



A.L.M.T.

Diamond·cBN Tools

A.L.M.T. Corp.

Diamond·cBN Tools

Nano technology and Eco-friendly tools from A.L.M.T. bring next generation of cutting, grinding, and polishing.



Grinding Tools

◆...interpretation ◇...product

P3~23

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Diamond Wire Saw

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A.L.M.T.Corp. offers a wide range of products to meet all of your cutting, grinding, and polishing needs.

Thank you for using A.L.M.T.



P11
Flute MAX



P12
Flute Master



P13
Hybrid Wheel



P14
Flank Master



P15
VITMATE



P16
EG Wheel



P17
Nanomate V-Heart



P17 - 18
Nanomate Premium



P19
MT Bond Wheel



P20
MB SPARK



P21
DPG Wheel



P22
Super Sizing



P22
CMP Conditioner



P23 Electro-plated
Internal Wheel



P25
Rotary Dresser



P30 Rotary Dresser
for Internal Grinder



P30
Crown Dresser



P31
Disk Dresser



P31
CVD Ace Dresser



P34
BL-UPC



P35
UPC-Nano groove



P35
UPC-Nano endmill



P36
UPC-Nano ballendmill



P36
UPC-Nano Profile



P37
UPC-R



P38
UPC-F



P38
UPC-T



P39-40
NewD, e-EDGE



P41 Ultrasonic
Assisted Cutting Unit



P42-45
PCD Rotating Tool



P46
PCD Small Saw



P48
PWS-R



P48
PWS-E



P49
CPG Tool Grinders



P50
RD Drive Unit



P50
Brake Dresser



P50
ODIUP



P50
TACUMINO Dress

Grinding Tools



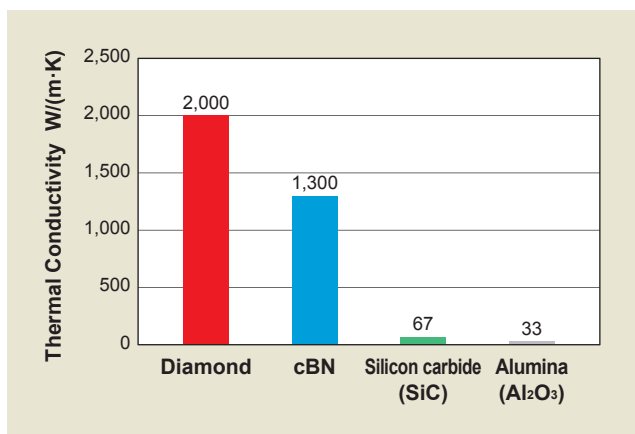
Superabrasive Wheel

Grinding Wheels with diamond and cBN are called “Superabrasive Wheels”, to distinguish from conventional wheels such as aluminum oxide and silicon carbide.

*cBN (or CBN) = Cubic Boron Nitride

□ Comparison of Superabrasive and Conventional wheel (based on characteristics)

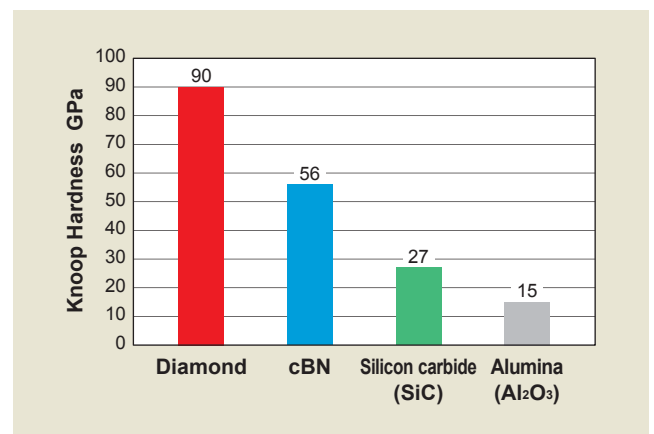
① Thermal Conductivity



Superabrasives have better thermal conductivity.
(Inhibit temperature rise of workpiece)

Deterioration risk of work hardness under proper condition is low. High quality process such as high compressive stress and low damaged layers are obtained.

② Hardness



Superabrasives have higher hardness.

High efficiency and accuracy as well as low cost process are obtained under proper condition. Also, continuous processing is available due to low frequency of tool change.

□ Abrasive

Type	JIS Display
Natural Diamond	D
Synthetic Diamond	SD
Coated Synthetic Diamond	SDC
Cubic Boron Nitride	cBN
Coated Cubic Boron Nitride	cBNC

□ Type of Bond

Resin	B
Metal	M
Vitrified	V
Electro-plated	P

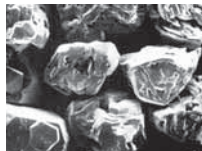
□ Grit Size

Display Size	JIS	Average (μm)
16	16/20	1190
20	20/30	840
30	30/40	590
40	40/50	420
50	50/60	300
60	60/80	250
80	80/100	177
100	100/120	149
120	120/140	125
140	140/170	105
170	170/200	88
200	200/230	74
230	230/270	63
270	270/325	50
325	325/400	44
400		37
600		30
800		20
1000		15
1500		10
2000		8
3000		5

Synthetic Diamond



Natural Diamond



Resin Bond



Metal Bond



Coated Synthetic Diamond

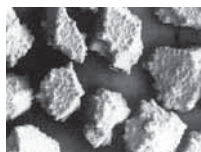
cBN Abrasive



Monocrystal

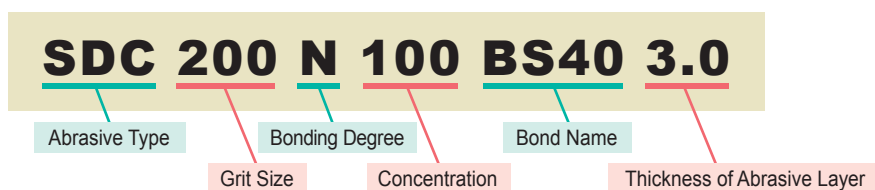


Polycrystal



Coated Monocrystal

□ Identification System of Diamond & cBN Wheel



□ Concentration

Degree of Concentration	Grain Content ct/cm ³ (mg/cm ³)
150	6.6 (1320)
125	5.5 (1100)
100	4.4 (880)
75	3.3 (660)
50	2.2 (440)

