Dicing Systems

Dicing Tools

August 2001

Your Complete Connection

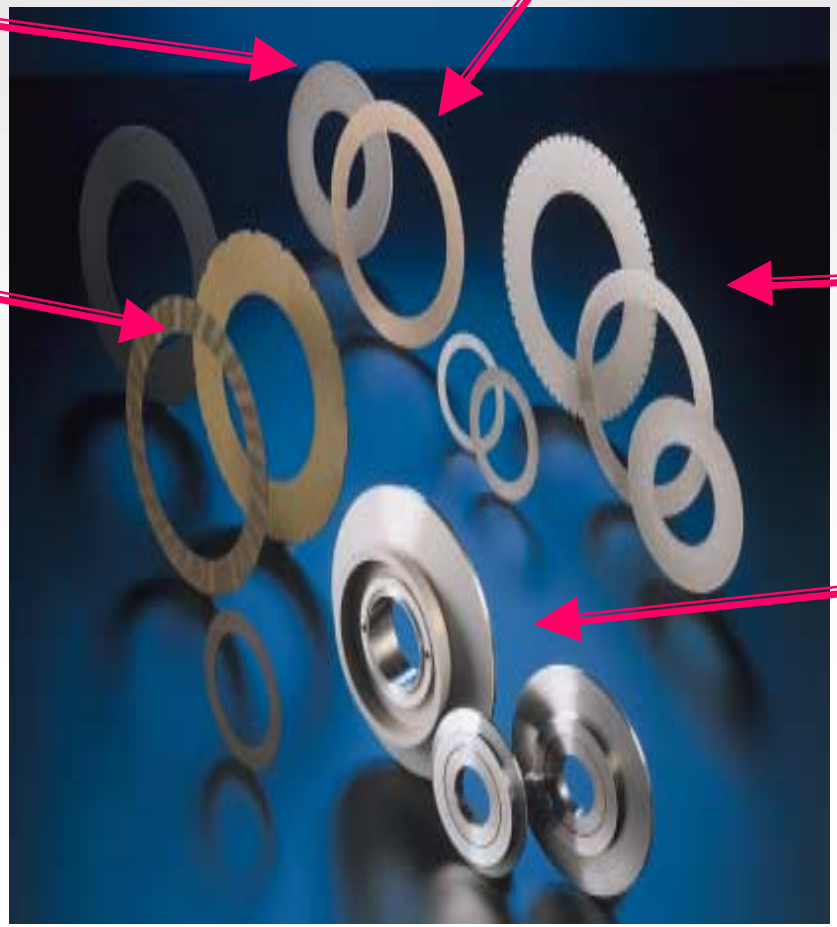
Dicing Products: Blades & Flanges

Dicing Systems

Large variety of dicing tools to support every dicing application :

Steel Core Ni Blades

Sintered Blades



Resin Blades

Nickel Blades

Flanges

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Dicing Products: Accessories

Dicing Systems

- *Lapping kit*
- *Special flange design*
- *High Cooling Flanges*
- *Vacuum Tool*
- *Torque meter*

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Dicing Tools Products

Dicing Systems

Blade Type	Diamond size Micron	Product	Material
Nickel Blade	30,50,70	PBGA,PCB	FR4, Plastic&BT Resin
	3-6,10,17	Magnetic & Tape Heads	TiC & Ferrite
	2-4,4-8,10	Ultrasound Sensors	PZT
	2-4,3-6	Active Devices (Discreet)	GaAs
	4-8	SAW Devices	LiNbO3,LiTaO3
	2-4,3-6	IC's	Silicon
Steel Core Ni Blades	30,50,70	MLC (Multi Layer Capacitors)	Green Ceramic
Resinoid Blades	53,88,105	CBGA	Alumina
	53,63,88	Ceramic Packages	Alumina
	15,20,30	SAW Devices	Quartz,LiNbO3,LiTaO3
	6,9	Tape for VTR	Ferrite
	30,45	Ink Jet Print Heads , Fiber Optics	Glass,Quartz
Sintered Blades	9,15,25	Magnetic Heads	TiC
	30,50	PBGA	Plastic&BT Resin
	9,10,15	Fibers Optics	Glass,Quartz

Dicing Systems

Blade Parameters

to be Defined/Optimized

- **Binder Type** : Nickel , Resin , Sintered , Steel Core
- **Dimension** : OD , ID , Thickness & Thickness tolerance
- **Edge Geometry** : Standard , Serrated (#of serration) , Angled
- **Abrasive** : Diamonds , CBN , Others

  Grit size , Concentration , Type
- **Matrix** : Hard , Soft

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Blades Type

Dicing Systems

- **Blade type and binders:**
  - **Steel Core:**
    - The hardest binder in use.
    - The diamonds on these blades are coated only on the cutting edge of the blade.
    - These blades are used mainly for soft materials such as Green Ceramic.
    - Thickness varies between 6.0 to 30 mils
  - **Nickel:**
    - Very common for soft materials such as PBGA ,PCB, PZT, Green Ceramic and Silicon. Also for the TiC and Ferrite
    - The Nickel binder grows together with the diamonds so all the volume of the blade is equally filled with diamonds.
    - Thickness varies between 0.6 to 15 mil.

Blades Type (cont.)

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- **Blade type and binders:**
  - **Sintered:**
    - These blades are very flat and have an accurate thickness.
    - Used mainly for PBGA ,TiC, Quartz and glass.
    - Very brittle binder.
    - Thickness varies between 5 to 30 mil.
  - **Resinoid:**
    - Soft blades that are self dressed.
    - Can be used for almost all materials with good results.
    - High blade wear.
    - Diamond grit size ranges from 3 to 200 mic.
    - Thickness varies between 3 to 50 mil.

Dicing Systems

Cut Quality/Throughput

Process Parameters

Blade :

- ***Diameter***
- ***Binder***
- ***Matrix Hardness***
- ***Thickness***
- ***Grit Size***
- ***Diamond Concentration***
- ***Edge***

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Cut Quality/Throughput

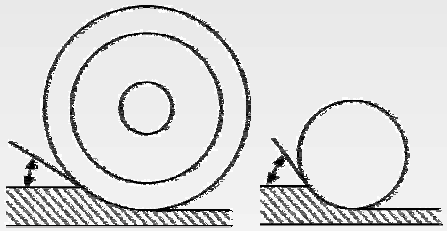
Dicing Systems

Blade Diameter

More edge surface → Less blade wear

Shallower angle of attack → Less chipping

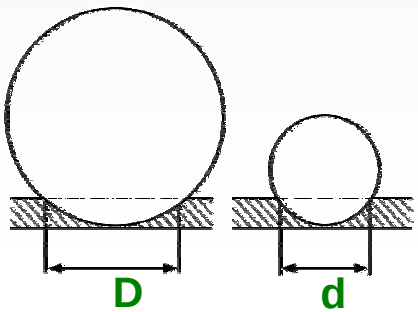
O.D -4”



O.D -2”

