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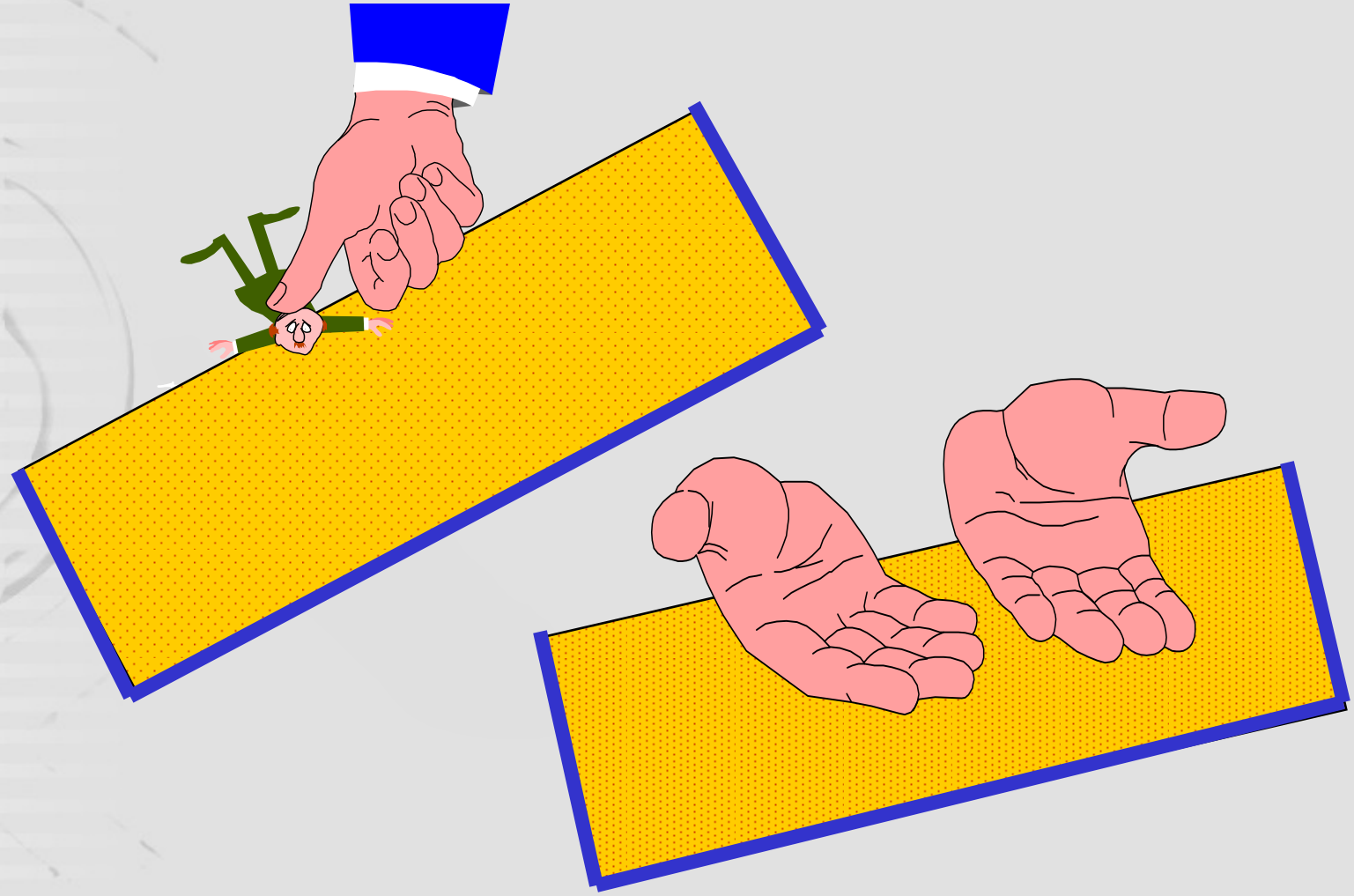
Pushing and Entering



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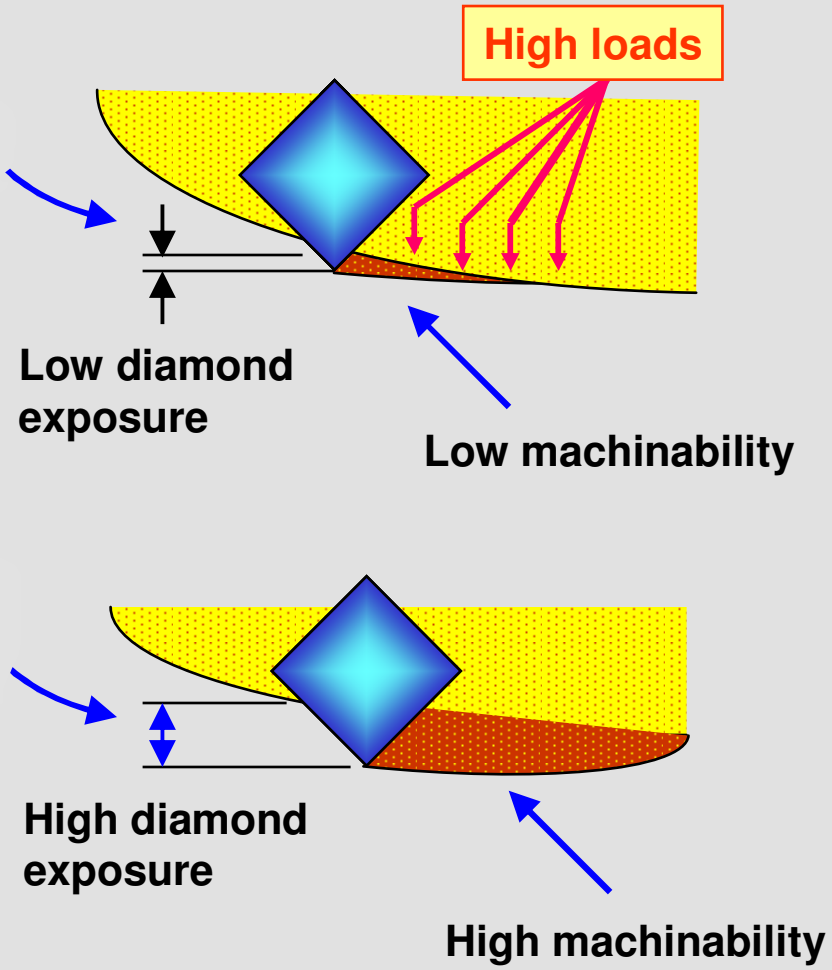
Dressed Blades versus Non Dressed Blades



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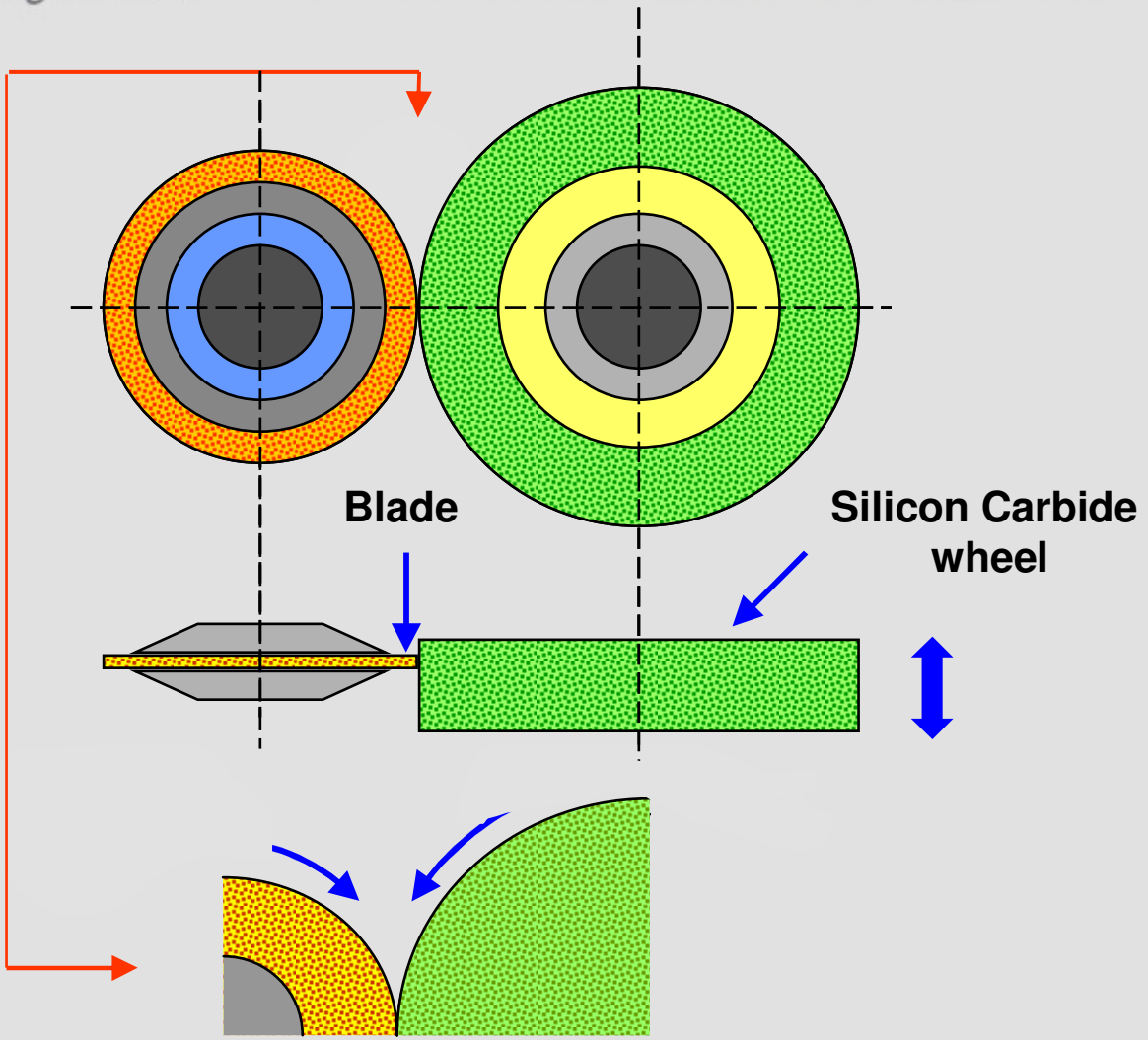
Blade Edge Grinding



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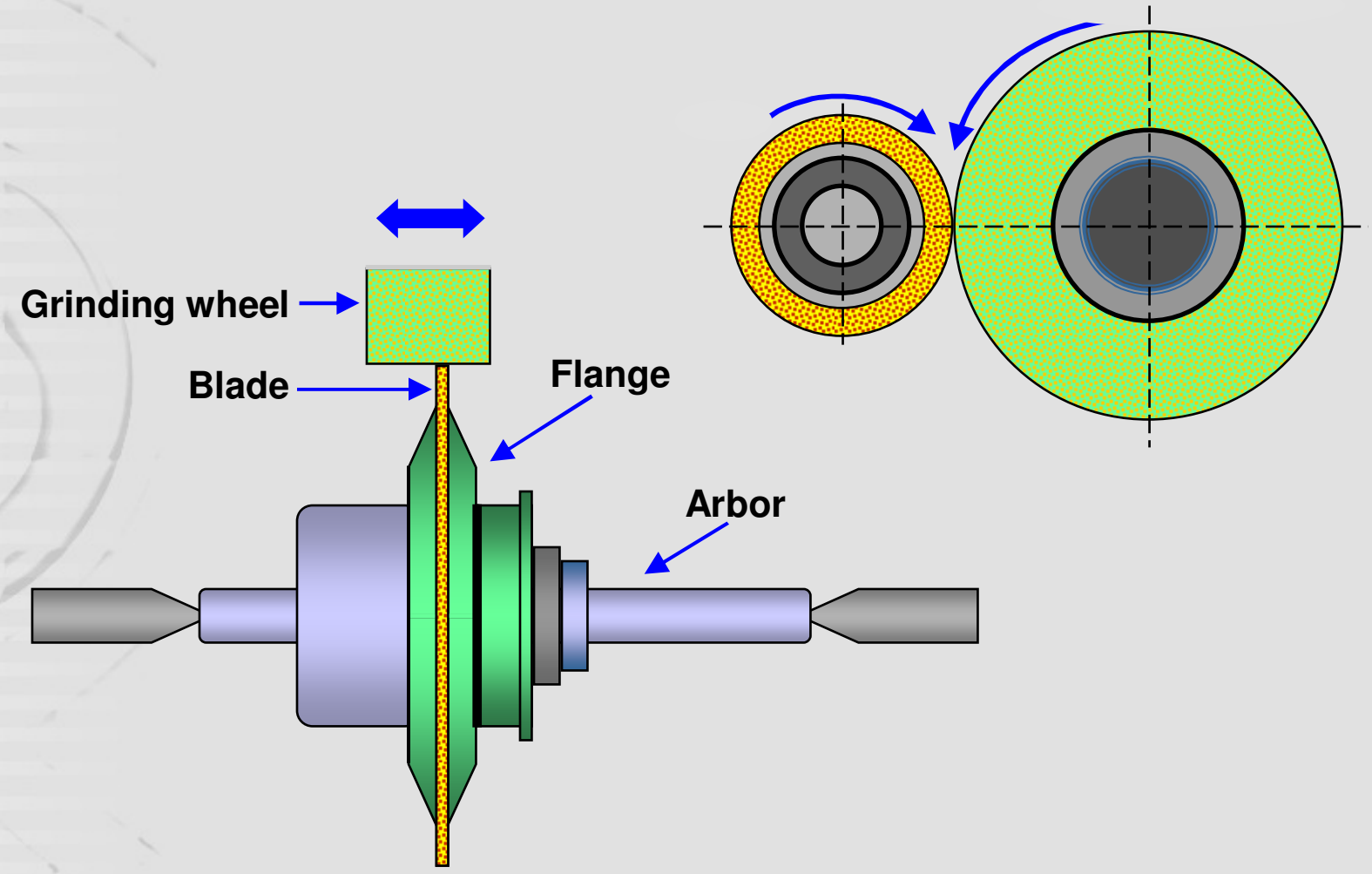
O.D. Grinding



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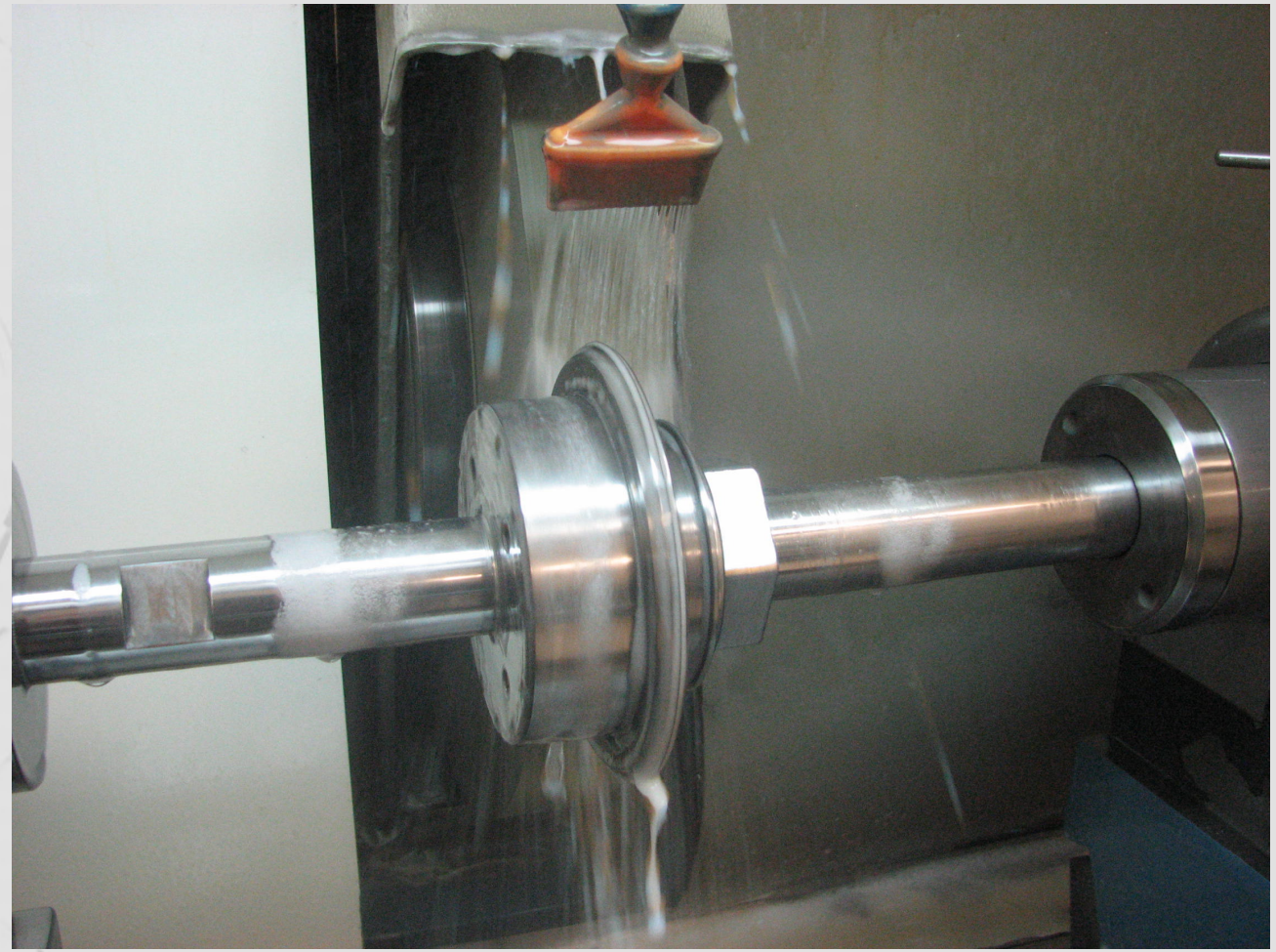
O.D. Grinding