Notes : 1ct=200mg

□ Bond Strength

"N" is standard and indicates the bonding strength of abrasive and bond



□ Material Processed by Diamond or cBN Wheel

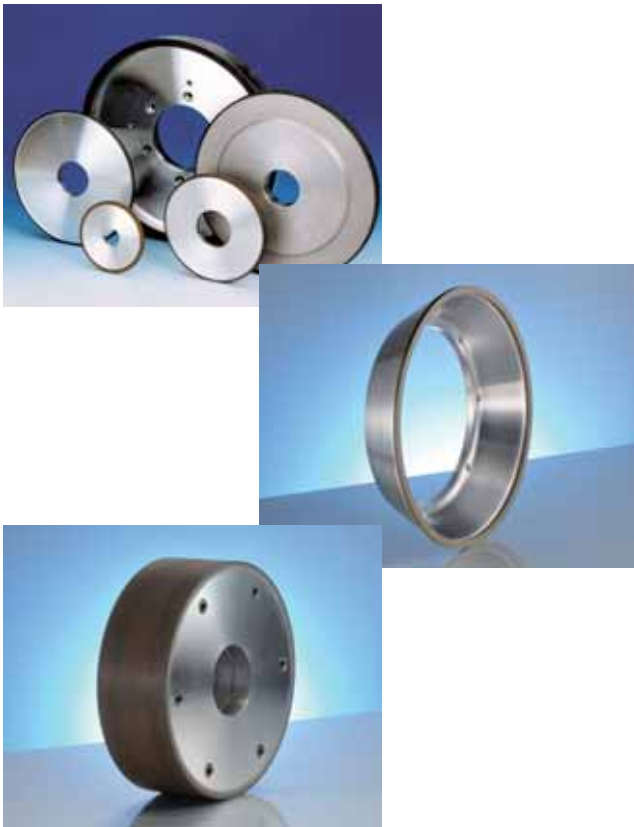
Diamond	• Cutting Tool • Cemented Carbide • Cermet • Ceramics (Alumina, etc.)	• Electric Parts • Ceramic (Aluminum nitride, etc.) • Silicon • Compound semiconductor	• Magnetic Material • Ferrite • Rare earth Magnet	• Crystalline Material • Glass • Crystal • Quartz • Sapphire	• Ceramic Products • Stone • Refractory Material • Tile • Asphalt • Concrete	• Wear Resistant Metal • Sprayed Metal • Cobalt base Alloy • Titanium Carbide	• Plastic • F.R.P.	• Graphite • Conventional Wheel (Grindstone) • Jewelry
cBN	• Cutting Tool • SKH • SKS • SK	• Wear Resistant Tool • SKD • Sprayed Metal • Cobalt base Alloy	• Structural Component • SCM • SNCM • SCr • SUJ	• Corrosion Resistant Metal • SUS	• Heat Resistant Metal • SUH • Nickel base Alloy • Titanium base Alloy	• Magnetic Material • Dust Core • Alnico	• Cast Iron	

Wheel Figure

Resin Bond Wheel

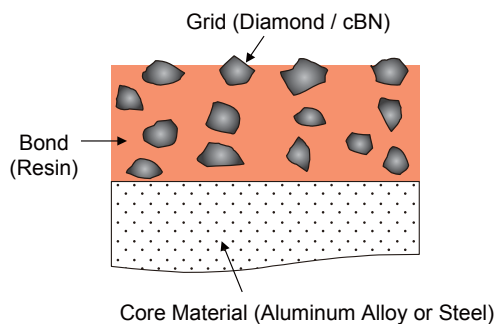
The main component of resin bond is thermo-hardening resin. Phenol resin is mainly used but polyimide resin, which has better heat resistance, is becoming more common.

Our products are widely used in many kinds of material.



■ Features

1. Elastic property of (resin) bond leads to excellent surface roughness.
2. Excellent durability of grinding ability for various kind of materials hard to be ground.



■ Applications

Metal material such as cemented carbide, cermet, and high speed steel

From rough to finish grinding for certain materials such as fine ceramics, ferrite, and glass

Metal Bond Wheel

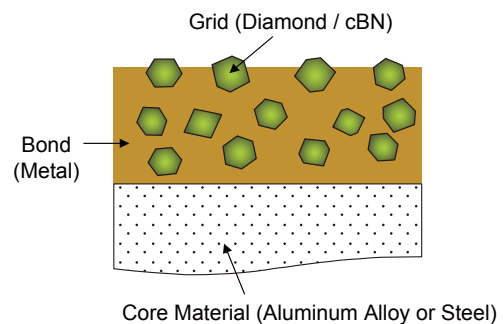
Metal Bond consists of various types of alloys: copper, tin, steel, cobalt, and tungsten.

MT Bond Wheel applying (our) special metal bond has excellent grinding ability as well as long tool life and is highly recommended for ceramics, carbide, and cermet.



■ Features

1. Higher wear resistance and abrasive retention lead to long tool life.
2. Good grinding ability on glass and ferrite by brittle (fracturing) mode.



■ Applications

Rough grinding for certain material such as glass, ceramics, ferrite, semiconductor material, and stone

Vitrified Bond Wheel

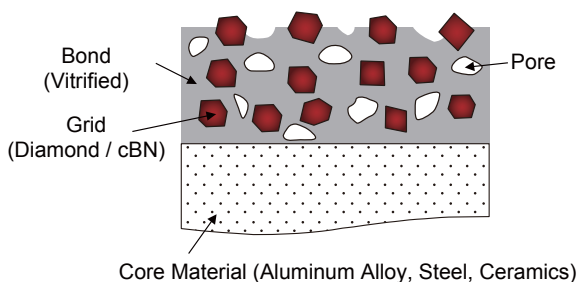
Vitrified Bond is glass-based ceramic and has been used for conventional grinding wheels through the ages.

We have abundant lineup: "VITMATE" applying cBN, "EG WHEEL" for cemented carbide and ceramic, and "NANOMATE" which is applicable to super finish grinding of semiconductor materials.



■ Features

1. Good grinding ability due to pores
2. Trueing and dressing of VITMATE can be operated with a Rotary Dresser on the machine
3. Special adhesion technology can be applied for high speed grinding.



■ Applications

Steel, cemented carbide, semiconductor material, and ceramics, etc.
Suitable for high efficiency processes of high speed grinding

Electroplated Wheel

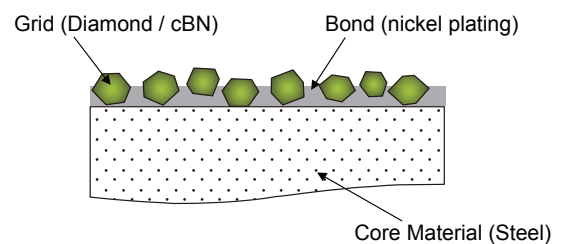
Abrasives are fixed by Ni plating on the surface of steel bodies which have various kind of precise forms.

Our products are widely used in many kinds of material.



■ Features

1. Excellent durability of grinding ability due to large protrusion (following good chip discharging property).
2. Excellent profile maintaining property due to large number of active grains.
3. Easy to be formed and body is reusable



■ Applications

Form grinding of cemented carbide, ceramics, magnetic material and steel, etc.
Dry grinding of rubber and FRP, etc.