More blade surface in kerf during cutting → Less vibrations

→ Higher cut speed



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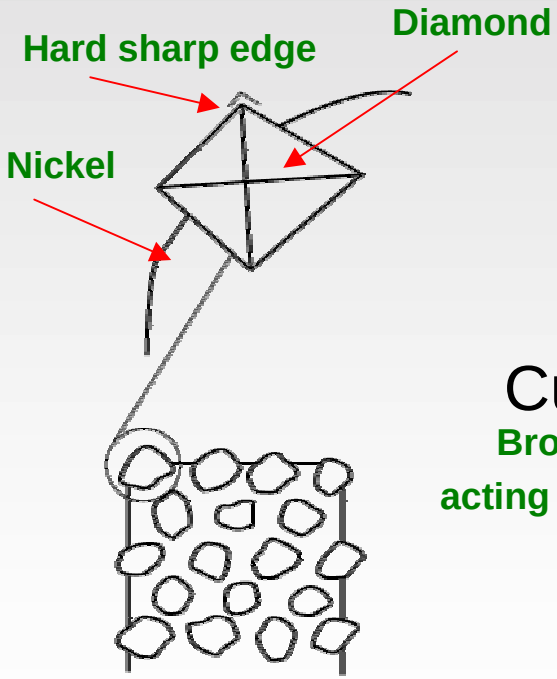
Cut Quality/Throughput

Dicing Systems

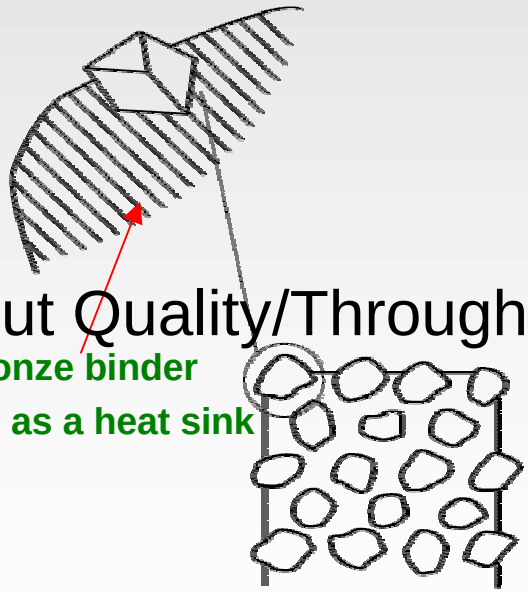
Diamond / Matrix Binder

Nickel Bond



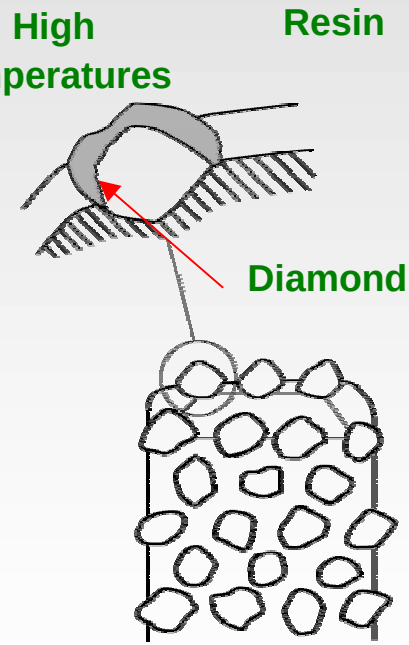
Low wear blade

Sintered Bond



Bronze and additives for a tough matrix

Resin Bond



Self sharpening blade
High blade wear

Cut Quality/Throughput

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Cut Quality/Throughput

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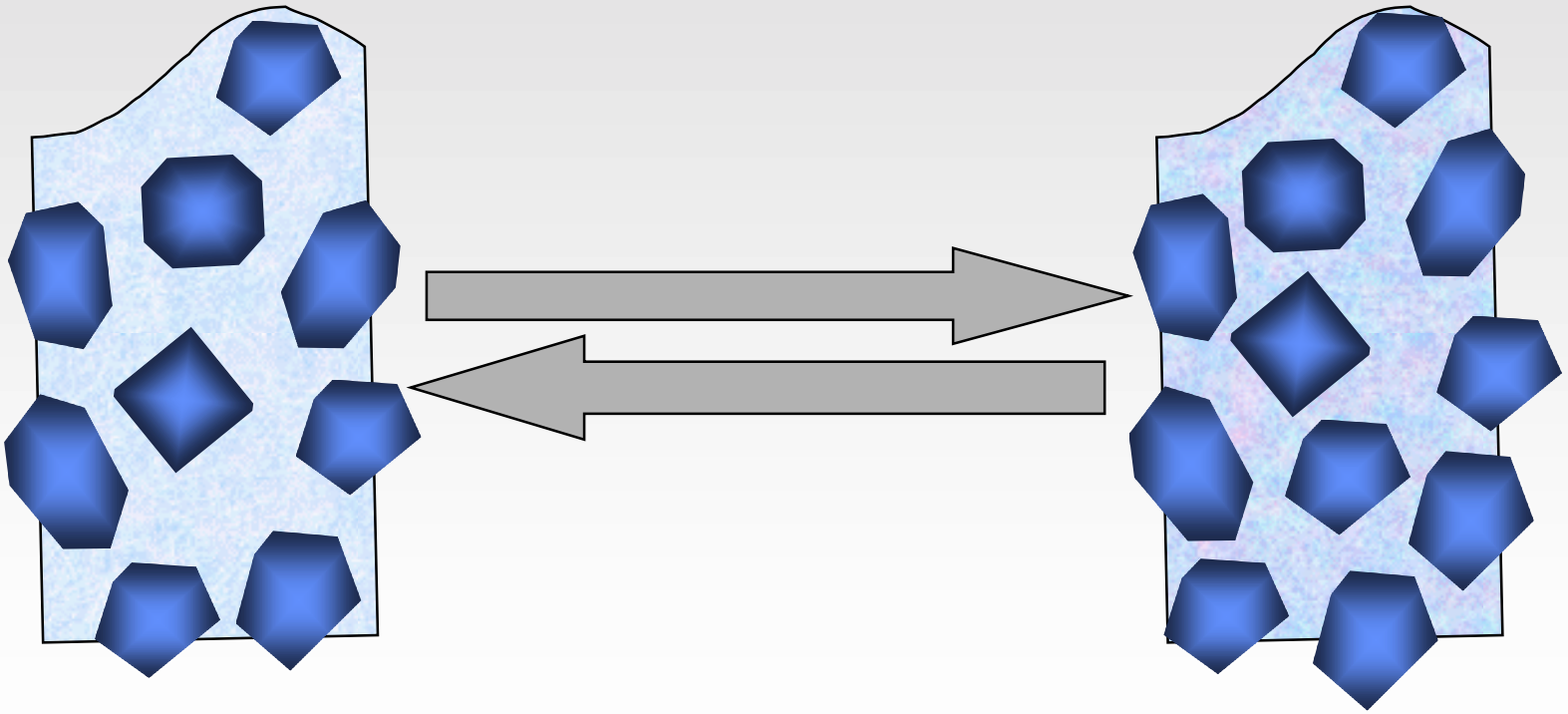
Soft ***Matrix Hardness*** ***Hard***