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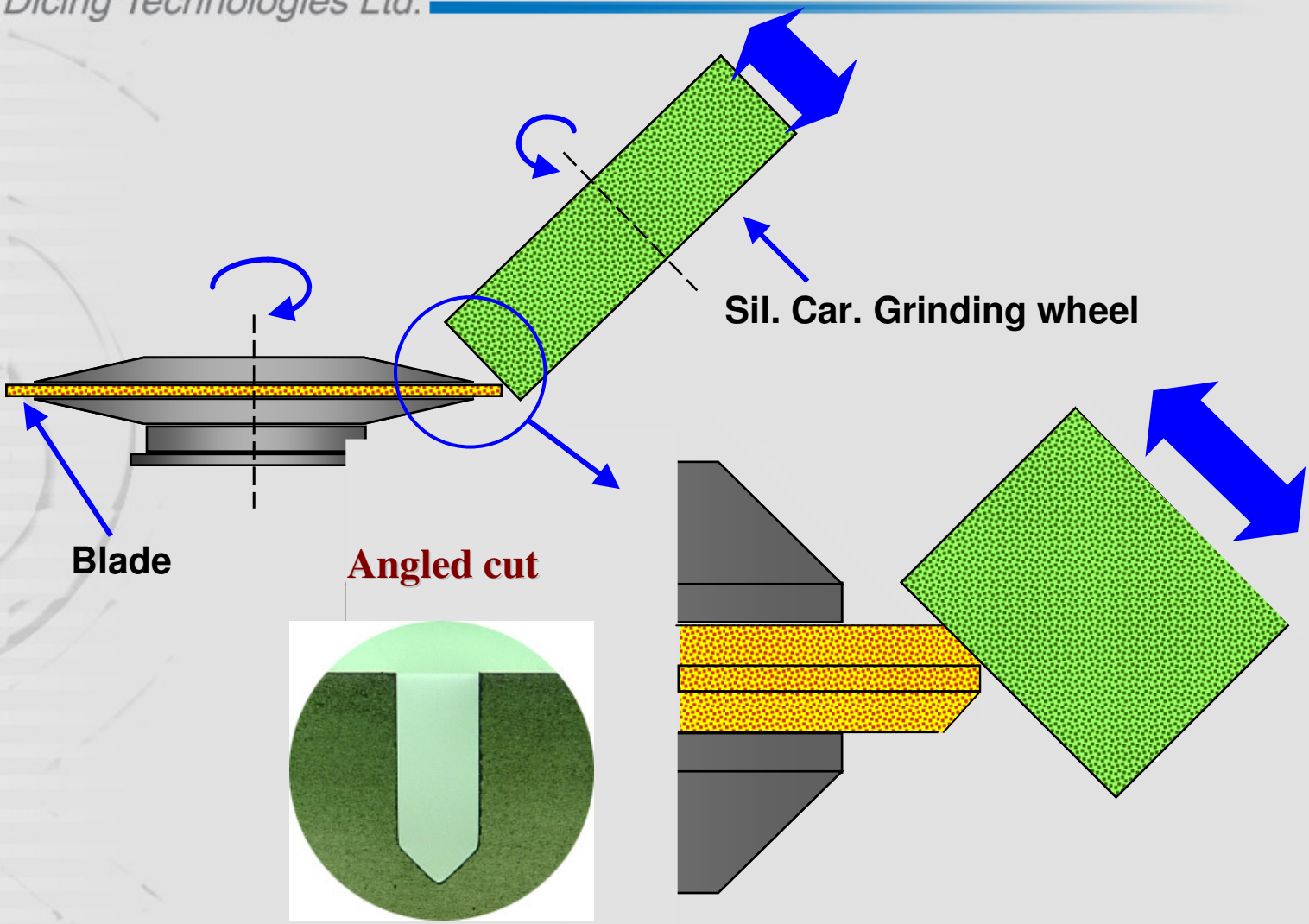
Profile Grinding



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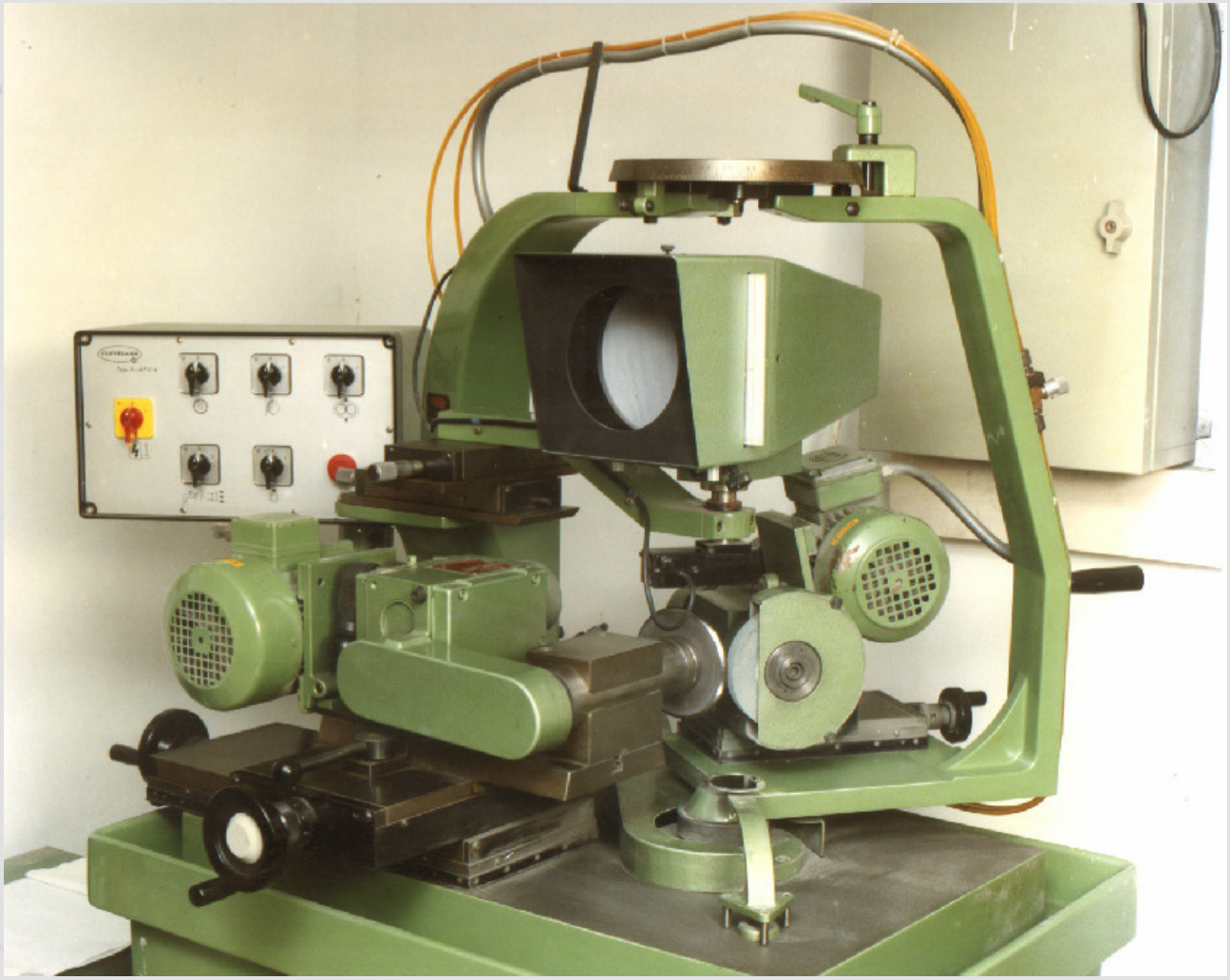
Dressing Machine



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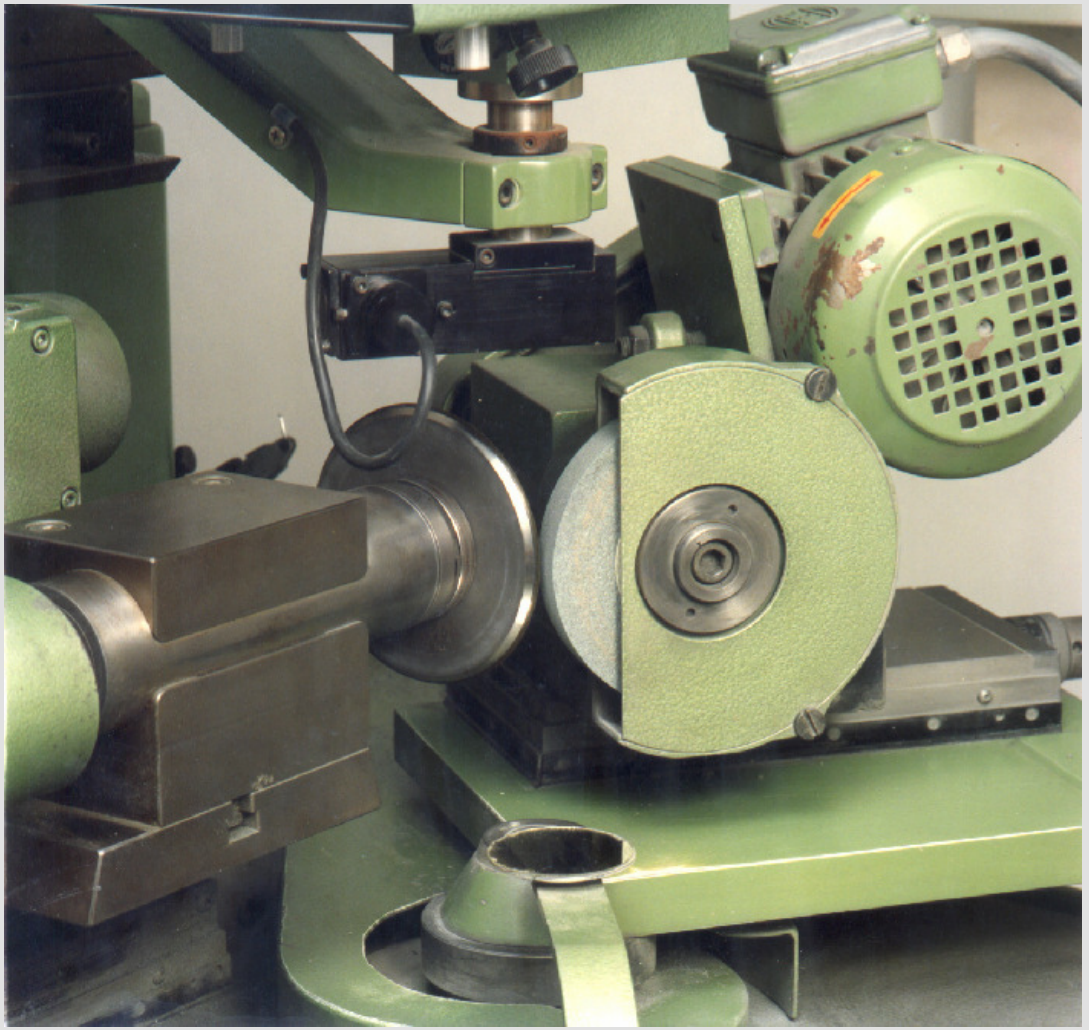
Dressing Machine



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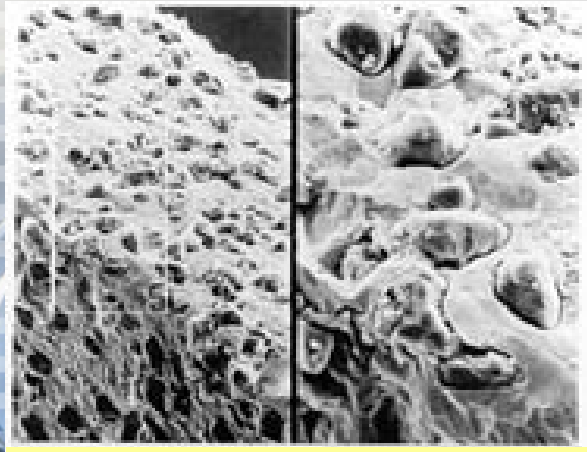
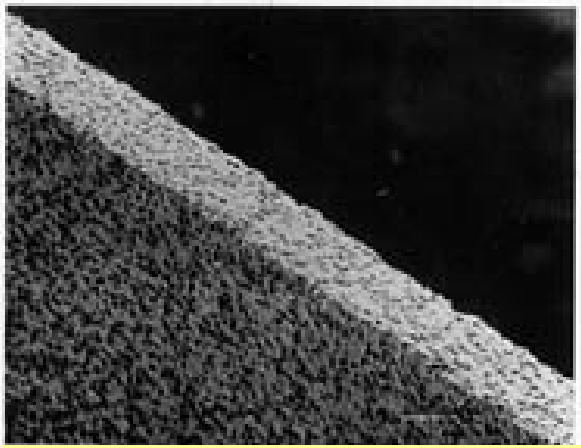
Dressing



Nickel blade
17mic. Grit - 330x / 1000x
after Electropolishing



Nickel blade
17mic. Grit - 100x
after Electropolishing

Nickel blade
17mic. Grit - 100x
After fine grinding
with a Si. Ca. wheel

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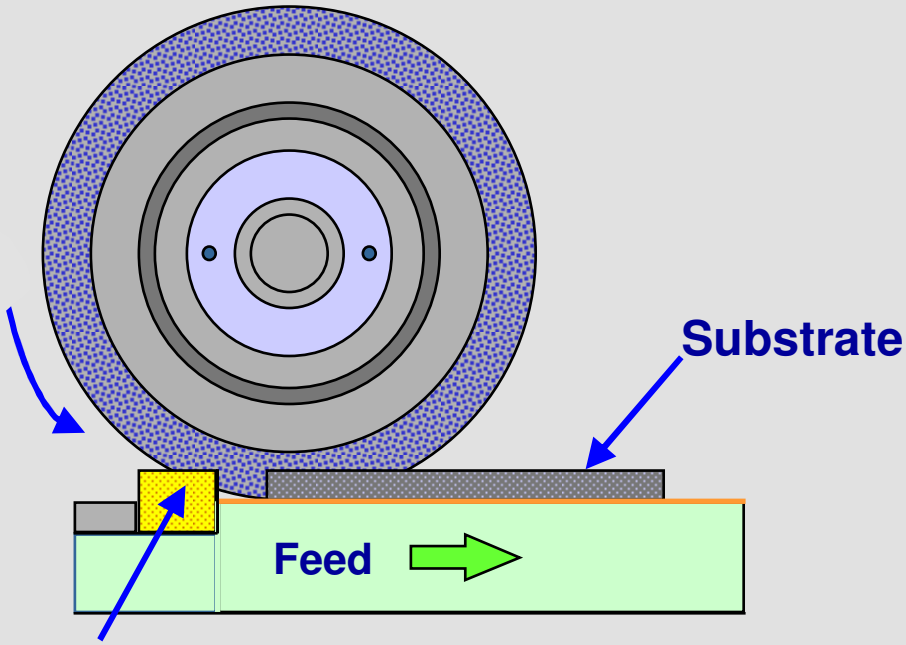
On Line Dressing

★ **After each cut the blades is passing a dressing media.**



Sil. Carbide or Al. Oxide Dressing Stick.