Wheel Figure

□ About Truing and Dressing

Truing and Dressing are important in allowing full grinding ability and effective wheel use.

Truing is wheel forming process including run-out elimination.



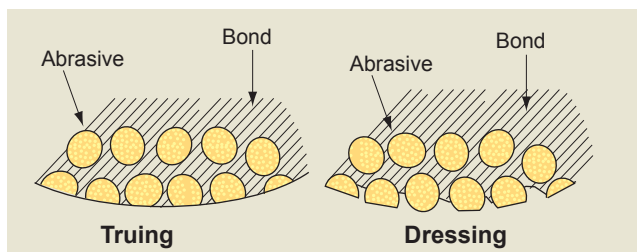
Table 1. Method of Truing for Each Type of Diamond and cBN Wheel

Truing Method and Tool			Applicable Abrasive	Applicable Bond (*1 *2)	Forming	Remarks
Diamond Tool Method	Rotating Type	Rotary Dresser	Dia	V	Possible	Used mostly with cBN wheel; cannot be applied to diamond except in some cases
			cBN	V.B	Possible	
		Metal Wheel	Dia	V	Possible	
			cBN	V.B.M	Possible	
	Static Type	Electrodeposition Arbor	cBN	V.B	Not Possible	
		Single Point, Multi-point Dresser	cBN	V.B	Not Possible	
		Impregnated Dresser	cBN	V.B	Not Possible	
		Block Dresser	cBN	V.B	Possible	
Electrodeposition Block Dresser	cBN	V.B.(M)	Not Possible			
Conventional Wheel Method	Rotating Type	Grinding Wheel	Dia	B.V.M	Possible	Rotating Type can be used for most diamond and cBN but Static Type is very limited
			cBN	B.V.M	Possible	
	Static Type	Stick	Dia	B.V.(M)	Not Possible	
			cBN	B.V.(M)	Not Possible	
Soft Steel Method	Rotating Type	Soft Steel Roll	Dia	B	Not Possible	Simple way applied from long ago; forming is not possible
			cBN	B	Not Possible	
	Static Type	Soft Steel Block	Dia	B	Not Possible	
			cBN	B	Not Possible	
Loose Abrasive Method	Lapping		Dia	B.V.M	Not Possible	Specialized equipment is required
			cBN	B.V.M	Not Possible	
Crash Method	Steel Roll		Dia	V	Possible	
			cBN	V	Possible	
Electro-discharge Machining	Electrode		Dia	M	Possible	
			cBN	M	Possible	

*1 : B: Resin Bond, M: Metal Bond, V: Vitrified Bond

*2 : Order of easiness for truing; () is not general

Fig.1. Illustration of Truing and Dressing



Dressing is abrasive projecting process by removing bond and chips on wheel surface.

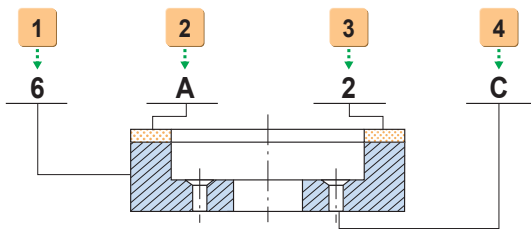
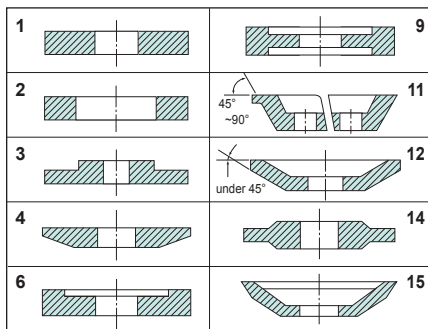
Table 2. Method of Dressing for Each Type of Diamond and cBN Wheel

Dressing Method and Tool			Applicable Abrasive	Applicable Bond
Diamond Tool Method	Rotating Type	Rotary Dresser	Dia	V
			cBN	V
		Metal Wheel	Dia	V
			cBN	V
	Static Type	Single Point, Multi-point Dresser	cBN	V
		Impregnated Dresser	cBN	V
		Block Dresser	cBN	V
Conventional Wheel Method	Rotating Type	Grinding Wheel	Dia	B.V.M
			cBN	B.V.M
	Static Type	Stick	Dia	B.V.M
			cBN	B.V.M
Soft Steel Method	Rotating Type	Soft Steel Roll	Dia	B
			cBN	B
	Static Type	Soft Steel Block	Dia	B
			cBN	B
Free Abrasive Method	Lapping		Dia, cBN	B.V.M
	Blasting		Dia, cBN	B.V.M
Crash Method	Steel Roll		Dia, cBN	V
Electro-discharge Machining			Dia, cBN	M
Electro-chemical Machining			Dia, cBN	M

*1 : B: Resin Bond, M: Metal Bond, V: Vitrified Bond Order of easiness for dressing

Identification Method of Wheel Shape

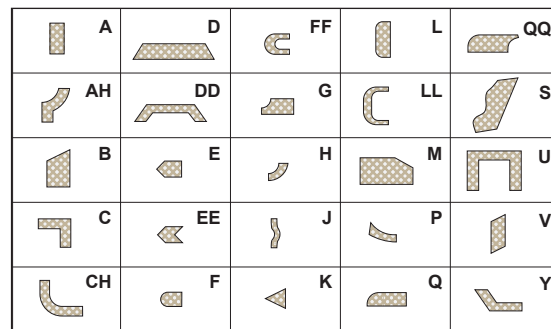
1 Standard Body Shape



3 Abrasive Layer Position & Symbol Reference to B

Symbol	Position	Diagram
1	Periphery	
2	Side	
3	Both Sides	
4	Incline or Roundness, Inside	
5	Incline or Roundness, Outside	
6	Part of Periphery	
7	Part of Side	
8	Whole	
9	Edge	
10	Internal	