Higher blade wear

Better Cut Quality
Better Chipping Size

Better Blade Life
Higher Load -
Affect Cut Quality

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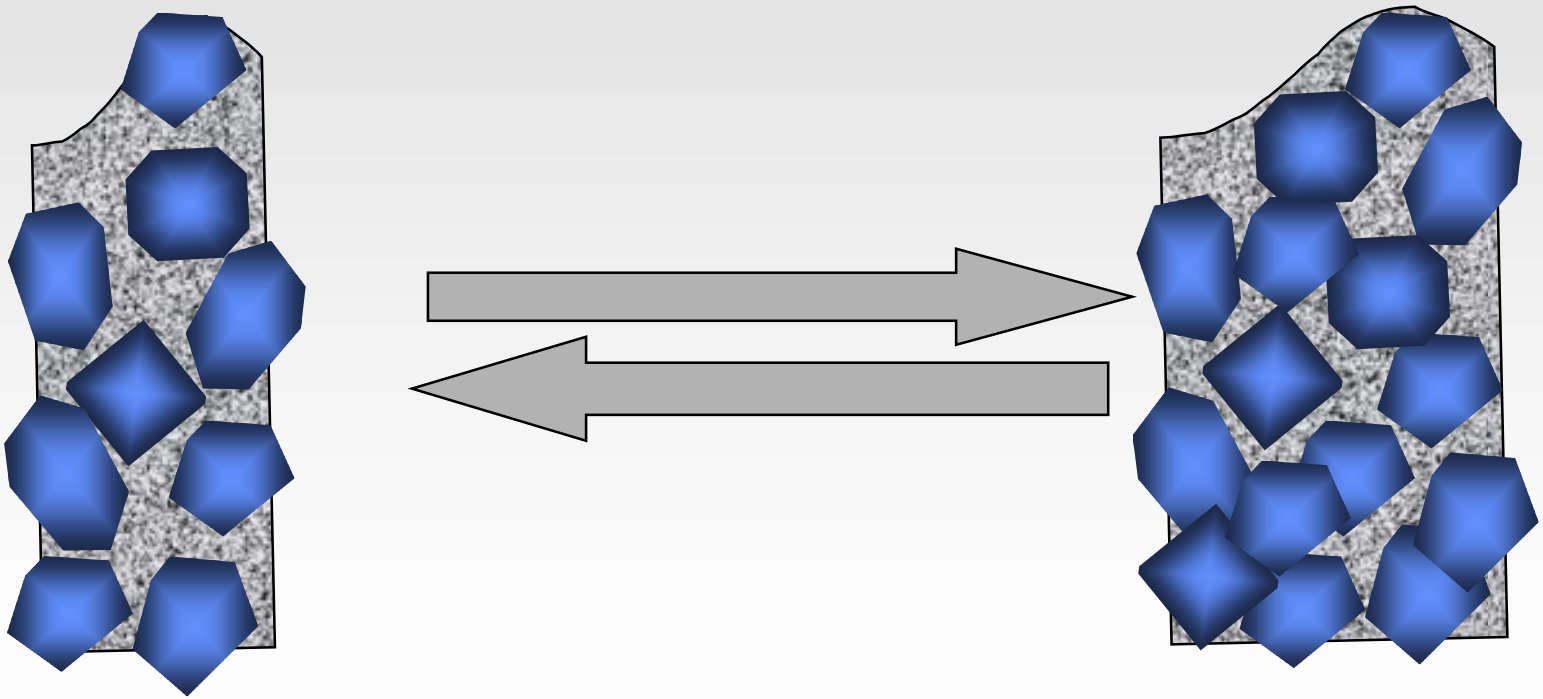
Cut Quality/Throughput

Dicing Systems

Blade Thickness



Smaller Kerf

Higher throughput/subst.

Better Blade Life

Better for thick substrates

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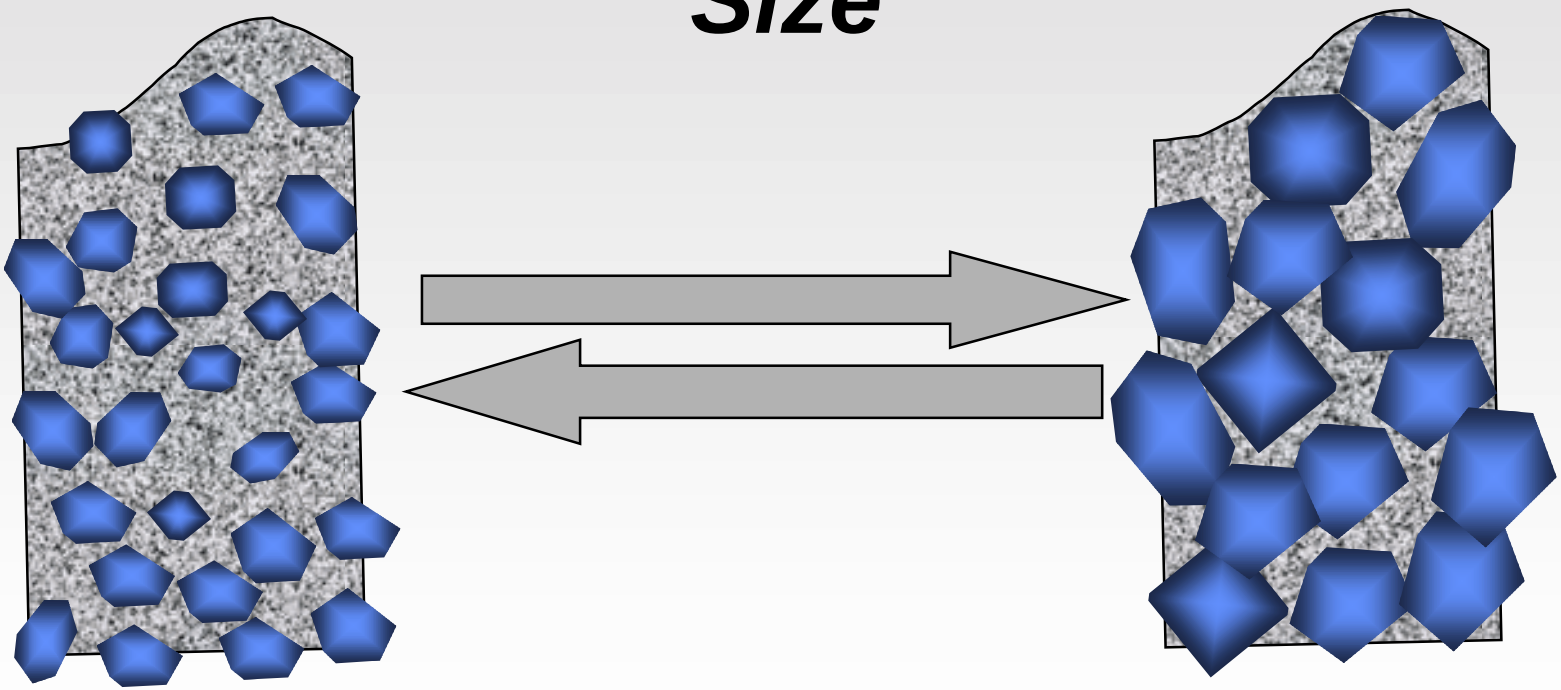
Cut Quality/Throughput