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Recommended dressing Procedure for Nickel Blades up to .003" thick

<u>On a Sil. Carbide dressing block</u>: - ADT P/N – 767- 000 - 001

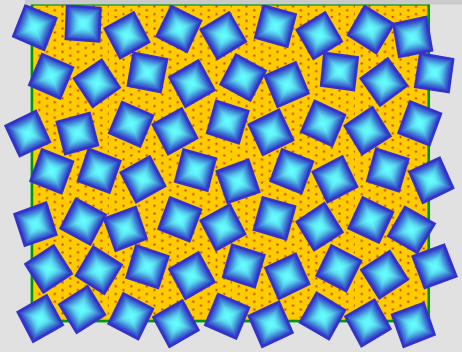
- **10x cuts .002" deep at 6" / sec.**
- **10x cuts .002" deeper than production depth at .2"/sec.**
- **10x cuts .002" deeper than production depth at .5"/sec.**

<u>On a blank Sil. wafer or on a production wafer:</u>

- **10x cuts .001" deeper than production depth at .1"/sec.**
- **Continue with .2"/sec steps 10-20x cuts depending on cut quality up to production speed.**

<u>Hub blades recommended dressing procedure:</u>

- **On a sil. Wafer 10-20 cuts at .5"/sec and gradually increasing the feed rate depending on kerf quality up to production speed**



<u>Spindle speed</u>:

2" blades - 30-40Krpm

4" blades - 14-16Krpm

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Recommended dressing Procedure for Nickel Blades Over .003" thick

<u>On a Sil. Carbide dressing block:</u>

- **20x cuts .002" deep at 6"/sec.**
- **10x cuts .020" deep at .5"/sec**
- **Make a height calibration on the saw**
- **10-20x cuts .001" - .002" deep at 1"/sec**

<u>On a production substrate</u>:

- **Depending on the material being diced, start at min. feed rate and at production depth. Increase the feed rate every 10-20x cuts depending on kerf quality up to production speed**

<u>Spindle speeds:</u>

2" blade - 25-35Krpm
3" blade - 15-25Krpm
4" blades - 10-15Krpm

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Recommended dressing Procedure for Pre Dressed Nickel blades Over .005” Thick

Pre dressed nickel blades are grounded on the edge to get a 90° flat edge and to expose the diamonds.

For best results, to minimize the load on the blade and get better cut quality, the following is recommended before production cuts.

- **On a Sil. Carbide dressing block, make 20-30x cuts at .0005” - .001” cut depth and 1”/sec. Feed rate.**

<u>Spindle speed:</u>
2” blades - 25-30Krpm
3” blades - 15-24Krpm
4” blades - 10-15Krpm

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BGA - Recommended Dressing Procedure for Nickel Blades 30, 50 & 70mic. Grit

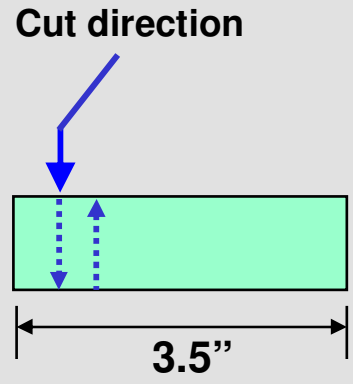
Follow this procedure to achieve the best cutting results, by dressing the blade on the dicing saw:

New (unused) blade:

A. Dressing the blade edge:

1) Dressing block - Sil. Car. 320 mesh ADT P/N 767--320-001
   3.5” x 1” x 3/16” (88.9 x 25.4 x 4.8mm)
   A 3mm thickness block is also available -
   ADT P/N 767-0320-001-030
2) Spindle speed 5Krpm
3) Cutting speed - 4”/sec (100mm/sec.)
4) Cut depth - .005” (0.13)mm)

Measure and set the dressing block thickness on each new dressing block prior to setting the .005” cut depth.



5) cut mode -scribe (cutting both directions)
6) Index - equal to blade thickness.
7) Number of cuts - to cut the entire length of the dressing block (3.5” / index)

- ***Do not perform “height” on the saw during this dressing***

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BGA - Recommended Dressing Procedure for Nickel Blades 30, 50 & 70mic. Grit

Cont.

B. Dressing the blade edge & side surface:

1) Dressing block - Same as above.
2) Spindle speed - 2” blades - 20Krpm. 3” blades 15Krpm
3) Cutting speed - 1”/sec (25mm/sec)
4) Cut depth - .004” - (0.1mm) deeper than production depth
5) Cut mode - Dice
6) Index - .040” (1mm)
7) Number of cuts - 4x

C. In process dressing (After production overloading):

1) Dressing block - same.
2) Spindle speed - 5K
3) Cutting speed - 1”/sec (25mm/sec)
4) Cut depth - .004” (0.1mm) deeper than production depth
5) Cut mode - Dice
6) Index - .040” (1mm)
7) Number of cuts - 6-8x

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BGA - Recommended Dressing Procedure for Metal Sintered Blades 30, 50 & 70mic. Grit

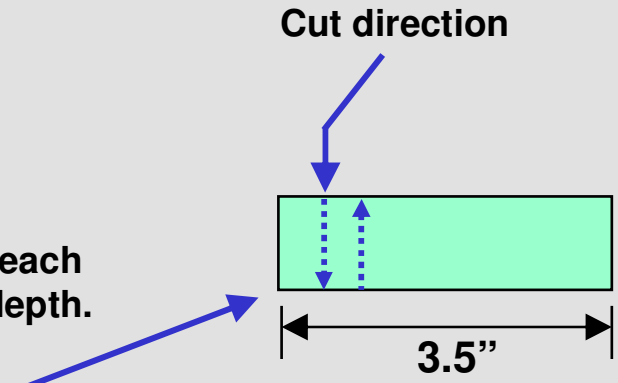
Follow this procedure to achieve the best cutting results, by dressing the blade on the dicing saw:

New (unused) blade:

A. Dressing the blade edge:

1) Dressing block - Sil. Car. 320 mesh ADT P/N 767--320-001
   3.5” x 1” x 3/16” (88.9 x 25.4 x 4.8mm)
   A 3mm thickness block is also available -
   ADT P/N 767-0320-001-030
2) Spindle speed 5Krpm
3) Cutting speed - 4”/sec (100mm/sec.)
4) Cut depth - .003” (0.076)mm)

Measure and set the dressing block thickness on each new dressing block prior to setting the .003” cut depth.



5) cut mode -scribe (cutting both directions)
6) Index - equal to blade thickness.
7) Number of cuts - 40x

Do not perform “height” on the saw during this dressing

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BGA - Recommended Dressing Procedure for Metal Sintered Blades 30, 50 & 70mic. Grit

Cont.

B. Dressing the blade edge & side surfaces:

1) Dressing block - Same as above.
2) Spindle speed - 2” blades - 20Krpm. 3” blades 15Krpm
3) Cutting speed - .5”/sec (13 mm/sec)
4) Cut depth - .002” - (0.05mm) deeper than production depth
5) Cut mode - Dice
6) Index - .040” (1mm)
7) Number of cuts - 4x

Perform a height calibration prior to dicing production wafers

Remark:

The above dressing procedure should be optimized per each application

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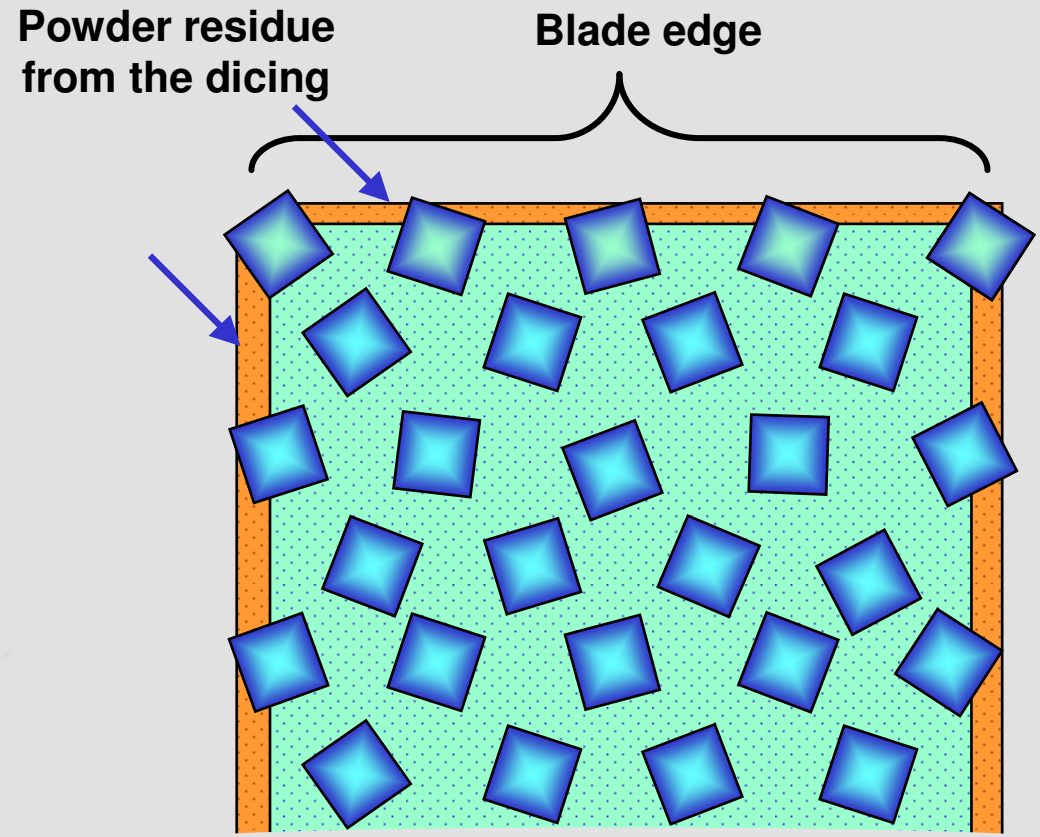
Re - Dressing During the Cutting Process



Process Techniques & Parameters

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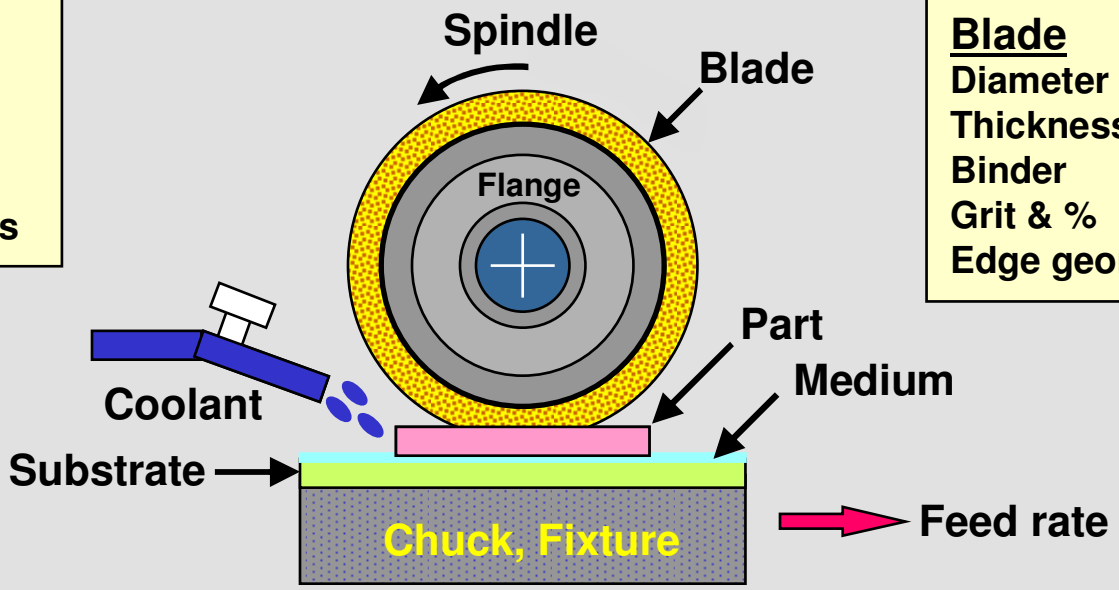
Application Characteristics

Spindle
Diameter
RPM
Torque
Vibrations



Blade
Diameter
Thickness
Binder
Grit & %
Edge geom.

Part

Material
Thickness
Straightness
Conductivity
Patterns

Mounting

Holding:
Magnetic
E. Magnetic
Vacuum
M. Clamping

Substrate:
Glass
Alumina
Silicon
Lava
None

Medium:
Tape
None
Cement
Double stick
Wax

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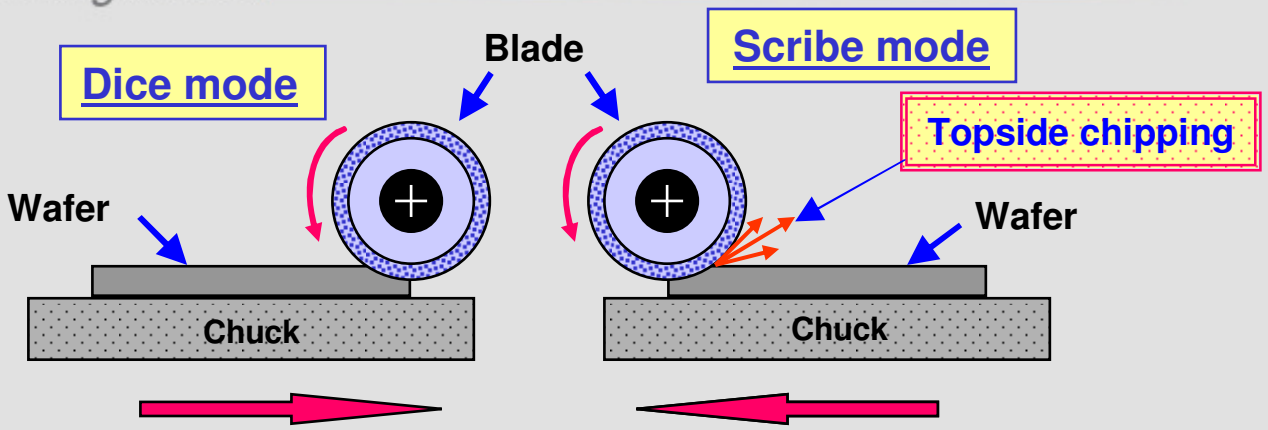
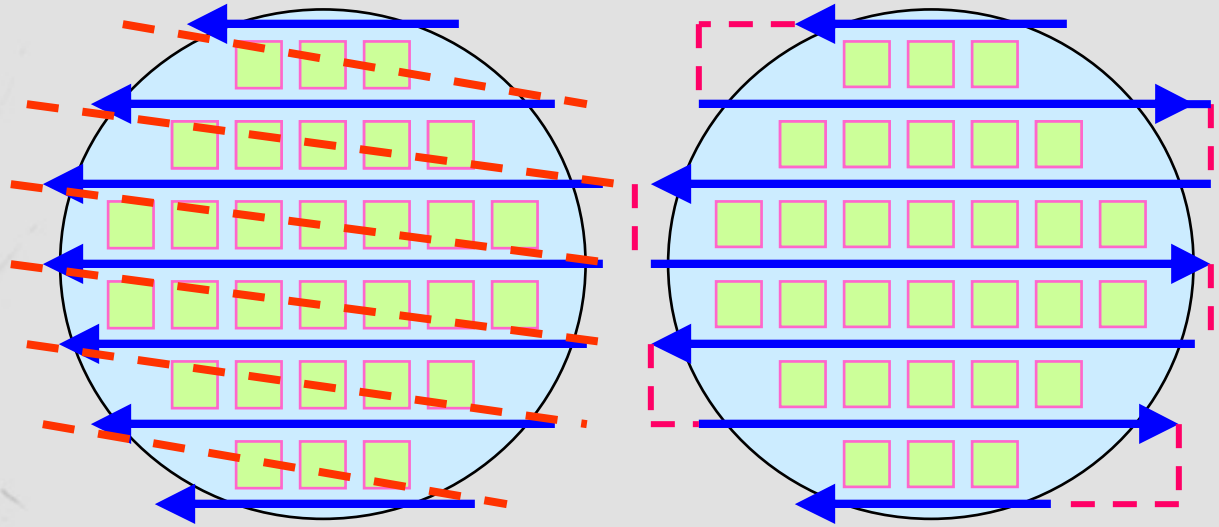
Cutting Mode





