickel
Hard / Brittle

Spindle torque
Diamond grit
Blade thickness
Cut depth
Nickel Bond Dressing

Before dressing
Diamonds are not exposed

Blade edge

Blade edge after dressing