2 Cross Sectional Shape of Abrasive Layer

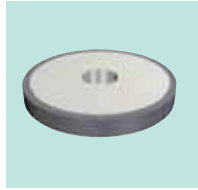
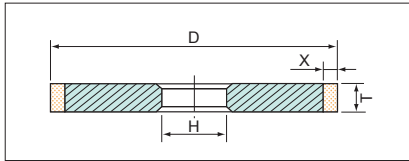
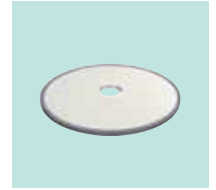
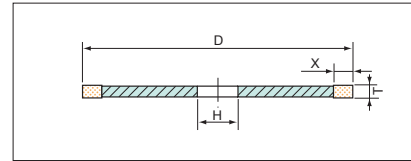
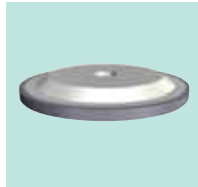
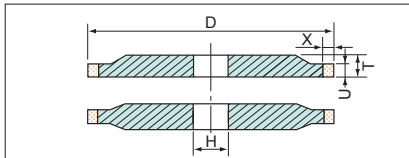
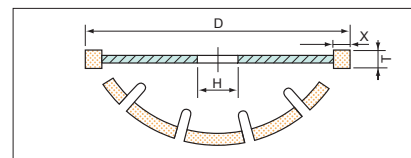
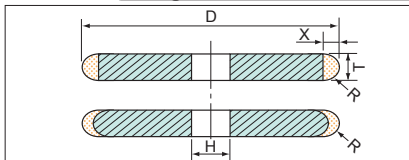
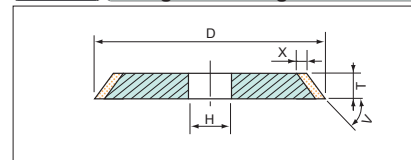
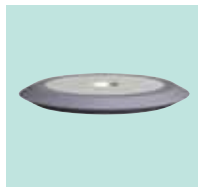
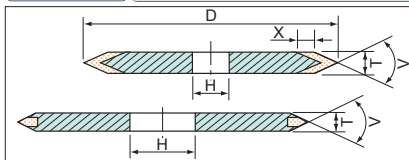
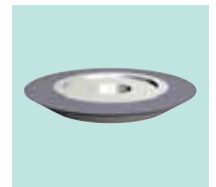
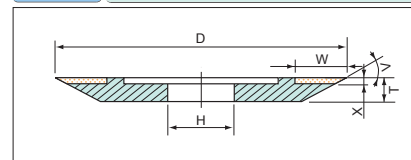
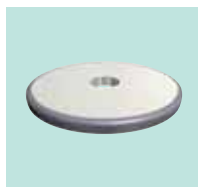
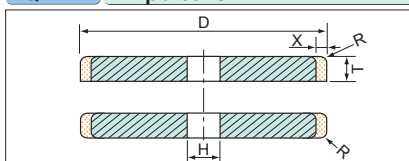
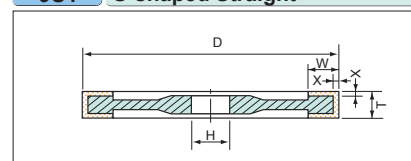
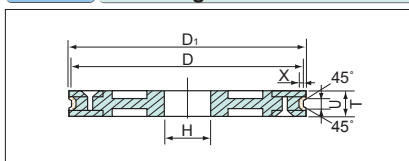
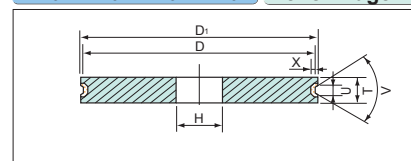


4 Modification & Symbol

Symbol	Modification	Diagram
B	Spot Facing Hole	
C	Countersinking Hole	
H	Straight Hole	
M	Straight & Threading Hole	
P	Relief at One Side	
Q	Insert of Abrasive Layer	
R	Relief at Both Sides	
S	Segmented Abrasive Layer	
SS	Slot Segmented Abrasive Layer	
T	Threading Hole	
V	Reverse Attachment of Abrasive Layer	
W	With Shaft	
Y	Reverse Insert of Abrasive layer	

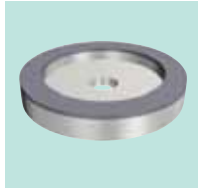
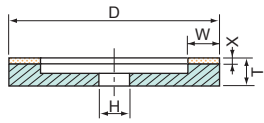
Wheel Figure

□ Standard Wheel Shape 1

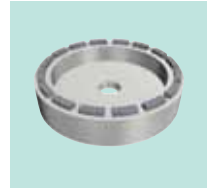
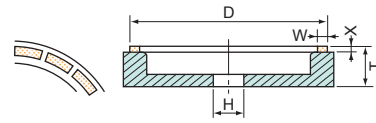
1A1 Straight**1A1R** Cutting**3A1/14A1** Straight with Boss**1A1RSS** Cutting Saw**1F1/1FF1** Straight with R**1V1** Straight with Angle**1EE1/1E6Q** V Face**4B2** One Side V Face**1Q1/1L1** Chipbreaker**9U1** U-shaped Straight**1DD6Y** Centering**1FF6Y/1EE6Y/1LL6Y/1DD6Y** Pencil Edge

Standard Wheel Shape 2

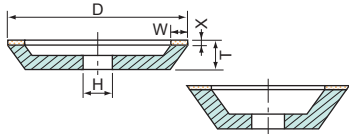
6A2 Plain Cup



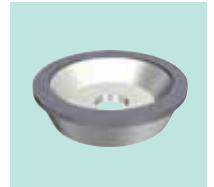
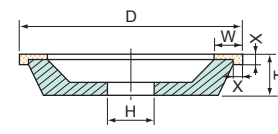
6A2S Segment Cup



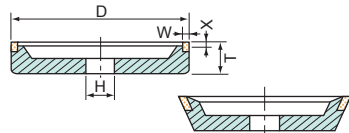
11A2/11B2 Flair Cup



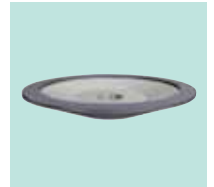
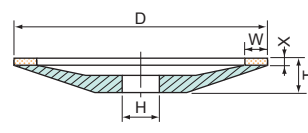
11C9/11Y9 L-shaped Flair Cup



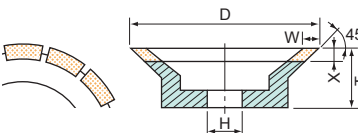
6A9/11V9 Corner Cup



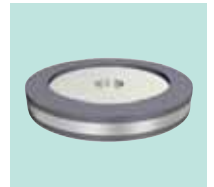
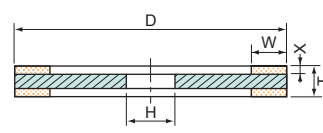
12A2 Dish



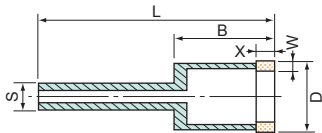
11V2S Wedge-shaped Segment Cup



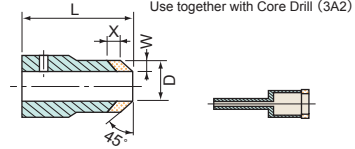
9A3 Both Side Cup



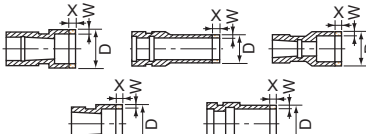
3A2 Core Drill



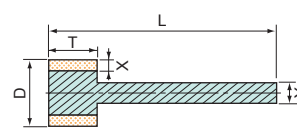
3V2T Chamfering



3F2 Curve Generator



W Internal with Shank



Flute MAX



FluteMAX

Suitable for grooving with water-soluble coolant

Flute MAX applies super heat resistant resin with a special filler to achieve both superior cutting ability and long tool life.