Dicing Systems

Diamond Grit Size

Fine ***Coarse***



Better Cut Quality

Smaller Chipping Size

Better Blade Life

Affect Cut Quality

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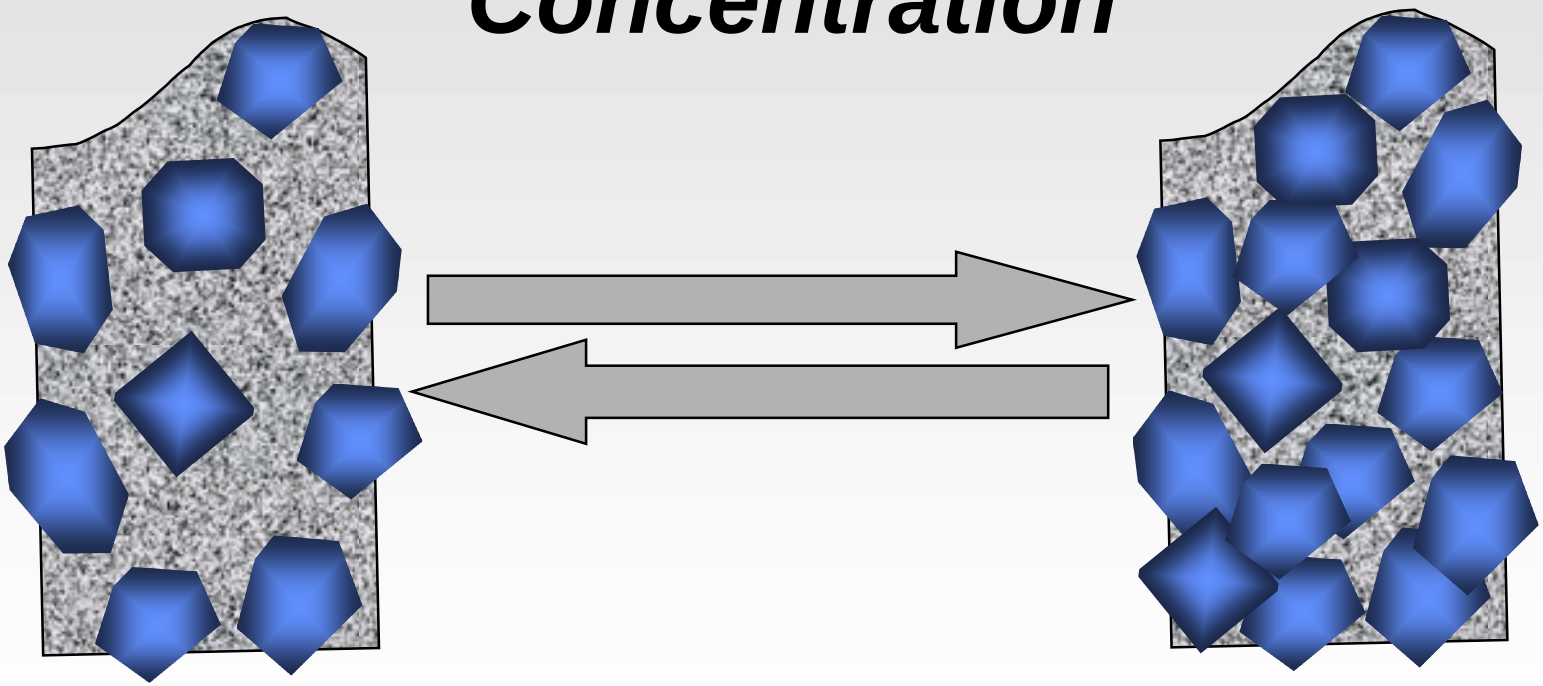
Cut Quality/Throughput

Dicing Systems

Low ***Diamond Concentration*** ***High***



Better Cut Quality

Better Chipping Size

Better Blade Life

Higher Load - Affect Cut Quality

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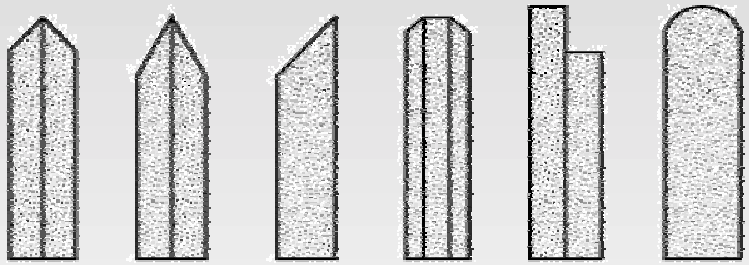
Cut Quality/Throughput

Dicing Systems

Blade Edge Geometry



Special Edge Shape (by Grinding)

4.256” .D
54 slots
.040” (1.00 mm) wide
.200” (5.08 mm) deep
4.600” O.D
60 slots
.050” (1.27 mm) wide
.200” (5.08 mm) deep
2.188” O.D
16 slots
.020” (0.50 mm) wide
.118” (3.00 mm) deep

Special Slots are Available

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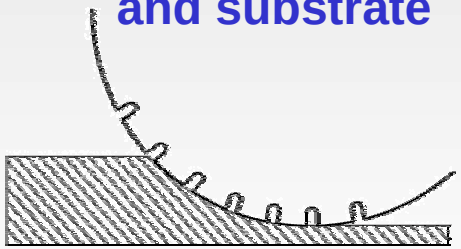
Cut Quality/Throughput

Dicing Systems

Blade Edge - Serrated Blades

Advantages

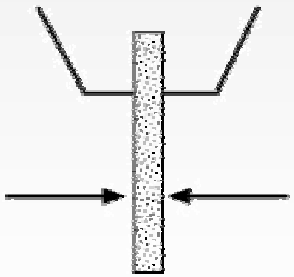
Less contact between edge and substrate → Less load during cutting



Better cooling due to serrations → Longer life

Disadvantages

Kerf width is not as accurate as on regular blades



Vibrations

Chipping increases

Your Complete Connection

Cut Quality/Throughput

Dicing Systems

Blade Exposure

Maximum Recommended Blade Exposure :

- **Nickel Blades :**

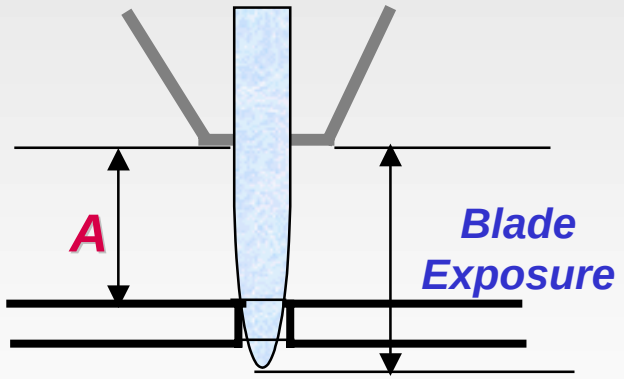
  Blade thickness X 30

- **Resin Blades**

  Blade thickness X 10

- **Sintered Blades**

  Blade thickness X 20



Minimum Recommended Blade Exposure :