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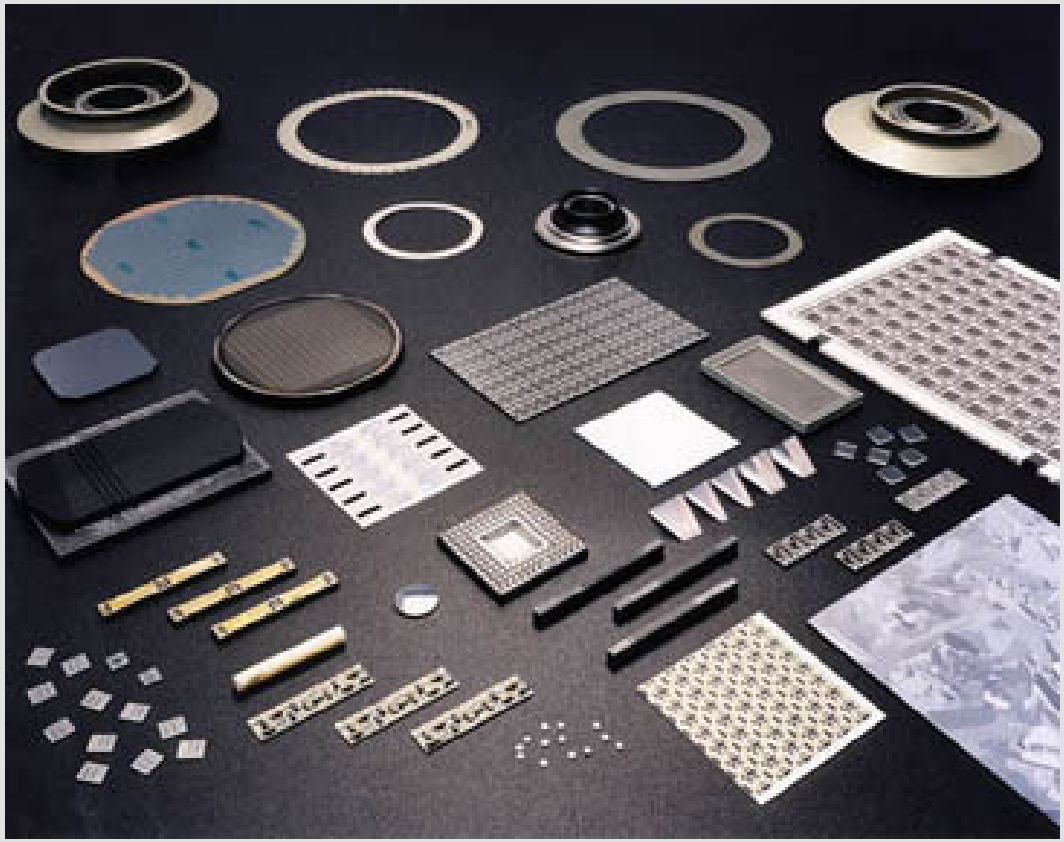
Application Characteristics



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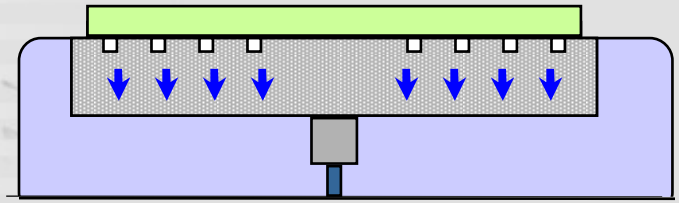
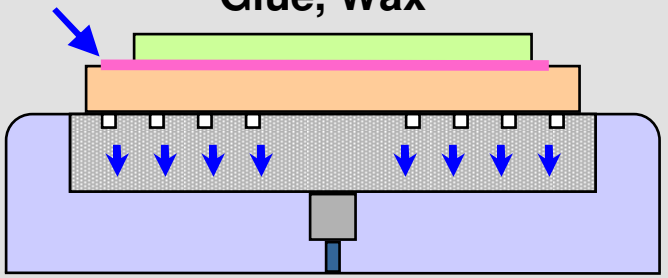
Mounting Methods

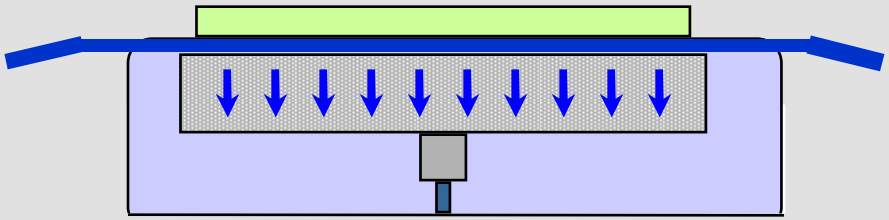
Vacuum (Ring chuck)



Glue, Wax

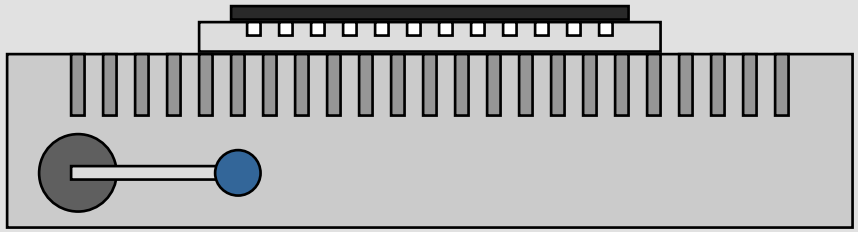


Tape on vacuum



Magnetic

- **Mechanical**
- **Electrical**



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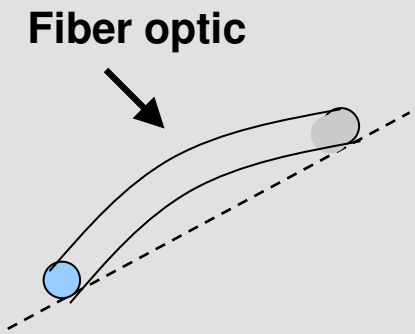
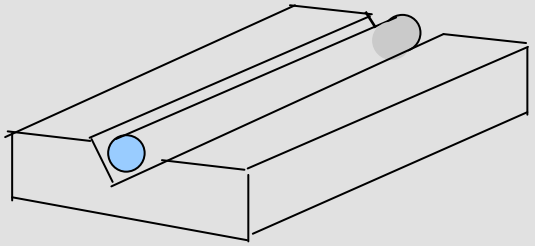
Special Clamping Methods





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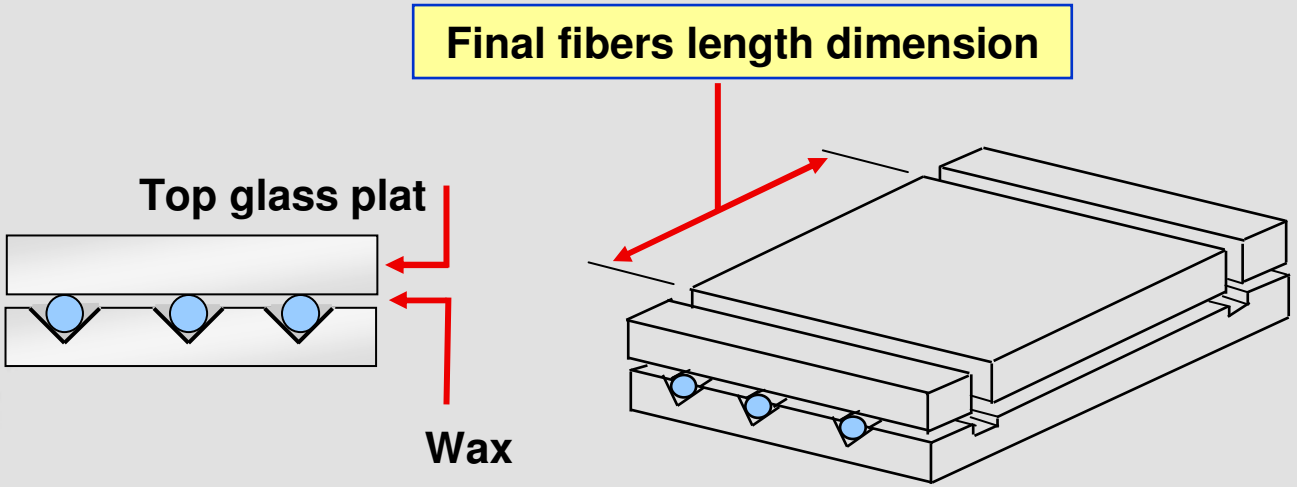
Special Clamping Methods



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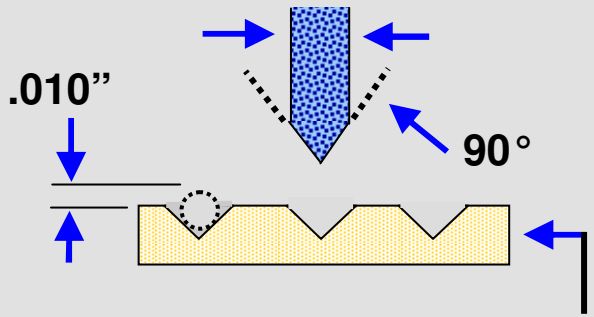
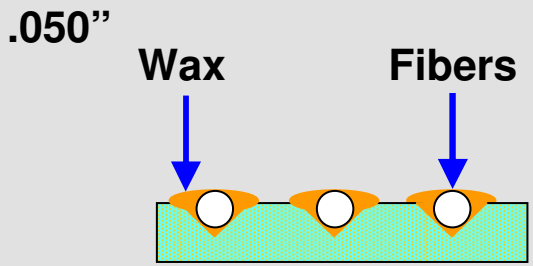
Special Clamping Methods



Heavy gauge glass plate



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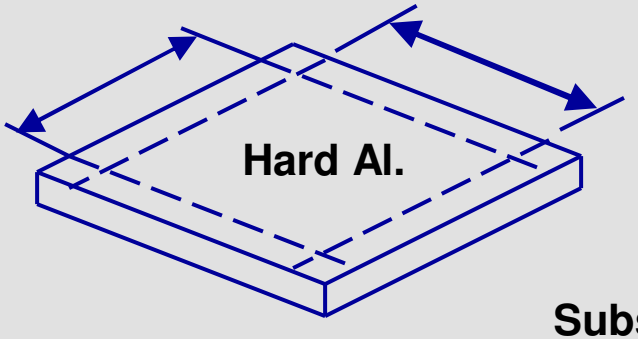
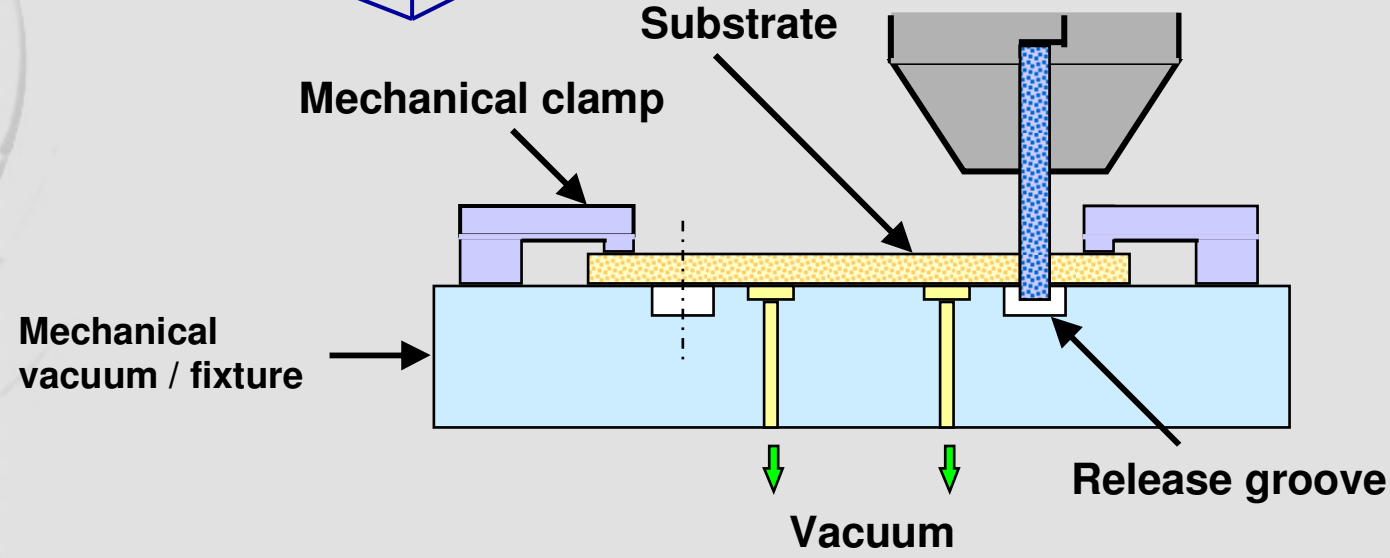
Special Mounting

Trimming 4 sides





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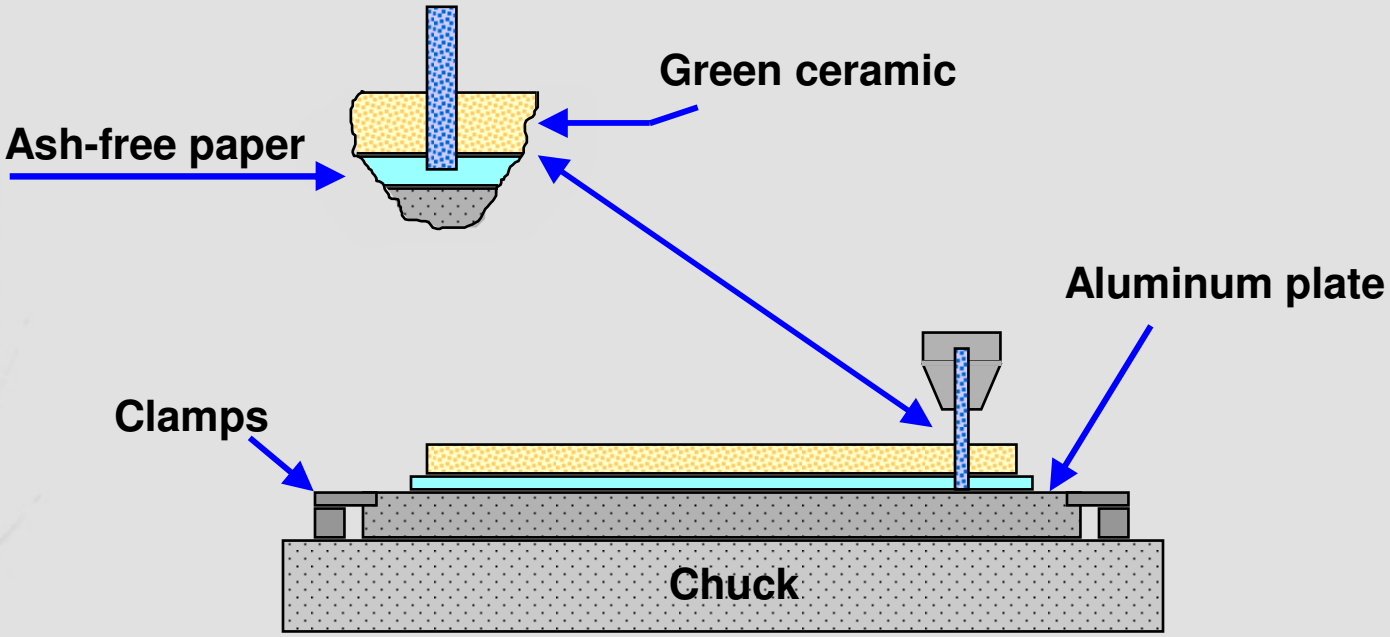
Special Clamping