Suitable for grooving applications such as endmills, drills, reamers, and creep feed grinding for various other tools.

Features

- Super heat resistant resin helps to reduce deterioration under high temperature.
- Excellent cutting ability and shape retention even for heavy load grinding such as creep feed grinding.
- High feed rate and long dressing interval compared to conventional wheels which lead to high efficiency and cost reduction.

Applications

- Grooving of endmills, drills and reamers
- Chipbreaker grinding of inserts
- Heavy grinding of various tools including special steel tools

3 different bond types

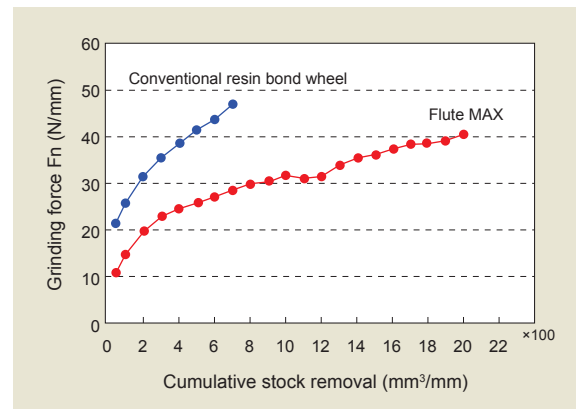
Bond grade	Special feature
L	Superior cutting ability
N	Standard
P	Superior shape retention



Creep feed grinding of cemented carbide

Conditions

Workpiece	Cemented carbide
Wheel specification	SDC140-100B
Wheel speed	V=1600m/min
Work speed	F=80mm/min
Depth of cut	a=0.5mm/pass
Coolant	water-soluble



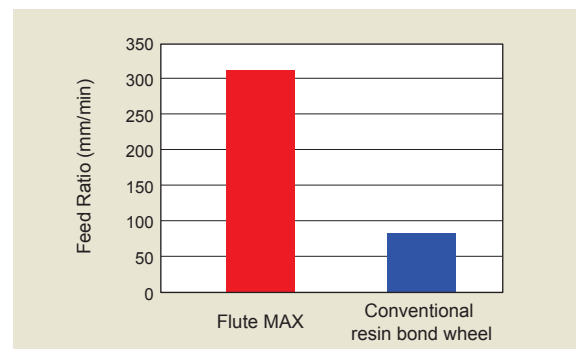
Result

Compared to conventional resin bond wheel Flute MAX can maintain low grinding force and cutting ability.

Flute Grinding of Cemented Carbide Endmill

Conditions

Workpiece	8D 2-flute endmill
Wheel specification	SDC270-100B
Wheel speed	V=1,600m/min
Depth of cut	a=1.5mm (1st time) 0.5mm (2nd time)
Coolant	water-soluble



Result

Flute MAX can achieve grinding by 4 times faster feed ratio than conventional resin bond wheel in same tool life.



Flute Master®



Flute Master®

Suitable for grooving with oil-based coolant

Flute Master was created to exhibit excellent heat resistance of metal bond and surpasses the grinding ability of the resin bond wheel.

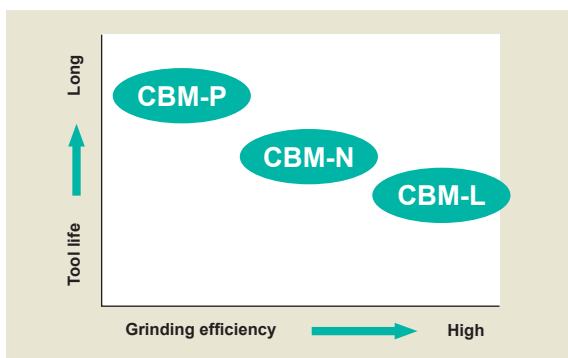
Features

Newly developed metal bond has both excellent grinding ability and provides long tool life. It also increases grinding efficiency, especially when used with oil-based coolant.

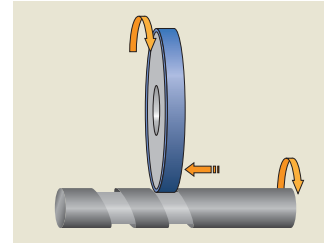
Applications

- Flute grinding of endmills, drills and reamers
- Chipbreaker grinding of inserts
- Heavy duty grinding of various tools, including special steel tools

Bond Line Up

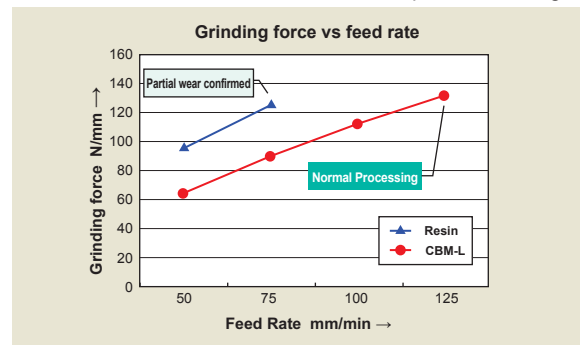


Flute Grinding



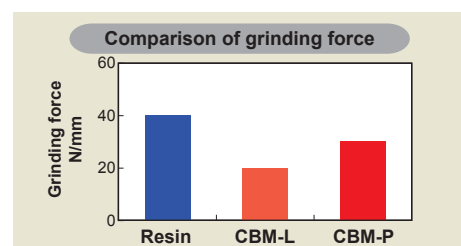
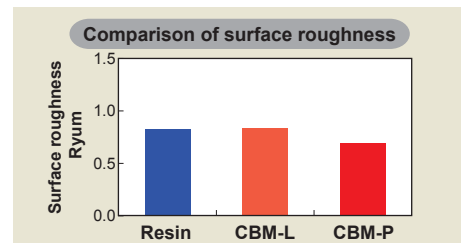
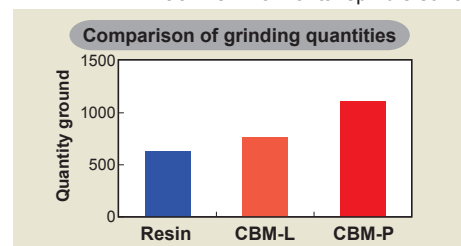
Relation between grinding force and feed rate