- **A = min .300mm (12mil)**

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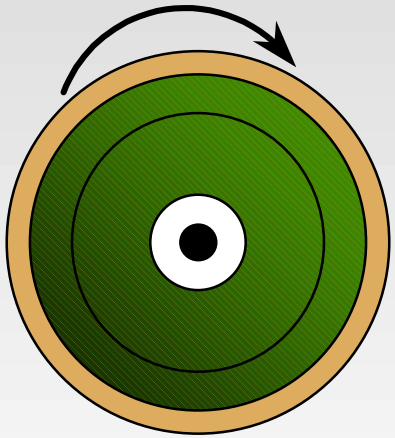
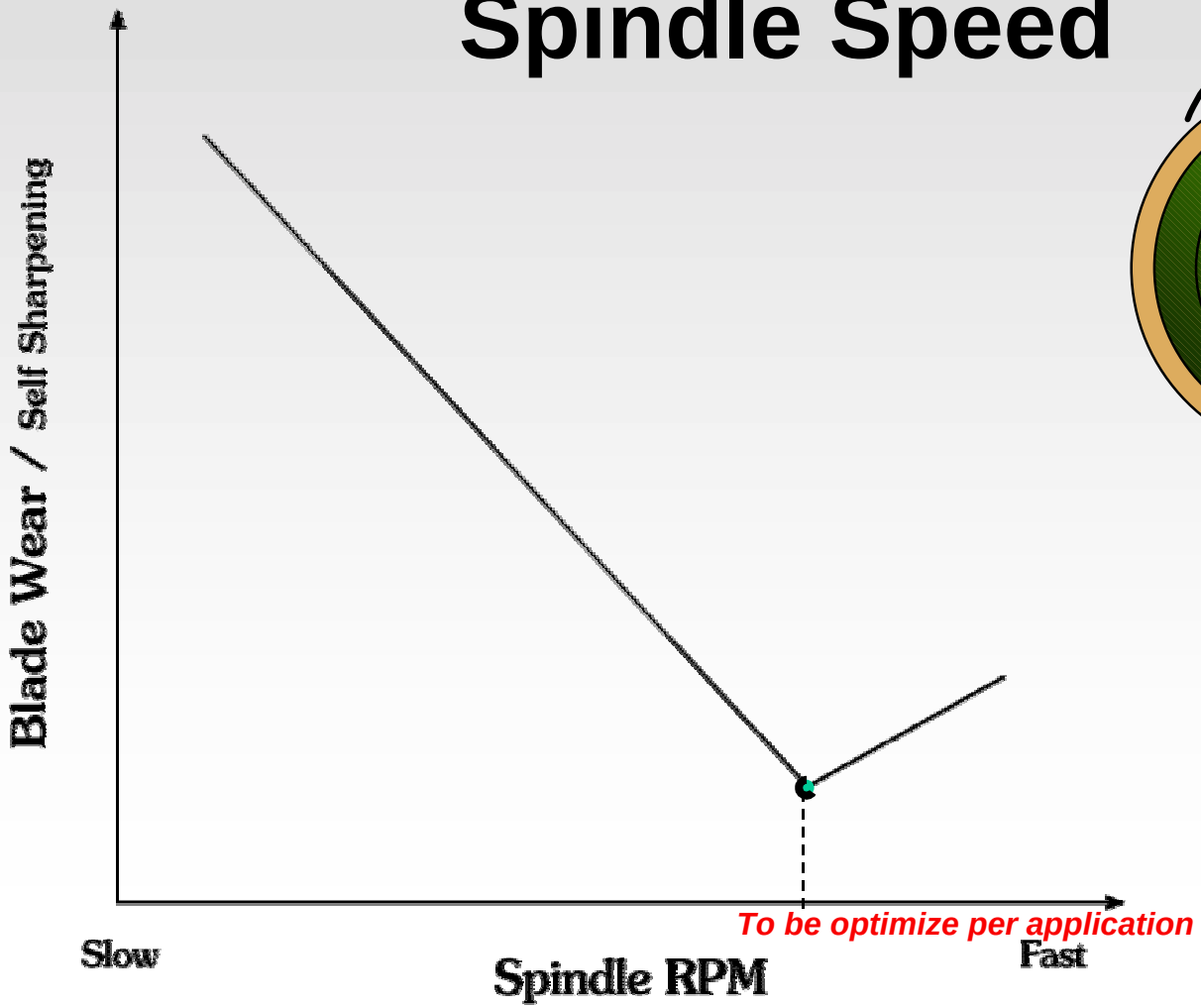
Cut Quality/Throughput

Dicing Systems

Spindle Speed





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Cut Quality/Throughput

Dicing Systems

Spindle Speed

Range of R.P.M. on Main Applications:

TiC, land definition	Nickel blade	12-14K R.P.M.
TiC, cutting through	Nickel blade	12-15K R.P.M.
Silicon	Nickel blade	18-20K R.P.M.
Hard alumina	Resinoid blade	14K R.P.M.
Green ceramic, wet	Nickel blade	12-16K R.P.M.
Green ceramic, dry	T. Carbide blade	10K R.P.M.
Sapphire, S.O.S.	Resinoid blade	8-10K R.P.M.
Quartz	Resinoid blade	8-10K R.P.M.
Ferrites	Nickel blade	14-18K R.P.M.
	Resinoid blade	10-14K R.P.M.
Glass	Resinoid blade	12-14K R.P.M.
Silicon on 2” saws	Nickel type blade	30-60K R.P.M.

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Cut Quality/Throughput

Dicing Systems

Mounting

- *Tape , UV Tape*
- *Lava* - abrasive material -> unload blade -magnetic heads
- *Crystal bond* - strong adhesion -> load blade- ceramic packages
- *Special designed fixtures* -automation
- *Wax* - good adhesion -> load the blade
- *Glass , Ceramic substrates* -stiff material - avoid back side chipping ; wear blade->new diamonds layers

Cut Quality/Throughput

Dicing Systems

Flange & Spindle Torque Recommendation

4” SAWS

- **Flange:**
  - **31±3 Inch • Lb.**
  - **(360±30 N • cm)**
- **Spindle Nut:**
  - **31±3 Inch • Lb.**
  - **(360±30 N • cm)**

2” SAWS

- **Spindle Nut:**
  - **22±2 Inch • Lb.**
  - **(254±23 N • cm)**

Optimization has to be done in production mode.

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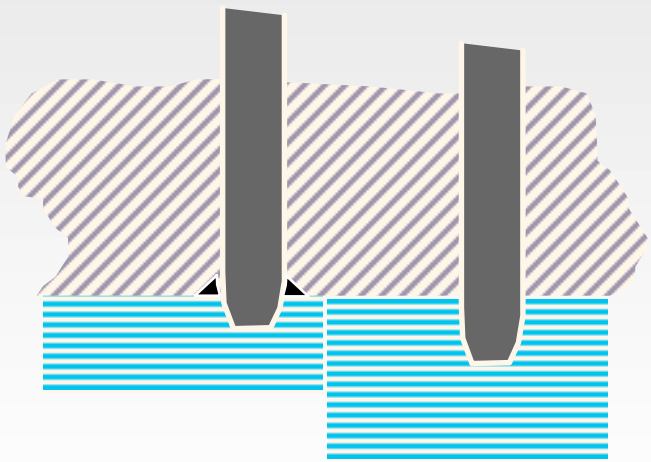
Cut Quality/Throughput

Dicing Systems

- **Cut Depth into tape**
  - **Deeper cut reduces blade taper effect.**
    This requires thicker tape



- **Feed Speed / Spindle speed**
  - **Optimizing this ratio reduces blade wear, indicates that it runs cooler.**
    This contributes to reduced back side chipping

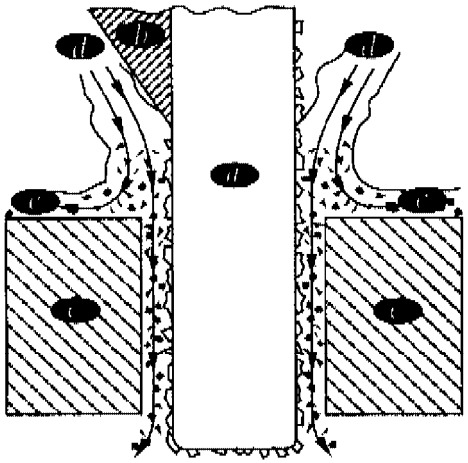
Your Complete Connection

Cut Quality/Throughput

Dicing Systems

Blade Coolant

- Direction - Main jet adjustment
- Additives
  - Reduce water surface tension and improve blade cooling
- Flow rate
  - Too low - does not provide effective cooling
  - Too high - may increase blade vibrations