Mechanical / Laminated fixture on chuck for MLC - Green Ceramic



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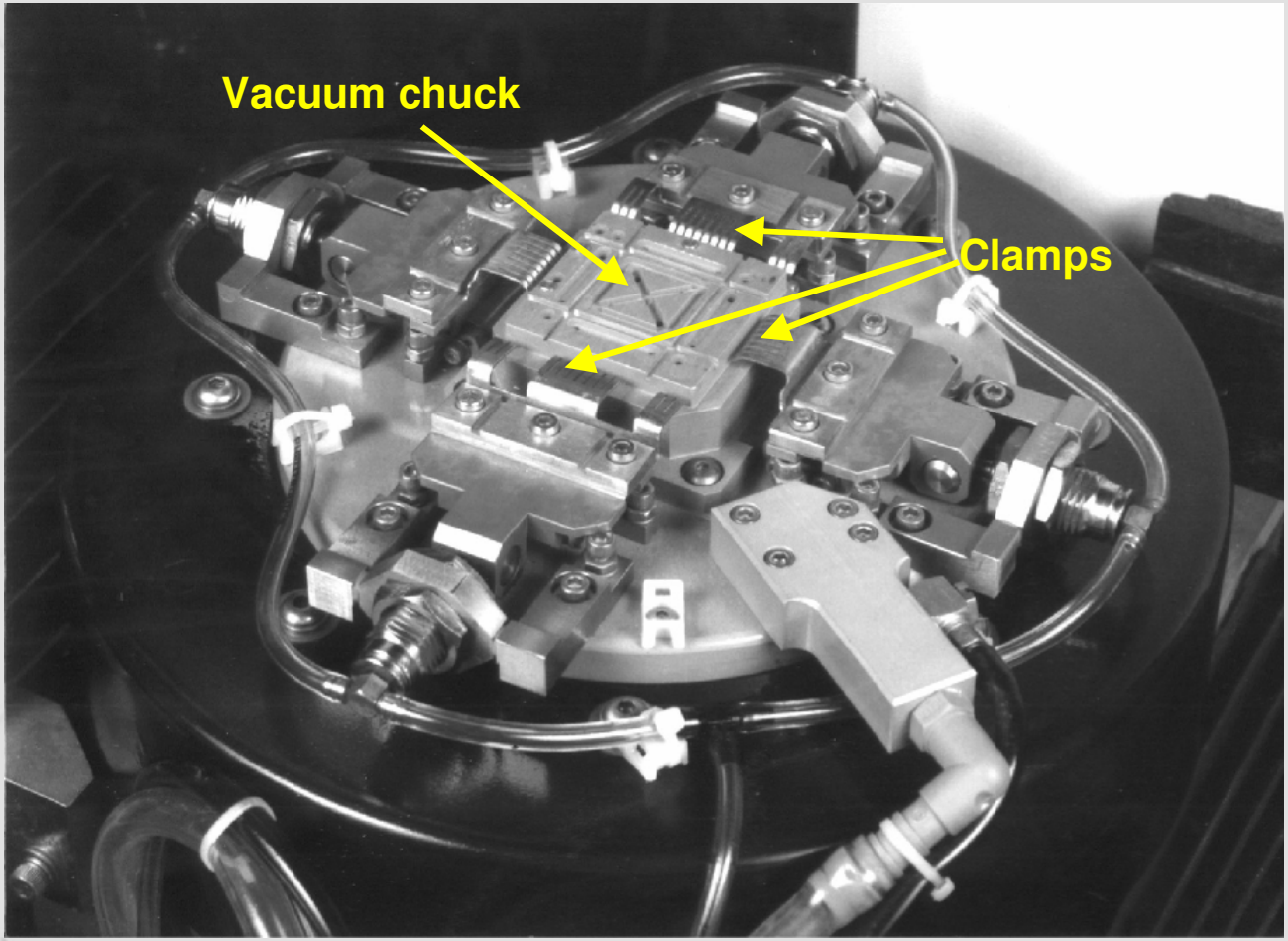
Special Clamping



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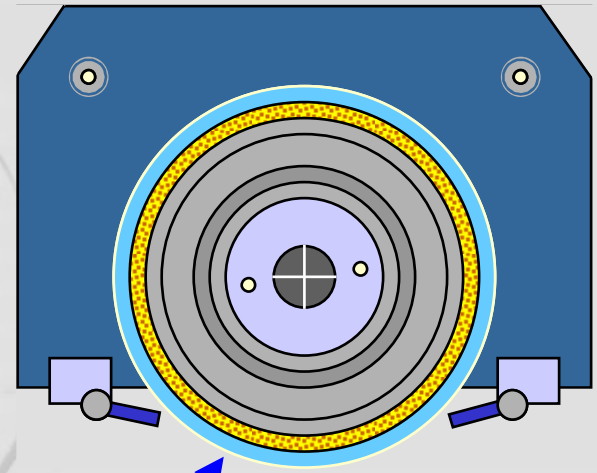
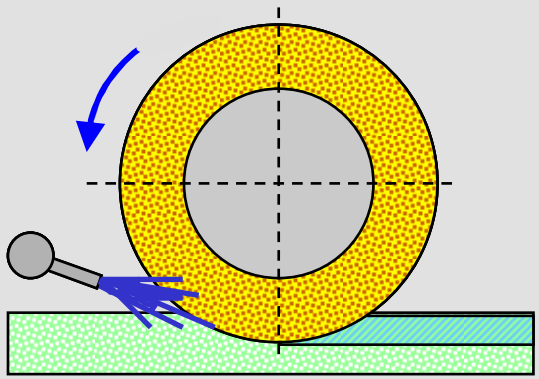
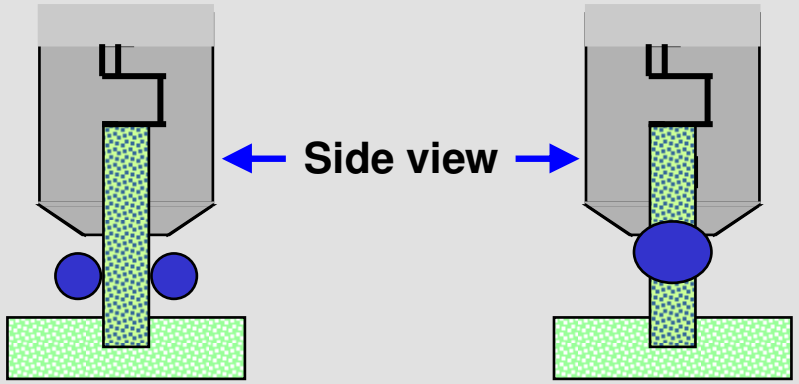
Blade Cooling



Air knife



Front view



Side view

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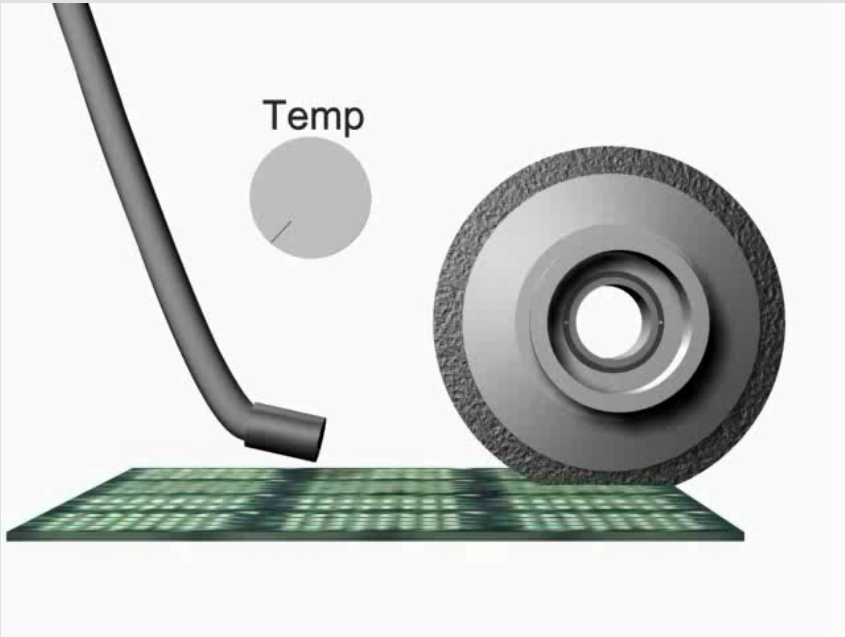
Blade Coolant



- **Direction & Flow rate:**

  Main jet adjustment:

  – Too low - does not provide effective cooling
  – Too high - may increase blade vibrations, blade straightness & poor substrate coolant
  – Too much pressure can lead to die lift off

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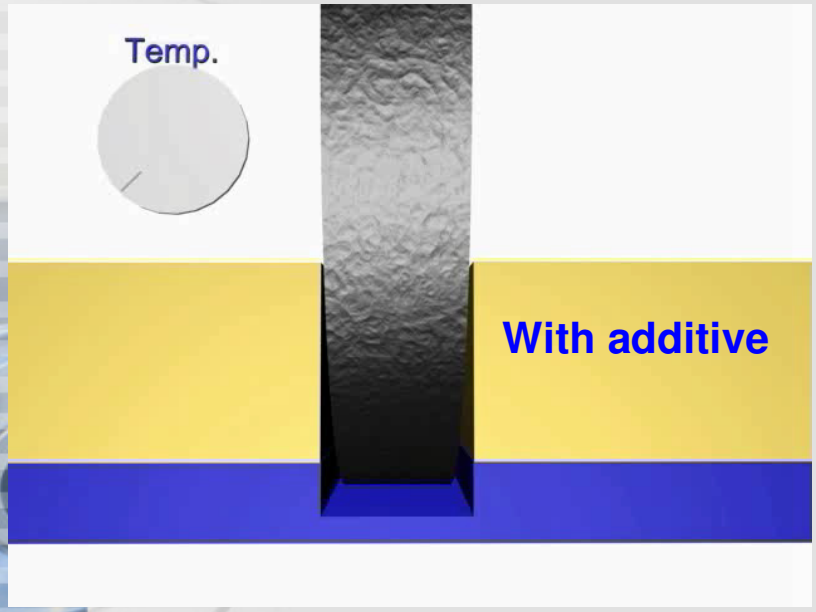
Blade Coolant with Additives



Coolant additives results in:

- Lowers the surface tension of the coolant for better coolant penetration.
- Minimizes the load
- Better washing of dicing dust

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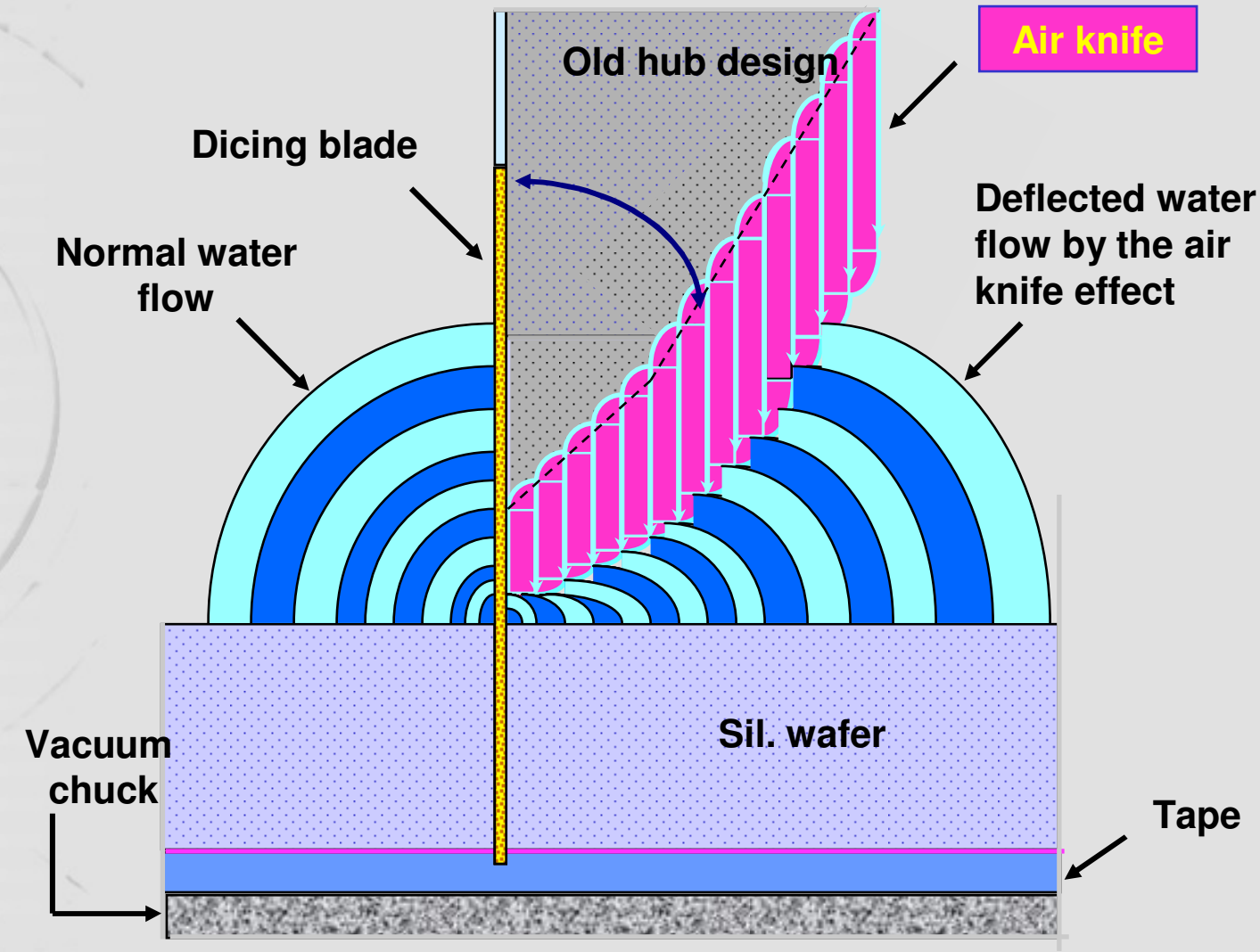
The Effect of Hub Geometry on the Coolant Flow



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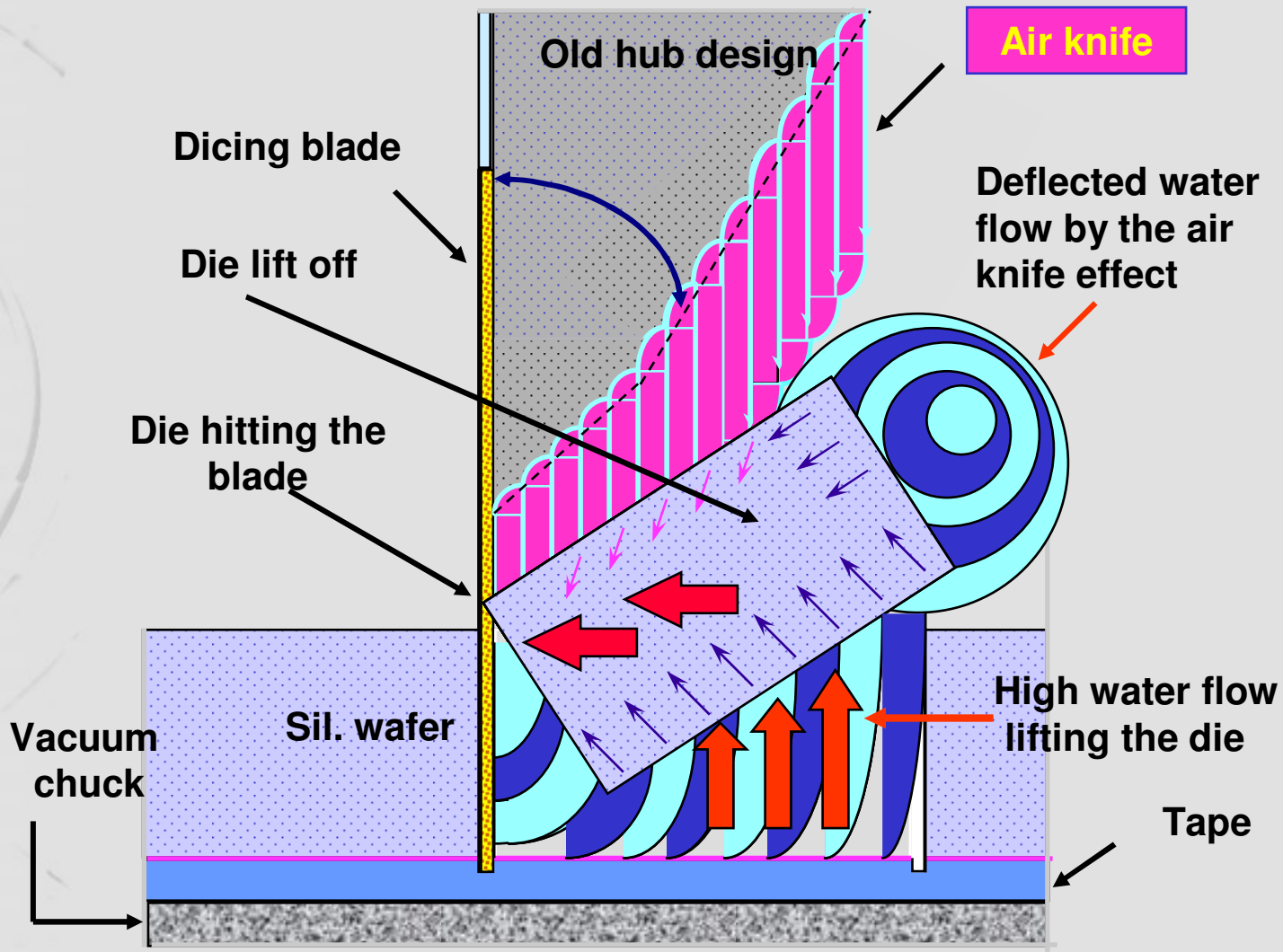
Effect of hub geometry on Die lift off / Blade Breakage