- 1) Wheel Specification
 - ① Resin : SDC325N100B
 - ② CBM-L : SD325L100CBM
- 2) Work Material : Cemented Carbide
- 3) Conditions :
 - Wheel Peripheral Speed : 1500m/min
 - D.O.C. : 3mm
 - Coolant : Oil-based
 - Machine : Horizontal spindle surface grinder

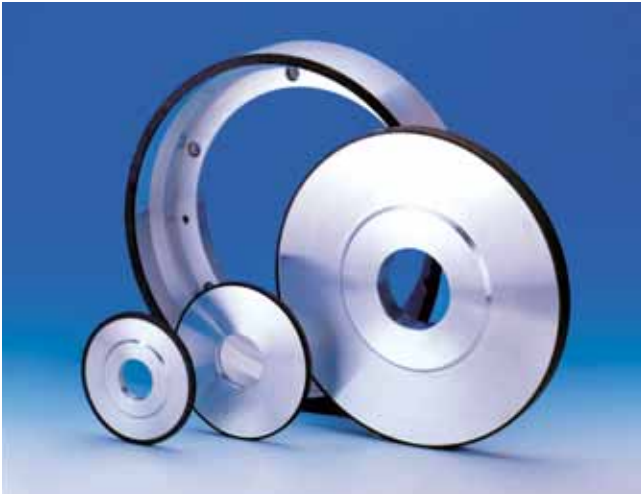


Grinding performance

- 1) Wheel Specification
 - ① Resin : BN140-100B
 - ② CBM-L : BN140L-100CBM
 - ③ CBM-P : BN140P-100CBM
- 2) Work Material : SKH51(HRC60)
- 3) Conditions :
 - Wheel Peripheral Speed : 1500m/min
 - D.O.C. : 1mm
 - Feed rate : 40mm/min
 - Coolant : Oil-based
 - Machine : Horizontal spindle surface grinder



Hybrid Wheel



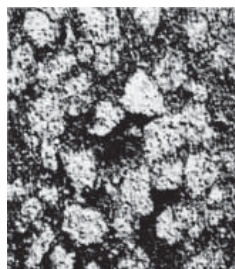
Suitable for cermet grinding

Features

The Hybrid Wheel was developed for high-efficiency grinding of cermet, a material that is hard-to-cut.

- Excellent grinding ability and long tool life due to effect by micro-segment of special metal bond
- Good surface roughness and minimal chipping due to resin bond matrix

Micro-segment structure

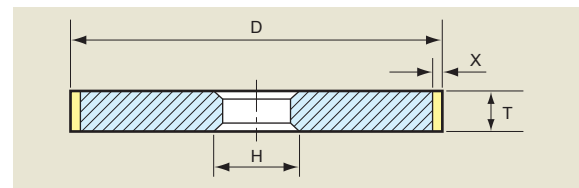


Applications

- Peripheral grinding of cermet, surface honing, grooving and chipbreaker grinding, etc.
- Various grinding including cemented carbide and ceramics

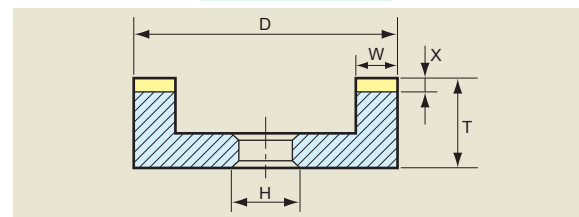
Type and standard size

Straight Type



Item Number	D	T	X	H
HS050	50	3,5,8,10, 15,20	3,5	As requested
HS075	75			
HS100	100			
HS125	125			
HS150	150			
HS175	175			
HS180	180			
HS200	200			
HS250	250	10,15,20, 25,30		
HS300	300			
HS350	350			
HS400	400			
HS500	500			
HS600	600			

Cup Type



Item Number	D	T	X	H
HC050	50	3,5,8,10	3,5	As requested
HC075	75			
HC100	100			
HC125	125			
HC150	150			
HC175	175	5,8,10,15		
HC200	200			
HC250	250			
HC300	300			
HC350	350			
HC400	400			
HC500	500			

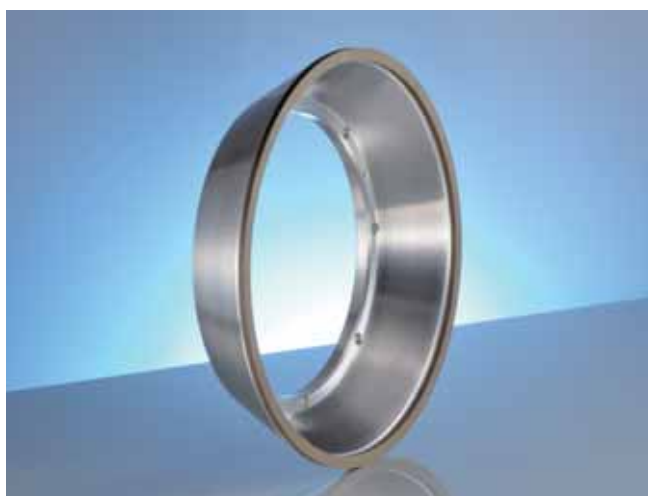
*All cup wheel types are available

Performance of Hybrid Wheel

		Hybrid	Conventional resin bond
Wheel	Size	Ø350×12W×6X, 6A2	
	Specification	SD325-HB	SDC325R75B
Work Material	Size	12.7□×3,175	
	Specification	TIC-TIN Cermet	
Grinding Condition	Machine	TA outer grinder	
	Peripheral Speed	1600m/min	
	Cutting Speed	Side	3mm/min
		R part	40mm/min
	Coolant	Water soluble	
Result	Current Value	9A	10A
	Dress Interval	300~400%	100%
	Processing Quantity	150~200%	100%
	Surface Roughness	Good	Good
	Chipping	Good	Good

Flank Master® (Peripheral grinding and finish grinding of cutting edge)

For carbide / cermet cutting tools Type-R



■ Features

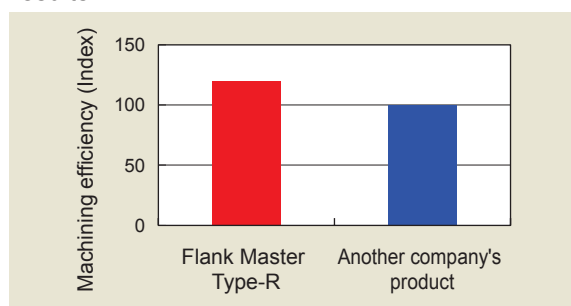
Applies special metal filler to improve heat radiation drastically. Realize good cutting ability and long tool life by reducing heat deterioration of grit and bond from cutting heat.