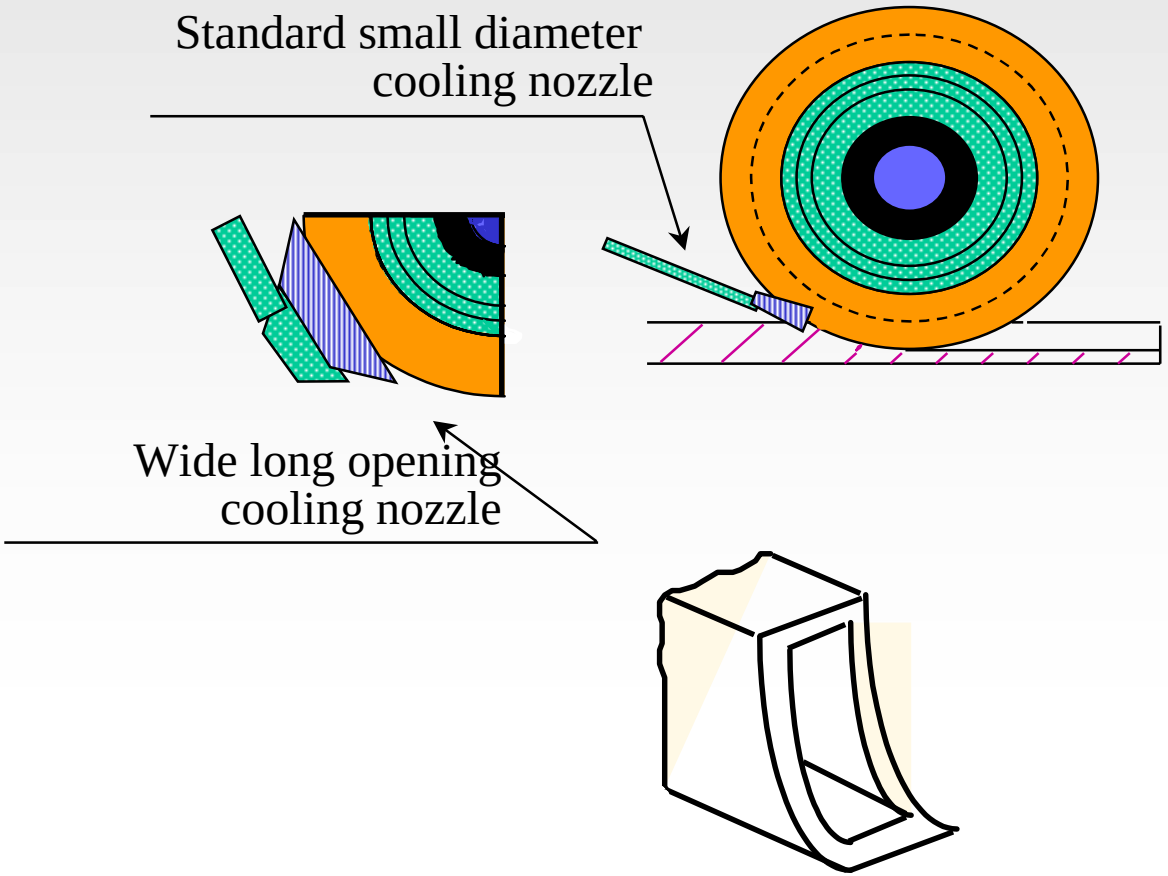


Your Complete Connection

Cut Quality/Throughput

Dicing Systems

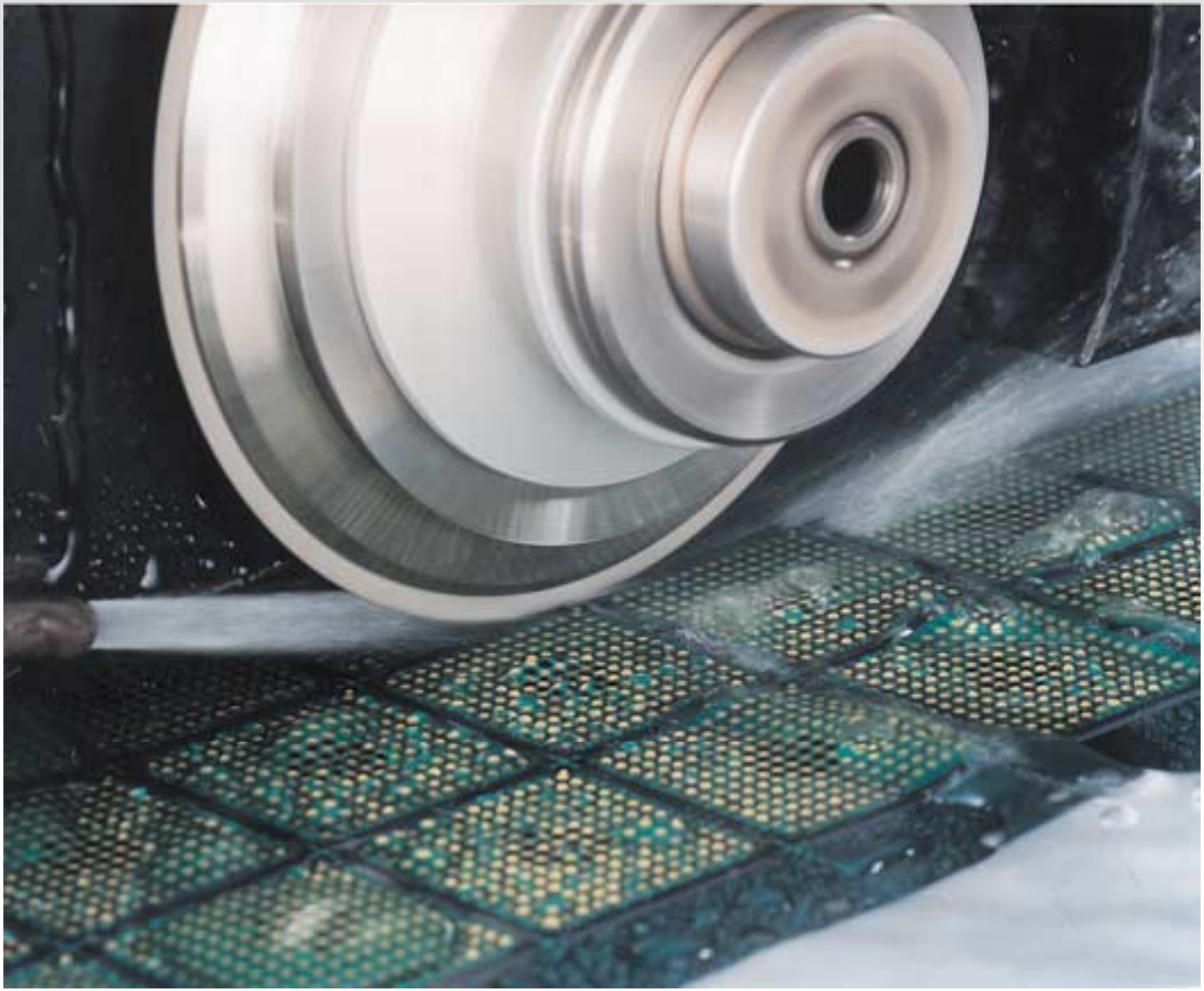
Blade Coolant - Nozzle configuration



Your Complete Connection

Package Singulation

Dicing Systems



Your Complete Connection

Package Singulation

Dicing Systems

CBGA

Resin Blades

Resin Blades

CBN

Non Abrasive Blades

MLP

Solid Cooper

Nickel Blades

Tape application

Nickel Blades

Low diamond Conc.