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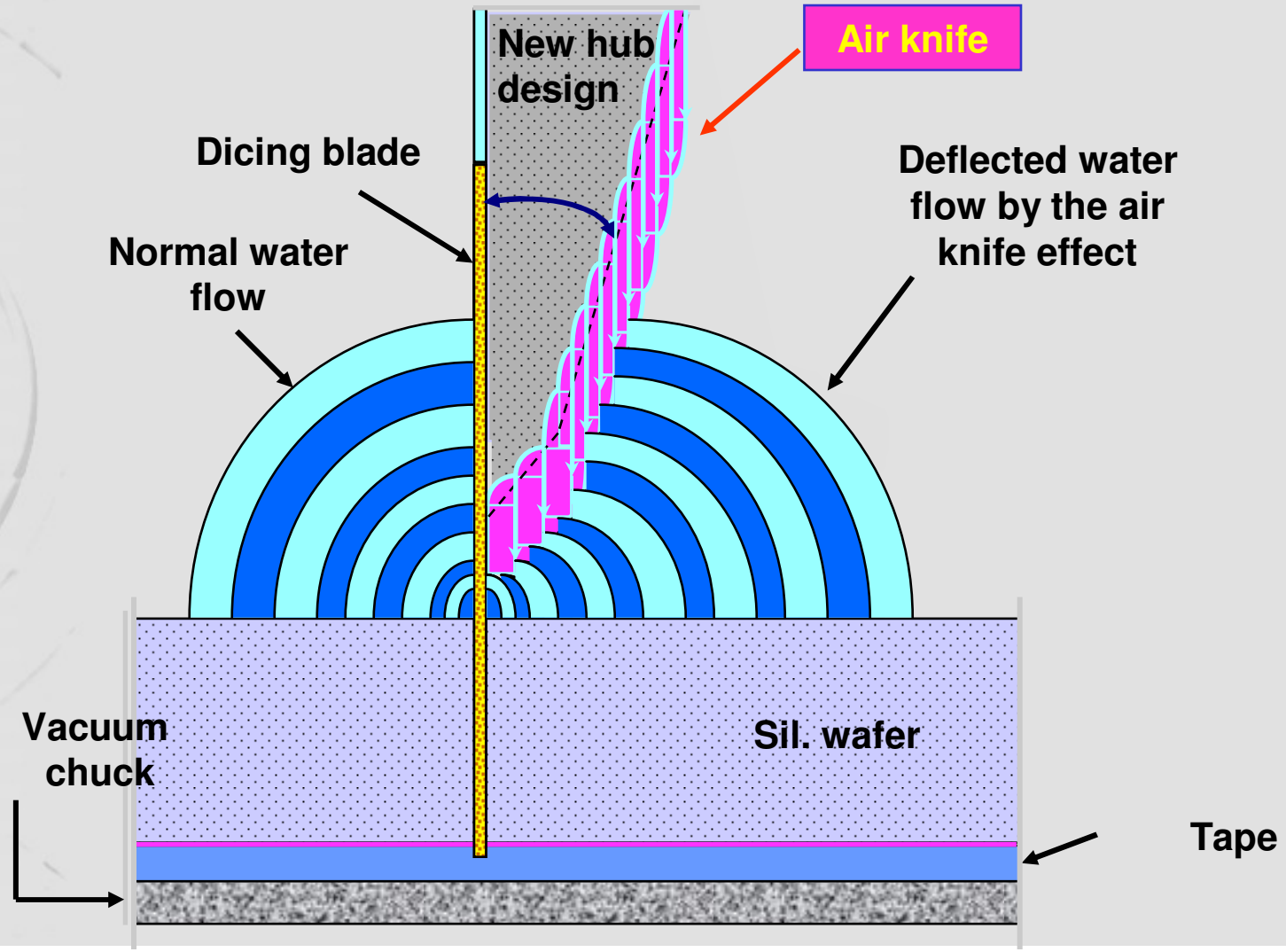
The Effect of Hub Geometry on the Coolant flow



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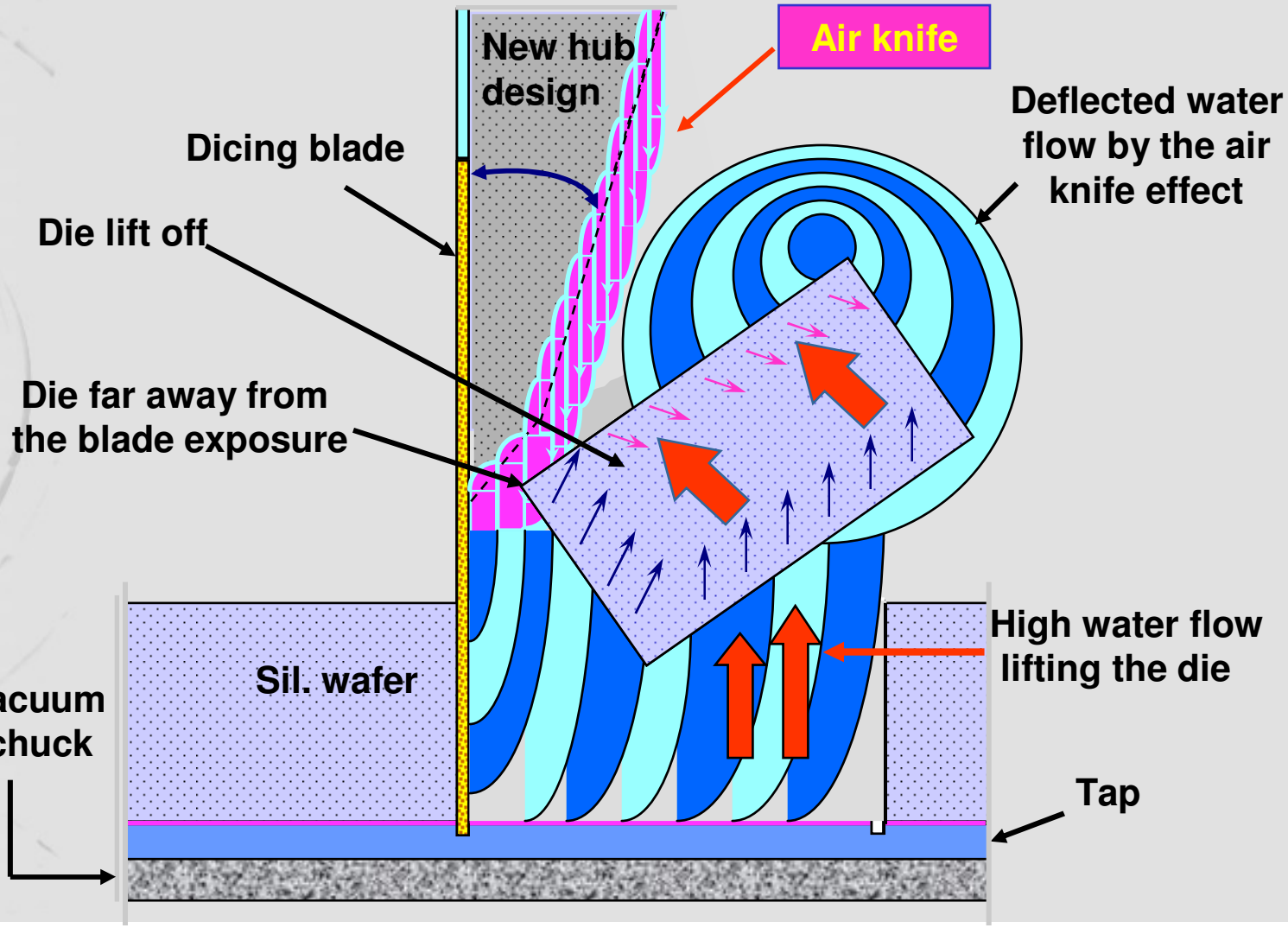
Effect of Hub Geometry on Die Lift off / Blade Breakage



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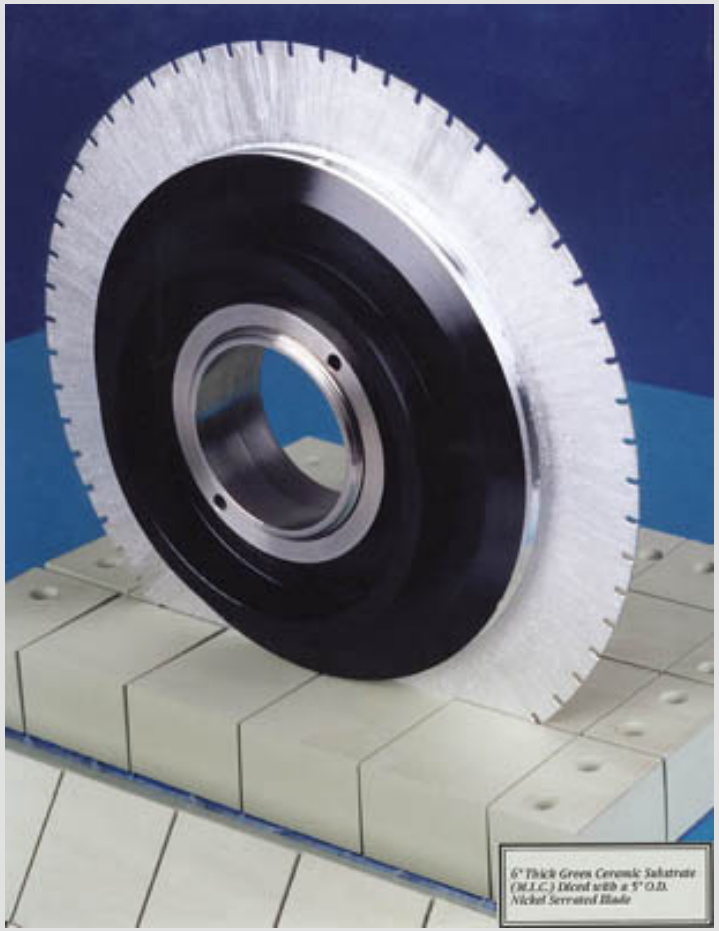
Blade Characteristics

Green Ceramic diced with nickel serrated

.6” thick Green Cer. (M.L.C.) diced with a 5” O.D. nickel serrated blade



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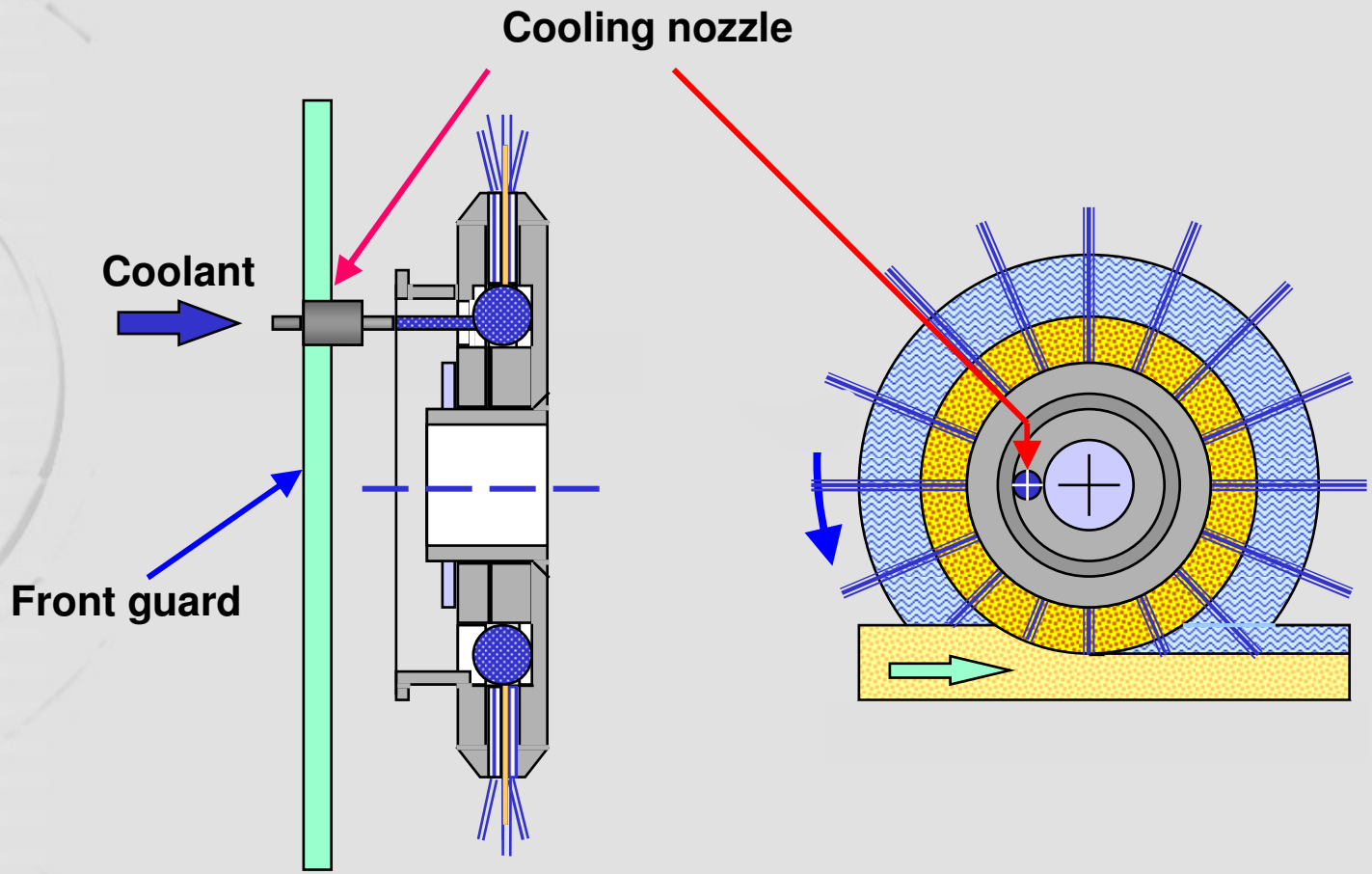
High Cooling Flange set-up