■ Peripheral grinding of cemented carbide insert

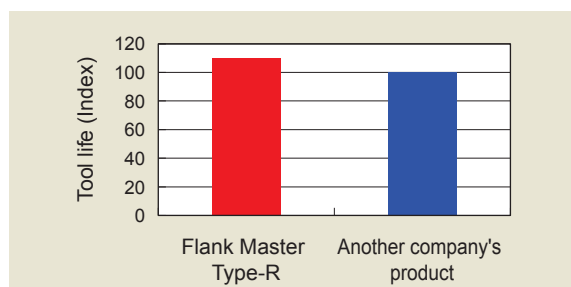
1. Conditions

- 1) Machine : NC peripheral grinder
- 2) Workpiece : carbide
- 3) Coolant : water-soluble
- 4) Wheel
 - SD400N100BFX (Flank Master Type-R)
 - SD400-100B (made by another company)

2. Results

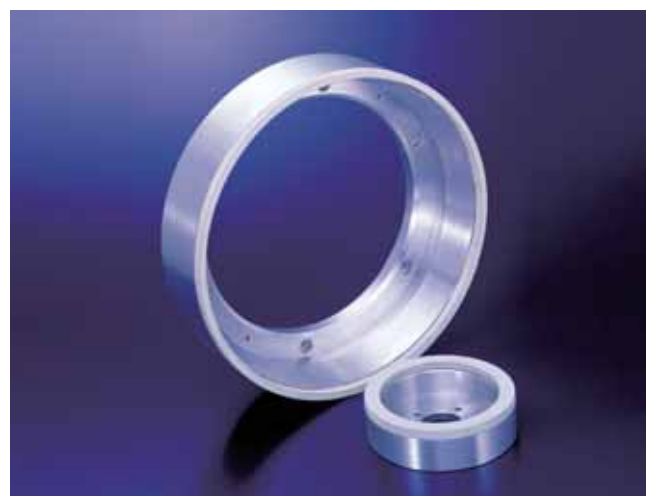


*Another company's product shown with index of 100



*Another company's product shown with index of 100

For PCD / PcBN cutting tools Type-V



■ Features

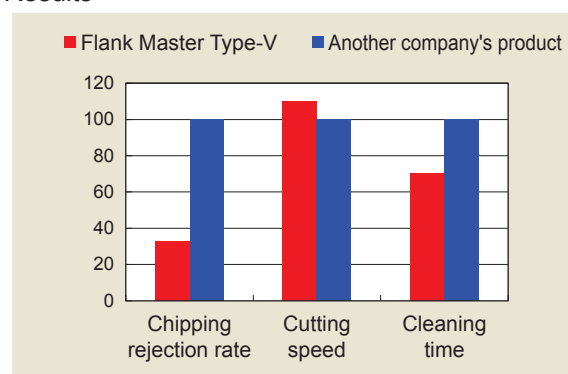
Combination of bond which has superior grit retention and pore structure realize good grinding ability and wear resistance that lead to high-efficiency and high-accuracy grinding

■ Peripheral grinding of PCD insert

1. Conditions

- 1) Machine : NC outer grinder
- 2) Workpiece : PCD (Polycrystalline Diamond)
- 3) Coolant : water-soluble
- 4) Wheel
 - SD2000N2-VPD (Flank Master Type-V)

2. Results



*Another company's product shown with index of 100

Cutting surface comparison



Flank Master Type-V

Another company's product

VITMATE®



■ Features

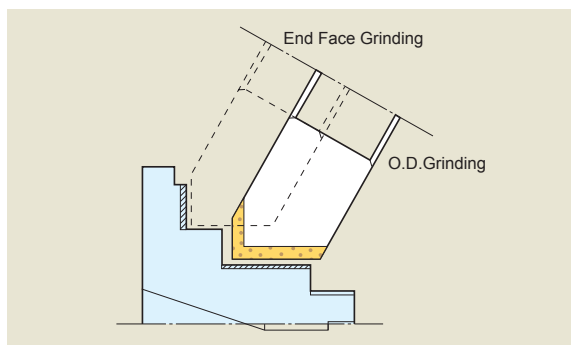
- Achieves high efficiency and low cost grinding thanks to high grit retention
- Easy to use with improved dressing performance.

■ Applications

Industries : Automotive, bearing, household appliances, tools machinery, gear, mold&die

Work piece : Cam, crank shaft, injection needle, rocker arm, compressor, bearing, ball screw, motor, etc.

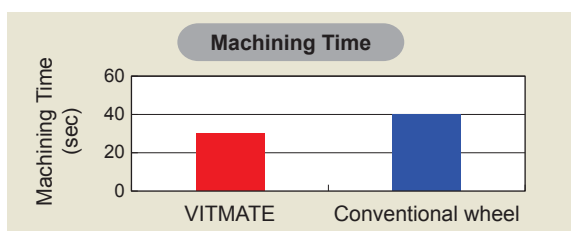
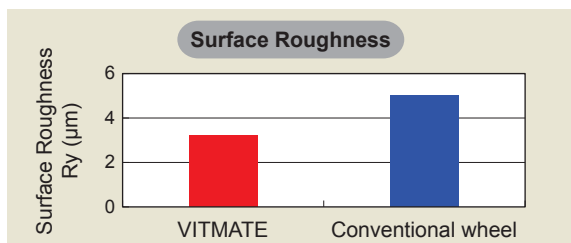
□ Angular grinding



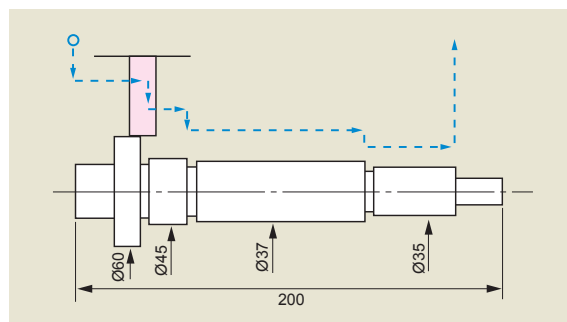
1. Conditions

- 1) Machine : Angular grinder
- 2) Wheel : Size : $\varnothing 350 \times 22U$
Specification : BN120N175VX5
- 3) Dresser : SD40-75M
- 4) Workpiece : SCM425 (HRC60)
- 5) Conditions
Peripheral speed : 80m/s
Stock allowance : O.D. $\varnothing 0.28\text{mm}$
End Face 0.15mm
Coolant : Water-soluble