PBGA

Sintered Blades

Tapeless application

Your Complete Connection

Package Singulation

Dicing Systems

Recommended Dicing Parameters

	Ceramic	*Plastic -Tape*	*Plastic -Tape less*
Blade :	**Resin 4”**	**Nickel 2”& 3”**	**Sintered**
Diamond grit :	**45 - 88 mic**	**30,50,70 mic**	**30 , 50**
Spindle speed :	**12-15 KRPM**	**30 KRPM**	**40-45 KRPM**
Feed Rate :	**10-40 mm/sec**	**40-100 mm/sec**	**80-100 mm/sec**
Blade dressing :	**No need**	**Before & during the dicing process.**	**Before**

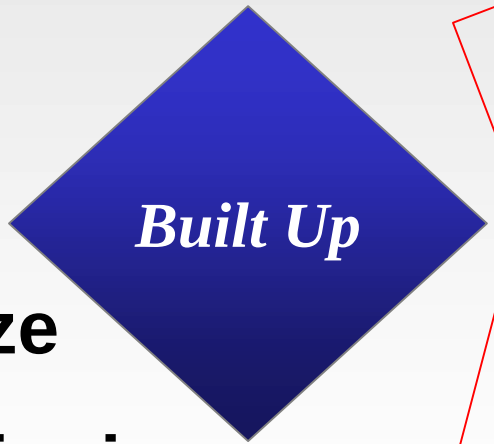
To be optimized by customer

Package Singulation

Dicing Systems

Troubleshooting

- Loading
- Vibration
- Wider kerf size
- Back side chipping



In process blade dressing process

Use bigger diamond grit size

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Package Singulation

Dicing Systems

Troubleshooting

- *Top side chipping*
  - Lower the diamond grit size
- *Back side chipping*
  - Lower the feed rate
  - Increase cut depth - min. substrate thick. + 1/2 blade thickness
  - Perform blade dressing
- *Blade breakage*
  - Lower exposure
  - Perform blade dressing

Your Complete Connection

Package Singulation

Dicing Systems

Troubleshooting

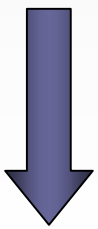
Nickel blade

Built up (Soft materials)

>Blade thickness increases

>Larger Kerf Size

>Smaller Package Size



Dressing process

>Blade thickness decreases

>Smaller Kerf Size

>Bigger Package Size

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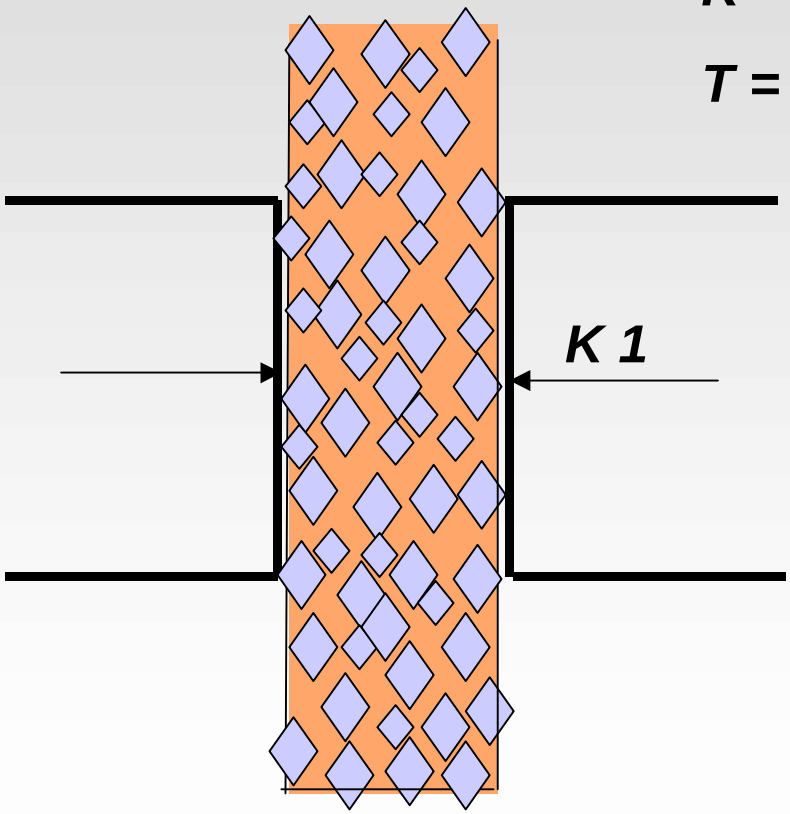
Troubleshooting