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High Cooling Flange set-up

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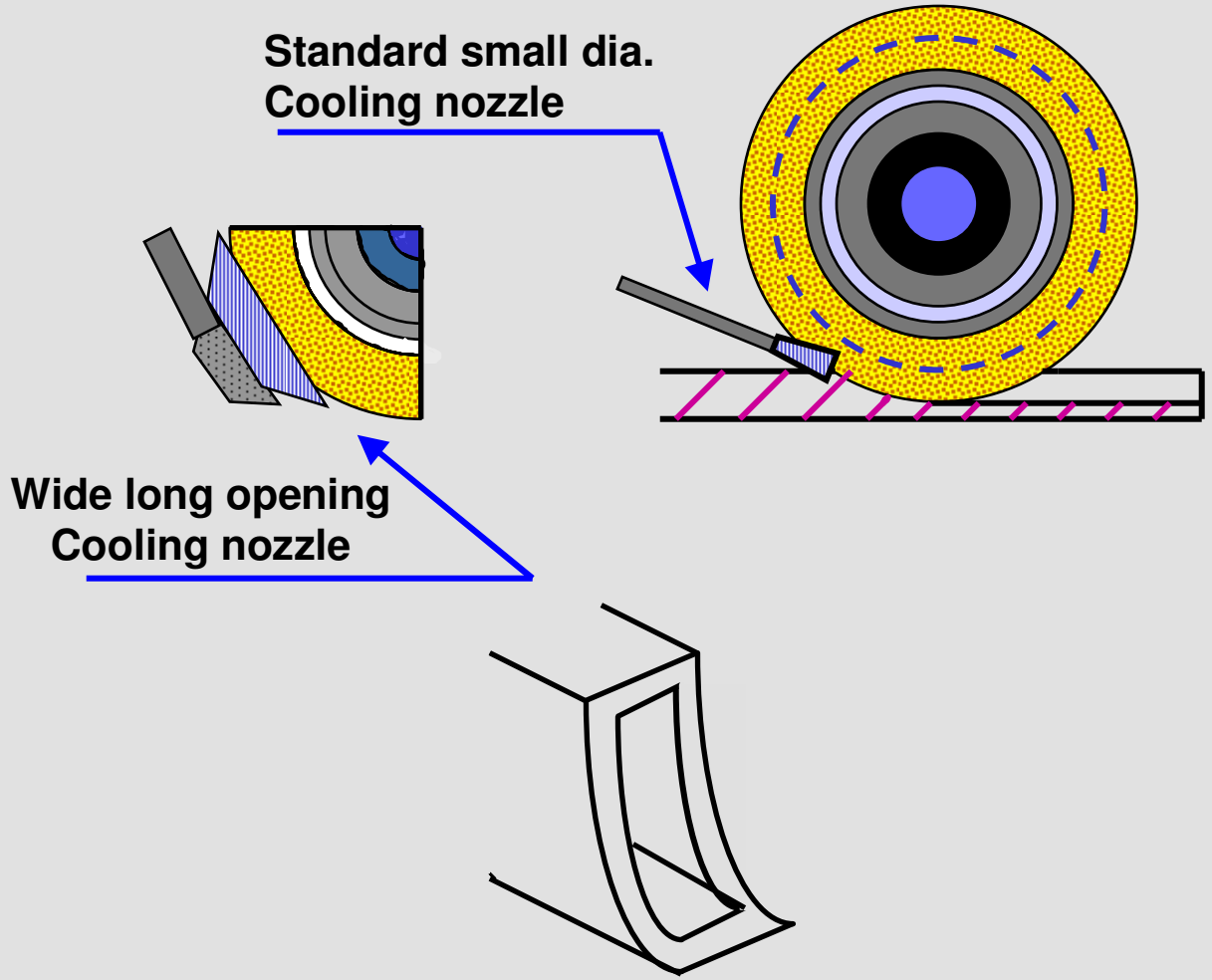
Blade Wear - Coolant Compensation



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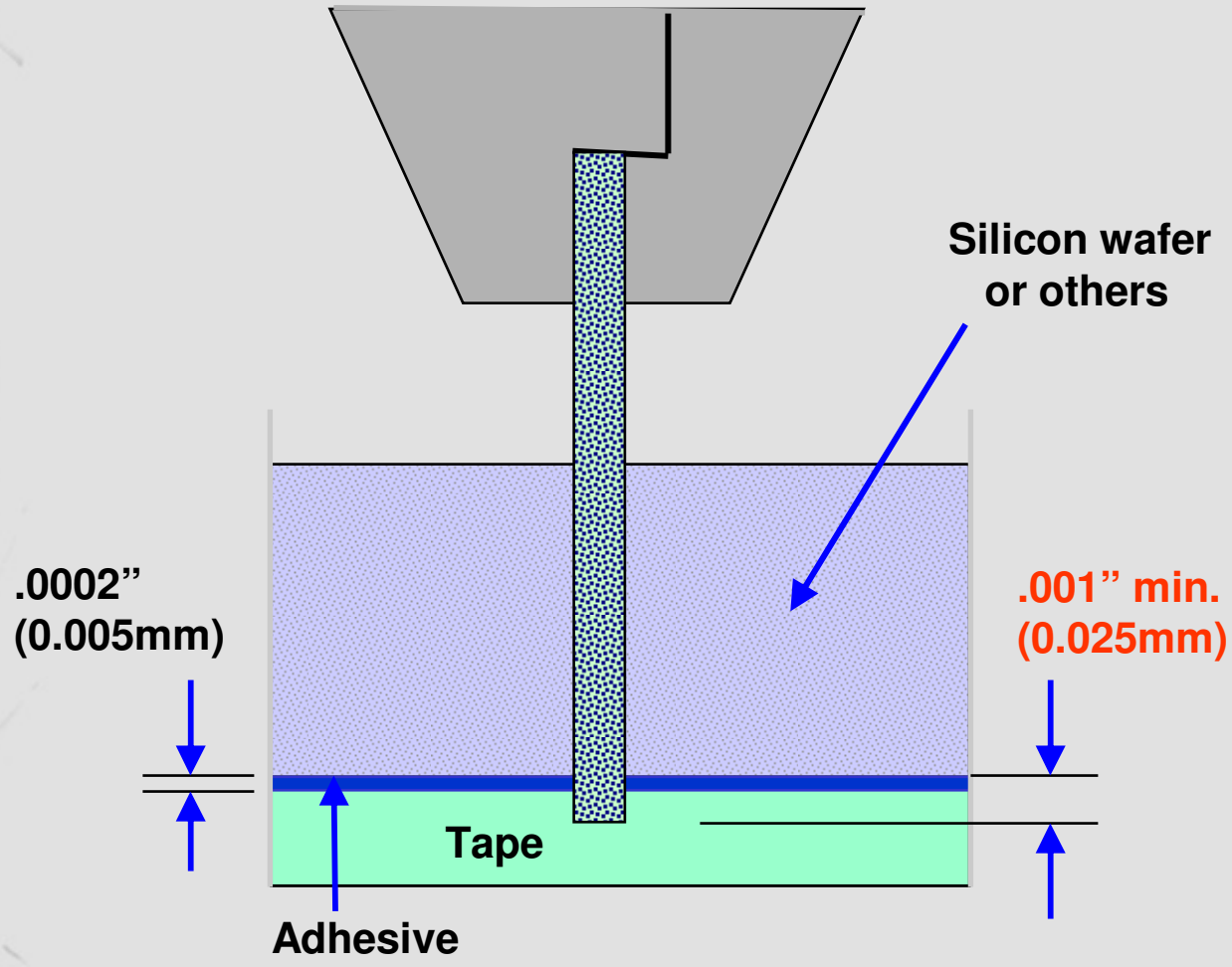
Cutting Through into Tape



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Process Parameters
Blade Exposure

Maximum Recommended Blade Exposure :

Nickel Blades

- Blade thickness X 30

Sintered Blades

- Blade thickness X 20

Resin Blades

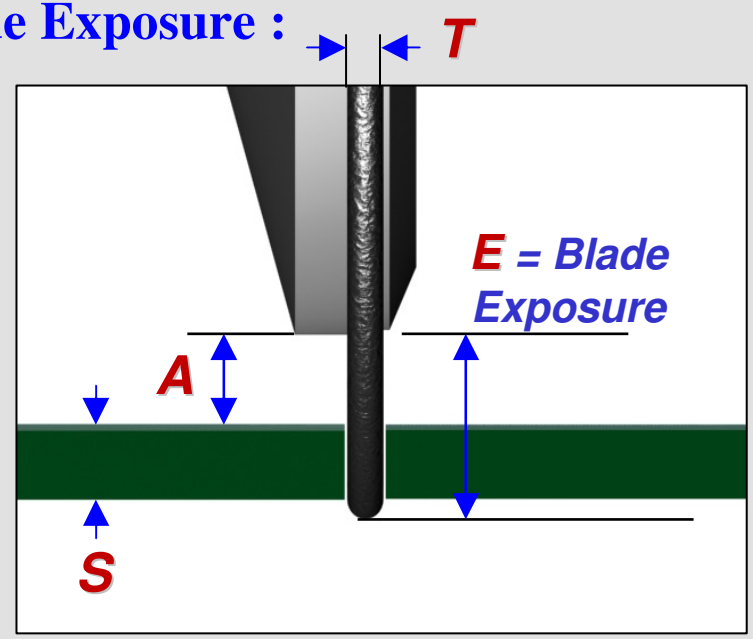
- Blade thickness X 10

$$E = A + S + T/2$$

A = min .300mm (12mil)

T = Blade Thickness

S = Substrate thickness



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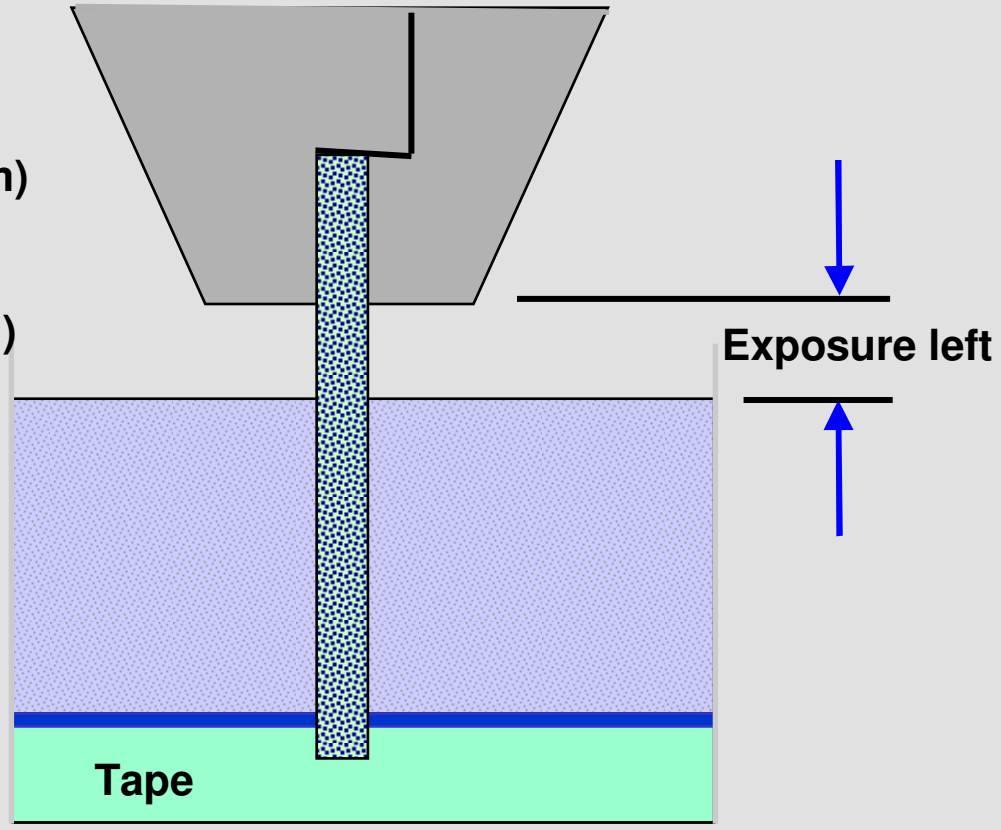
Exposure Left

Recommended exposure left on thin blades for Sil. application

Min. Exp. Left
.005" (0.127mm)

Max Exp. Left
.010"(0.254mm)



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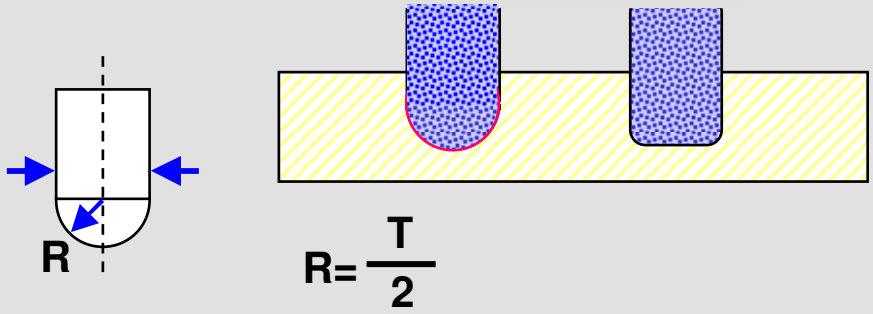
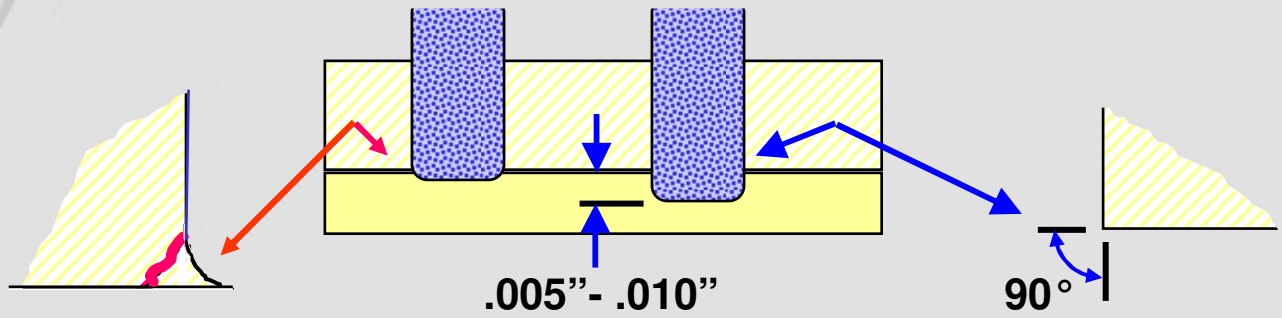
Cutting Through - Thick Substrate

The Theoretical max. radius on the blade edge = 50% of blade thickness



It is important to dice .005” - .010” (0.13-0.25mm)



A shallower cut will result in a lip effect at the back side

= Back side chipping & device size issues

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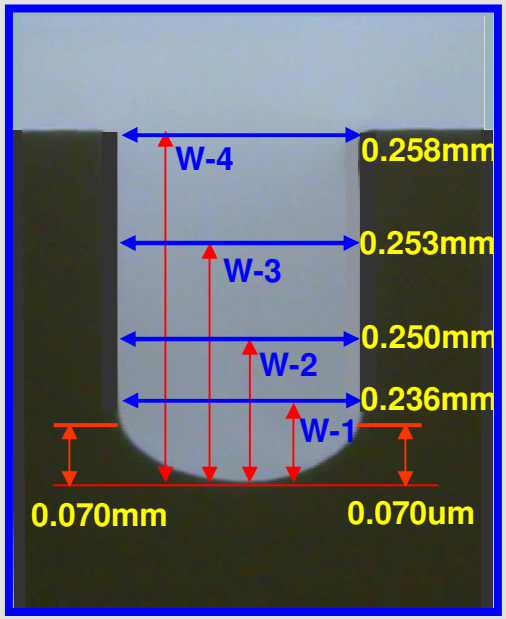
Kerf Profile Measurement



Measurement location	Kerf width um
W1=0.050	236
W2=0.075	250
W3=0.100	253
W4=0.300	258
Height	**70/70**
W4-W1	22
W4-W2	8
W4-W3	3

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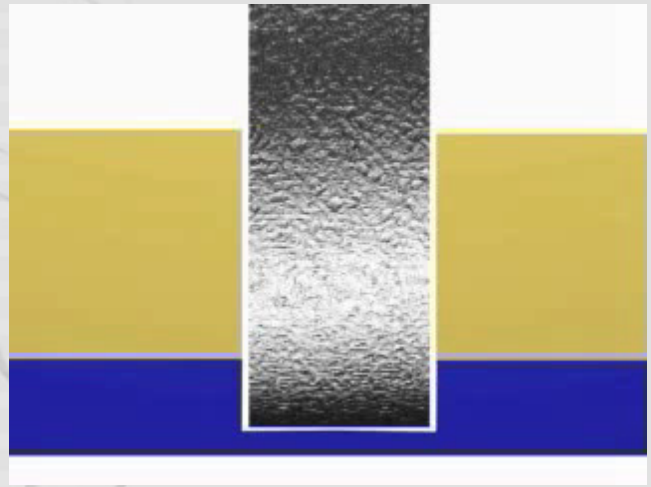
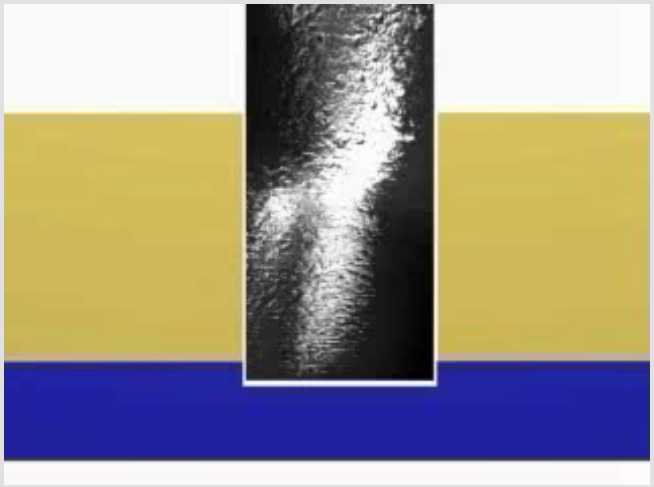
Process Parameters

Cut Depth into tape





Deeper cut

Shallow cut

- Deeper cut reduces blade radius affect.
- Optimum cut depth = 0.5 x blade thickness.

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Dicing Green Ceramic

Wet process:

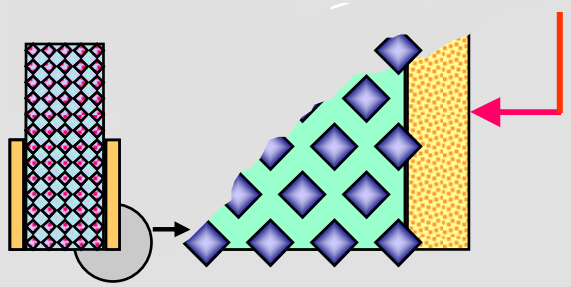
Using nickel serrated blades 17, 30, 50 & 70mic. Grit

For better cut quality anon serrated blade can be used

Dry Process:

Using nickel blades and Tungsten carbides

(Same diamond grit as with the wet process)



Nickel blade:

Advantages - Minimum blade wear
Easy handling
Availability

Disadvantages - Powder build-up
Extra blade cleaning is needed

Tungsten carbide blade:

Advantages - A cleaner cut in some applications

Disadvantages - Short life, poor availability, blade breakage

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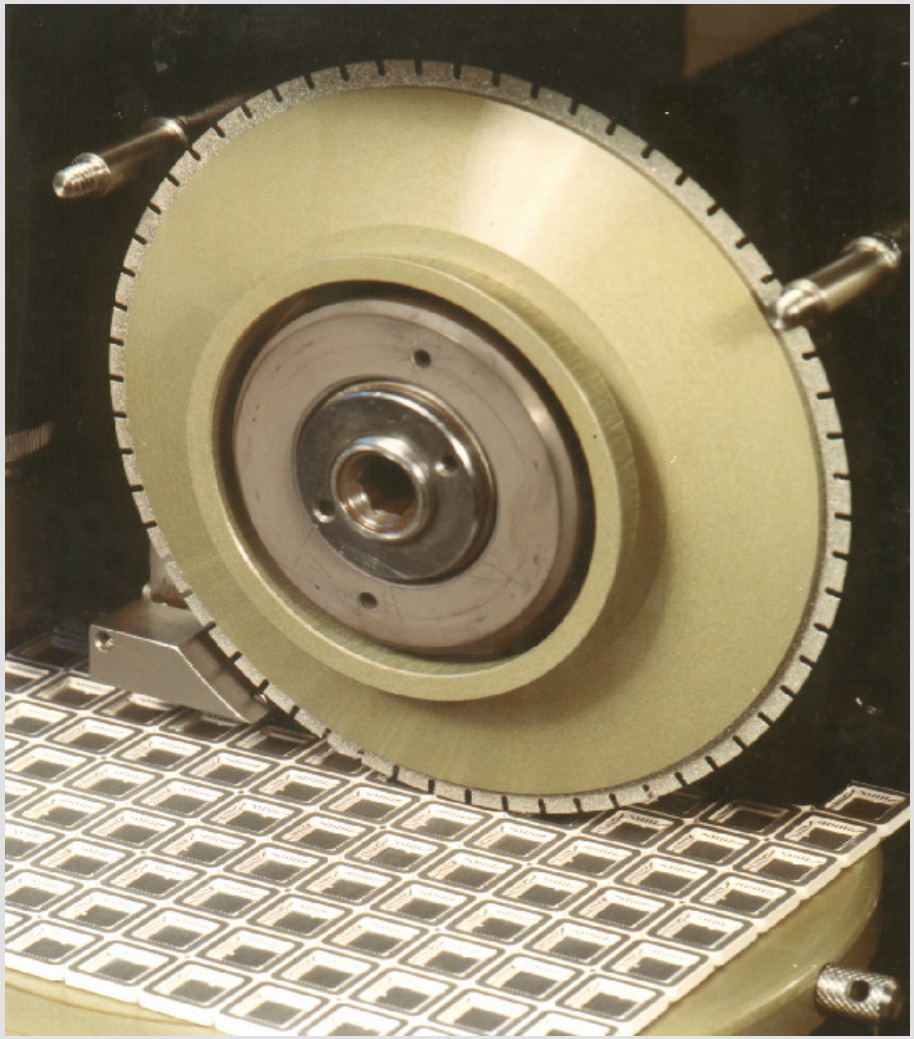
Green Ceramic



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Dicing Seminar

Major Applications - Material Dicing Guide

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Material Dicing Guide - Blade related

Material	Hardn.	Brittleness	Blade Matrix & Diamond Grit [mic.]						Remarks
	Hard		Resin ,	Grit	Nick., Grit		Sint. , Grit		
Sapphire			QKP	53,63	No		No		
Ruby			GWK	53,63	No		No		
Alumi. Nitride			KUP, RUP	63-105	No		No		
Alumina			KUP, RUP	45-63	No		No		Also with standard matrix
Titanium Car.			KUP, QKP	30-53	Yes	10-30	Yes	10-25	
Kovar			AUP	53,63	No		No		
Quartz			QIP, KUP	30	No		No		
Glass / Pyrex			KUP, QIP	30,45	No		No		
PZT			AUP	9-45	Yes	3-6,10	No		
Barium Titan.			QUP, QKP	20-45	No		No		+ QIP Softer
Led Telluride					Yes	3-6	No		
Lithium Niob.			KUP,QUP	15-30	Yes	3-6	No		
Bismuth Telur.			RUP, KUP	45,53	Yes	17,30	No		
Silicon			QUP	9	Yes	4-6	No		
GaAs					Yes	2-4	No		
Ferrite			AUP, QIP	4-30	Yes	3-6,10	Yes	2-30	
QFN	Soft		E06,T04&6	53-70	No		Yes	53	

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Popular Resin Matrices

E- Series: E01, E03, E06
To minimize wear and improve cut quality on QFN

T- Series: T04 & T06
New developments for QFN

C- Matrices: C02 & C03
Improved wear and quality for hard Alumina

Matrix Code	Hardn.	Subst. Material	Remarks
Standard		Hard Alumina and others.	Graphite Fib. Min. Wear.
RUP, RFP		Hard Al., some Glass, Bismuth Tel. Others	Best wear on new matrix.
KUP & KKP		-------"------- , Al. Nitr. T.Carbide, Lithium - -Niobate, others.	Direct [First] replacement to our Standard m.
IUP		Same as above but thicker subst., more Loading.	Softer than KUP
QUP		Same subst.materials as KUP but more Brittle.	Will Minimize chipping.
QKP		Same subst. materials as KUP but more brittle & thicker. Sapphire & Ruby	Will minimize Chipping & loading. 53 & 63mic grit
QIP		Quartz, Glass, Barium Titanate & other brittle mat.	Soft wearing mat. resulting in good edge quality.
AUP		PZT, some thicker Al. Kovar, some ferrites.	Soft resin but high dia. % For small grits.
AIP		Hard materials Requiring high blade wear	V. Soft bond with Low diamond %

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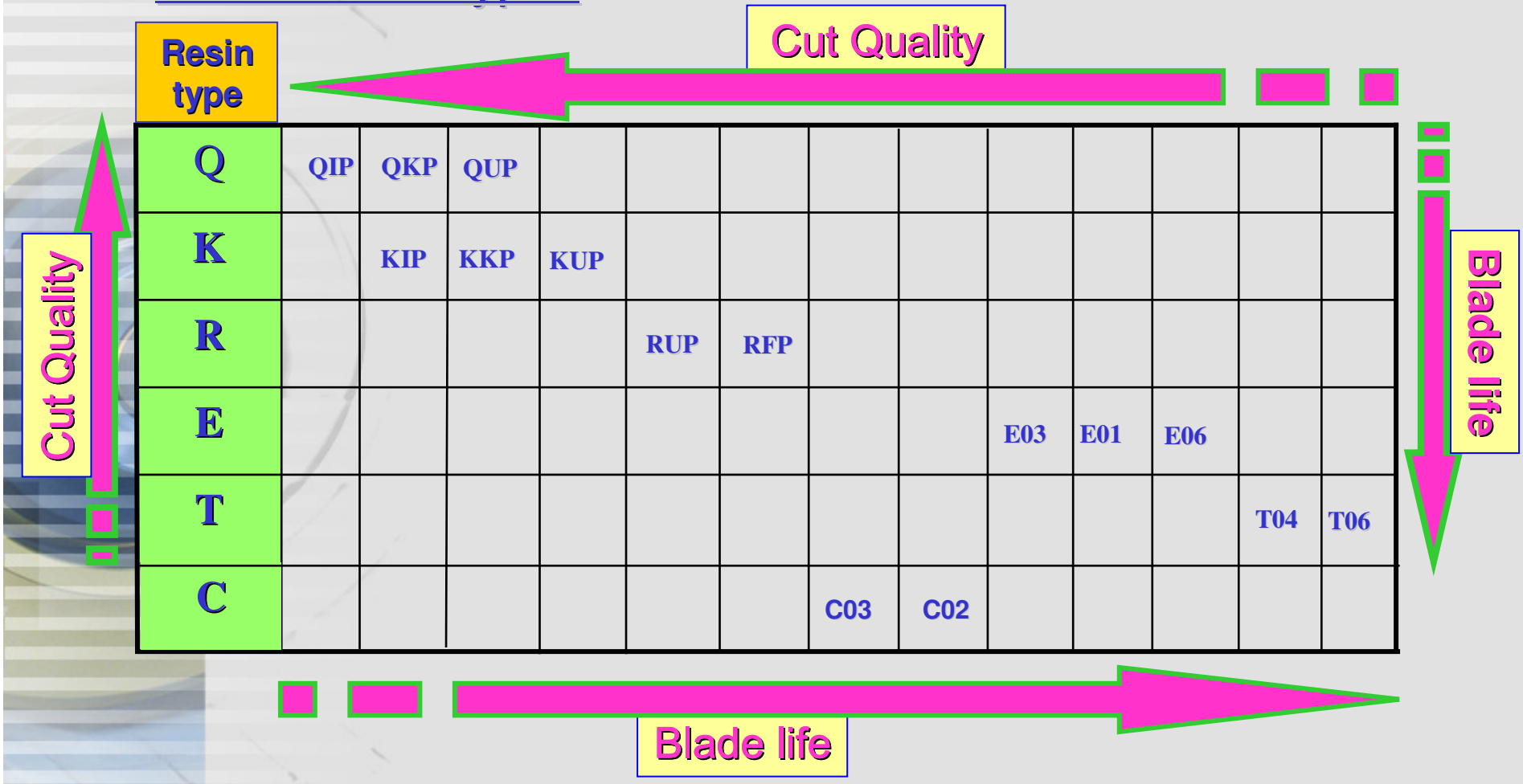
Resinoid Blade Selection

Resin matrix types



Resin type												
Q	QIP	QKP	QUP									
K		KIP	KKP	KUP								
R					RUP	RFP						
E									E03	E01	E06	
T												T04	T06
C							C03	C02					

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Material Dicing Guide - Blade related

Blade Type	Diamond size Micron	Product	Material
Nickel Blade	30,50,70	PBGA	FR4, Plastic & BT Resin
	6-8,10,17	PCB	FR4 & Copper
	3-6,10,17	Magnetic & Tape Heads	TiC & Ferrite
	2-4,4-8,10	Ultrasound Sensors	PZT
	2-4,3-6	Active Devices (Discrete)	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
	30,50	PBGA	FR4, Plastic & BT Resin
Resinoid Blades	53,88,105	CBGA	Alumina
	53,63,88	Ceramic Packages	Alumina
	75,88,105	QFN/MLP (F/C & H/E)	Copper + Resin
	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 (Tape & Tapless application)	FR4, Plastic & BT Resin
	9,10,15	Fiber Optics	Glass, Quartz
	30,40,50	QFN/MLP (H/E)	Copper + Resin
	20,30,40	Ceramic Packages	Alumina

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Blade Selection

Recommended Values

Product	Material	Blade Type	Blade O.D	Matrix	Diamond size mic	Spindle Speed KRPM	Feed Rate	
							mm/s	Inch/s
PBGA	Epoxy & Molding	Sintered / Nickel	2"		30, 40, 50	2": 30-45	100-200	4-8
			3"			3": 20-30		
QFN	Cooper & Molding	Resin	2"	Resin: E type	88, 105, 125	2": 25-30	50-125	2-5
			3"			3": 15-28		
PCB	FR4 / Epoxy & Cooper	Nickel	2"	"T" , "V" , "Z"	10 , 13 , 17	2": 25-30	100-150	4-6
			4"			4": 15-28		
Ceramic Packages	Alumina	Resin	2"	* KUP , RUP	45,53, 63	18-28	4-20	0.15-0.8
			4"			10-18		
Multi Layer Capacitor	Green Ceramic	Nickel Steel Core	4"		30, 50, 70	12-18	100-250	4-10
Ultrasound Sensors	PZT	Nickel	2"		2-4, 4-8, 10	25-35	0.5-10	0.02-0.4
IC	Silicon	Nickel	2"		2-4, 3-6	30-50	25-75	1-3

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Blade Selection

Recommended Values (cont.)

Product	Material	Blade Type	Blade O.D	Matrix	Diamond size mic	Spindle Speed KRPM	Feed Rate	
							mm/s	Inch/s
Optical and Electro-Optics components	Sapphire	Resin	2"	* QIP , QKP , QUP	30, 45 ,53	16-20	1-10	0.04-0.4
			4"			8-10		
Fiber Optics components	Quartz	Resin	2"	* QIP , QKP , QUP	30, 45, 53	18-30	2-10	0.1-0.4
			4"			8-18		
Fiber Optics components	Glass / Fused Silica	Resin	2"	* QIP , QKP , QUP	30, 45, 53	16-30	2-10	0.1-0.4
			4"			8-18		
Fiber Optics components	Si On Glass	Resin	2"	* QIP , QKP , QUP	9, 15, 25	20-30	0.5-2.5	0.02-0.1
			4"			10-15		
SAW Devices	Quartz	Resin	2"	* QUP , KUP , RUP	30, 45, 53	18-30	2-10	0.1-0.4
			4"			8-18		
SAW Devices	LiNbO3 ; LiTaO3	Nickel / Resin	2"	* QUP , KUP , RUP	Nickel: 4-8	16-30	2-10	0.1-0.4
					Resin: 15, 20, 30			
Tape Head	Ferrite	Resin / Nickel	2"	* QUP, KUP , RUP	Nickel: 3-6, 4-8, 10	25-35	2-10	0.1-0.4
					Resin: 15, 20, 30			
Magnetic Heads	AlTiCO3	Sintered / Nickel	4"		Sintered: 10, 17	Slicing: 8-12	1-5	0.04-0.2
					Nickel: 3-6, 10, 15	Parting: 8-12	1-10	0.04-0.4

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Maximum Recommended Spindle RPM -(Safety - only)

Nickel Blades:
2” O.D. - 40 - 60Krpm
3” O.D. - 35Krpm
4” O.D. - 30Krpm

M. Sintered:
2” O.D. - 40 - 60Krpm
3” O.D. - 35Krpm
4” O.D. - 30Krpm

Resinoid:
2” up to .015” thick - 35Krpm
2” .016”- .025”thick - 25Krpm
2” .026”- .035” thick- 20Krpm
3” up to .015” thick - 25Krpm
3” .016”- .025”thick - 22Krpm
3” .026”- .035” thick- 16Krpm
4” up to .015” thick - 16Krpm
4” .016”- .025”thick - 14Krpm
4” .026”- .035” thick- 12Krpm