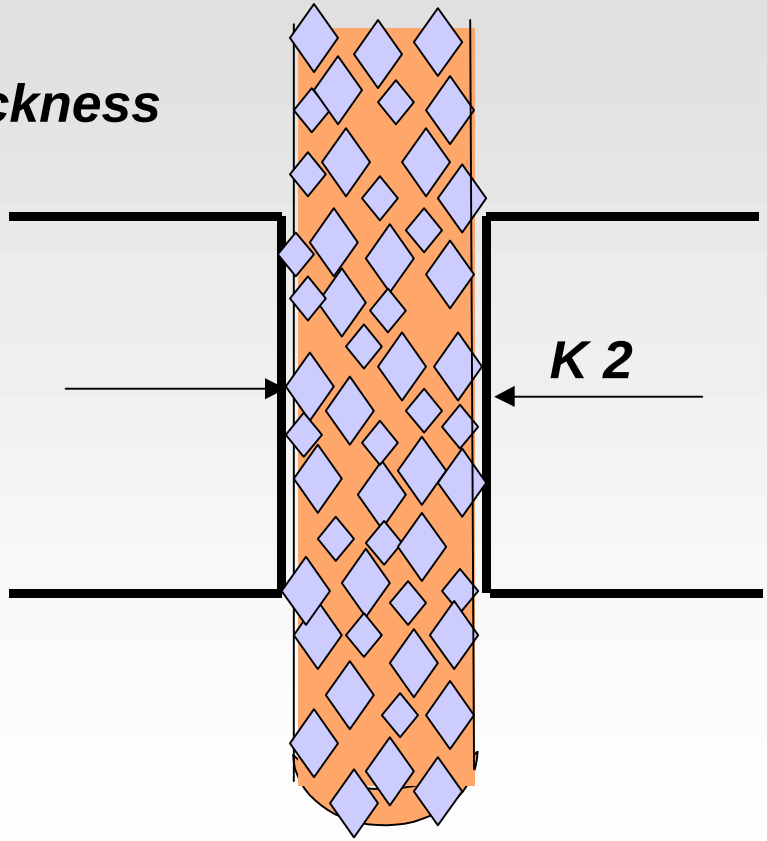
Dicing Systems

Sintered blade

K = Kerf Size

T = Blade thickness





T1 > T2

K2 < K1

Package > than spec

T1

New Blade

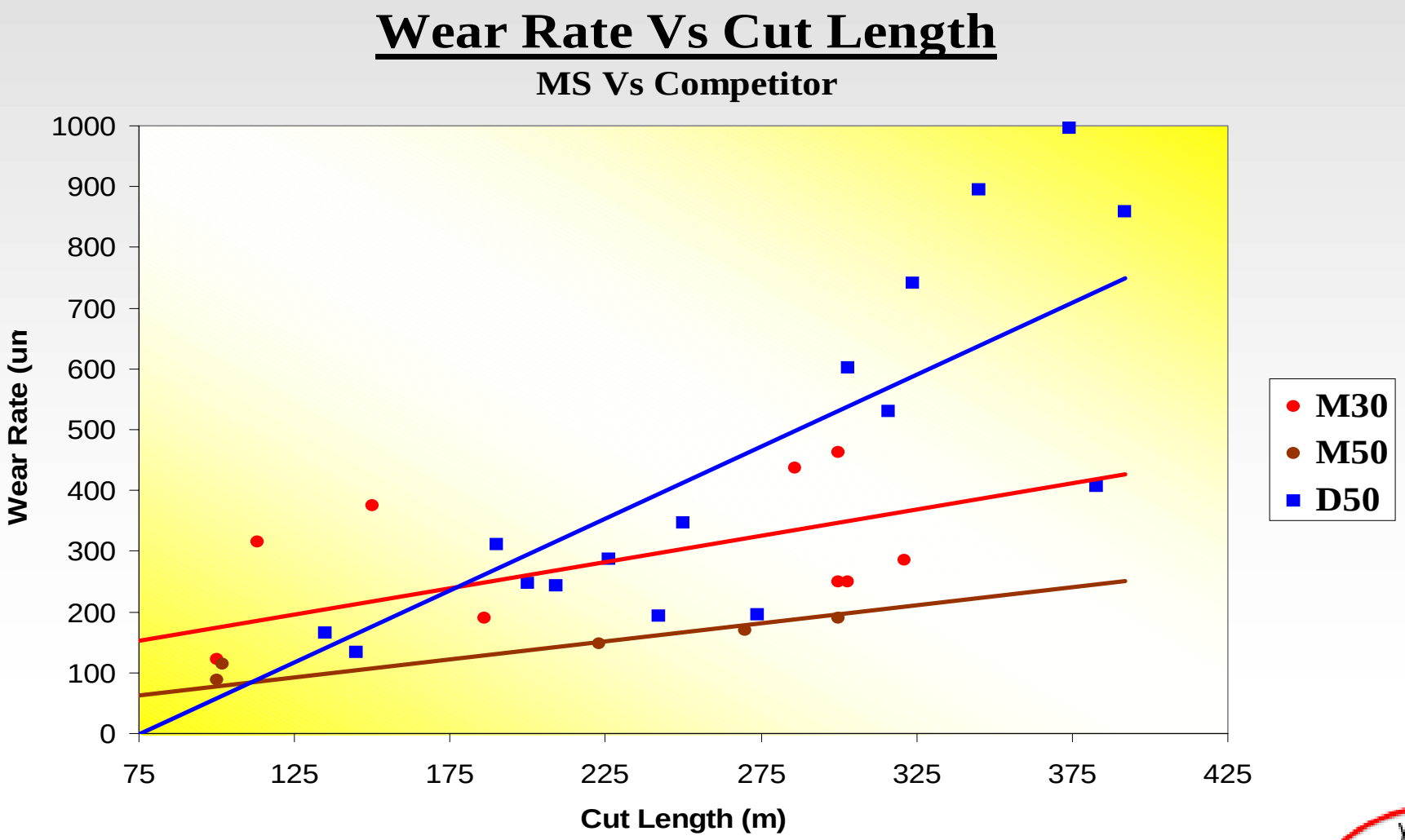
T2

After 1500-2000m cut length

Package Singulation

Dicing Systems

Sintered Blades evaluation results



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Dicing PBGA/CSP with K&S Blades

Dicing Systems

- **High cut accuracy** - *Thickness tolerance up to .0001”*
- **High cut quality** - *Large variety of diamond grit size : 13,17,30,50,70 mic*
- **Large kerf width range** - *Blades thick. up to .015” Ni and .030” Sintered*
- **Unlimited exposure** - *Blades OD from 50mm up to 76mm*
- **Large variety of edge shape** - *Different shape & serration #’s*
- **Proven product at production** - *AAPI , Amkor, ASE , Conexant, Micron Intel, ATK, ChipPAC ,*
- **Two Ni blade configurations:** *Semitec Hub or Micro-Swiss Annular*
- **Long life** - *Reduced saw down time*
- **Competitive price**
- **Process stability** - *Product repeatability*
- **Dicing Process Center** - *Process Application know-how*

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Blade Select

Dicing Systems

Micro-Swiss

Substrate material	PBGA	
Mounting metod	Tape	
	1st Choise	2nd Choise
blade material	**Nickel Lapped**	**Nickel Lapped**
Grit range [microns]	30 50	30 50
Spindle speed range [rpm]	21000 63000	21000 63000
Feed rate range [Inch/sec]	0.5 3	0.5 3

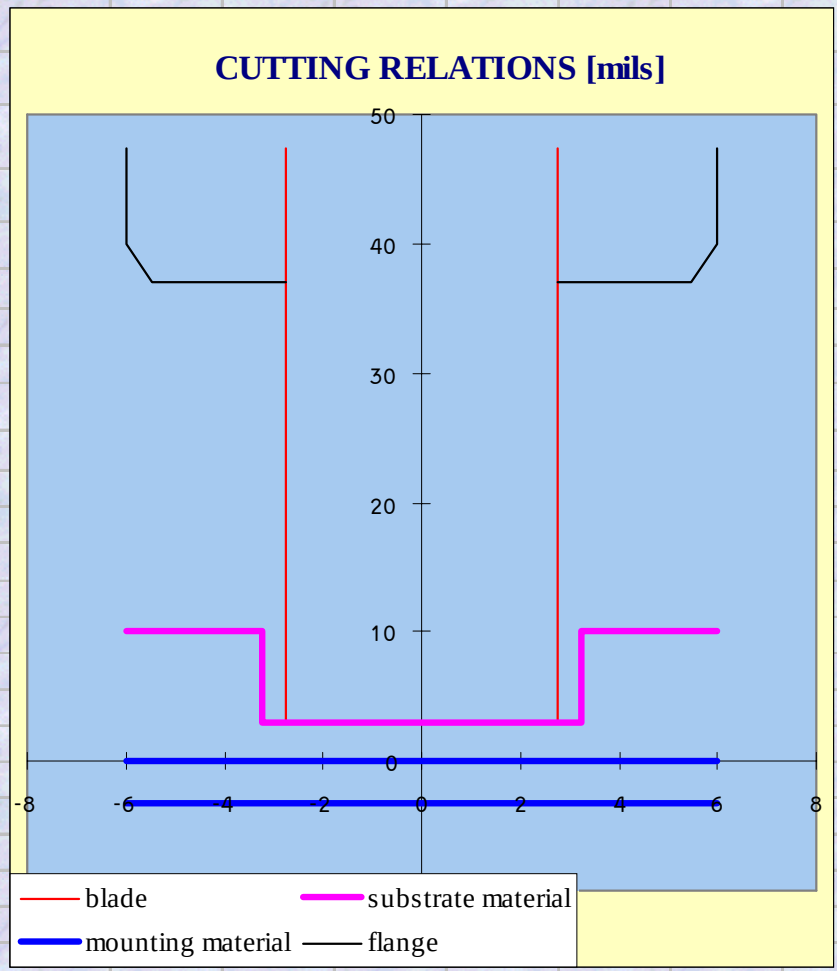
	mils	microns
Substrate thickness	10.0	254
Mounting material thick	3.3	84
MAX Kerf width	6.0	152
Cut depth	7.0	178
Blade thickness	5	127
Resulting kerf width	5.5	140
Min. Blade exposure	11	279
Max Blade exposure	37	940
Cut into mounting material	0	0
delta-Kerf	0.5	13
Spindle Diameter [inch]	2" <--choose	
Blade OD [inch]/[mm]	2.188	55.5752
Blade ID [inch]/[mm]	1.575	40.005
Flange OD [inch]/[mm]	2.12	53.848
Flange Model Number	4B785-4xxx-xxx	

Go to Select Blade

Go to Select Flange

Go to ORDER

RE-CALCULATE



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