2. Results



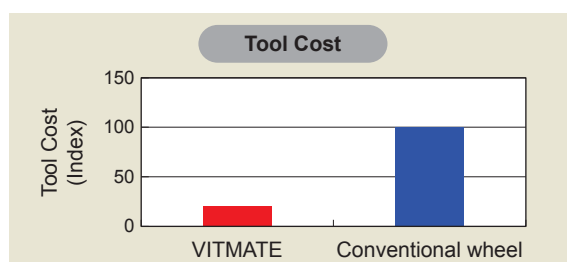
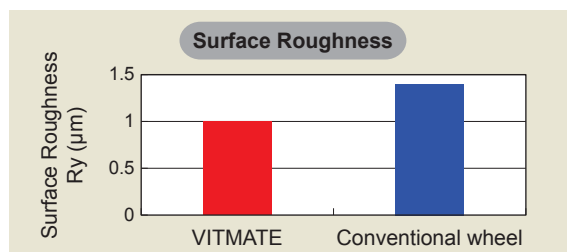
□ High-speed contouring grinding



1. Conditions

- 1) Machine : High-speed cylindrical grinder
- 2) Wheel : Size : $\varnothing 400 \times 10U$
Specification : BN120M200VE2
- 3) Workpiece : SCM435 (HRC60)
- 4) Conditions
Peripheral speed : 160m/s
D.O.C. : $\varnothing 0.2\text{mm}$
Feed rate : 300mm/min
Coolant : Water-soluble

2. Results



*Another company's product shown with index of 100

EG Wheel



Features

- Easy dressing and truing on a grinder with special diamond rotary dresser
- Excellent run-out and form accuracy in short time on a grinder
- Accurate arrangement of cutting edges for surface roughness, productivity and wheel life

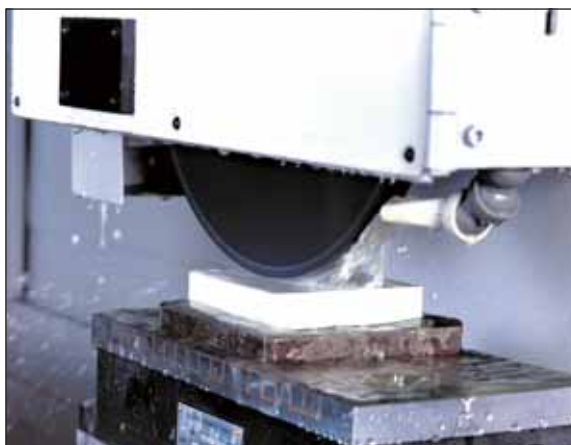
Applications

Industries : Machine tool, household appliances, automotive, bearing

Work piece : Ceramics and carbide

Production ranges

Outer diameter	Ø3~750mm
T size	3~300mm
X size	2~15mm
Grit size	SD (#80~#3000)



Surface grinding

Conditions

Workpiece : Ceramics post

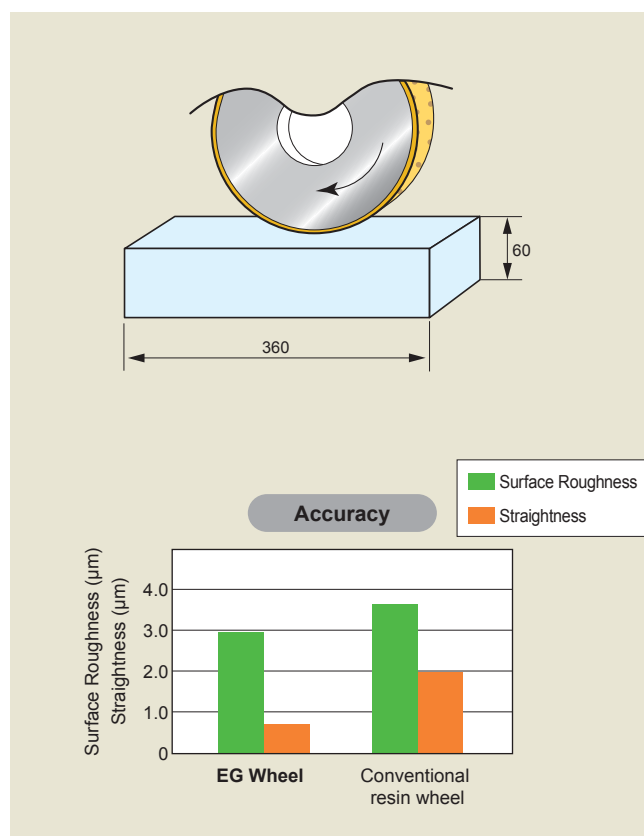
Alumina □60 × 360L

Application Example

1. Machine : Surface grinder PSG-63DXNC
2. Wheel : Ø300-15U
1) #270 resin bond wheel
2) SD230G100C3
3. Rotary Dresser : Ø150-10U
SD40-M
4. Dresser Drive Unit : SGS-50 (ALMT)

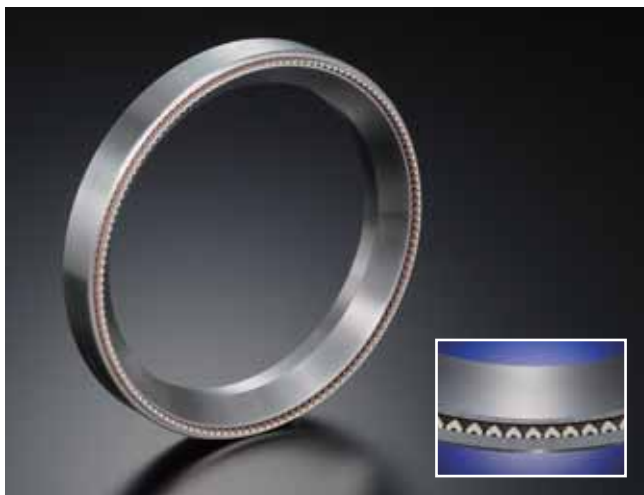
Result

1. 6 times productivity than conventional diamond resin bond wheel
2. Decreases dressing and truing time from 60min. to 5min.



Nanomate V-Heart

For Silicon



Nanomate
V-Heart

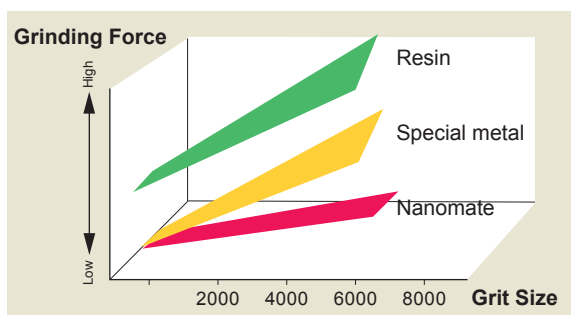
Suitable for rough grinding of deposited or sliced wafer

Strong diamond grit retention and high porosity vitrified bond, combined with a specially-shaped diamond layer, offers lower grinding force and improves grinding operations.

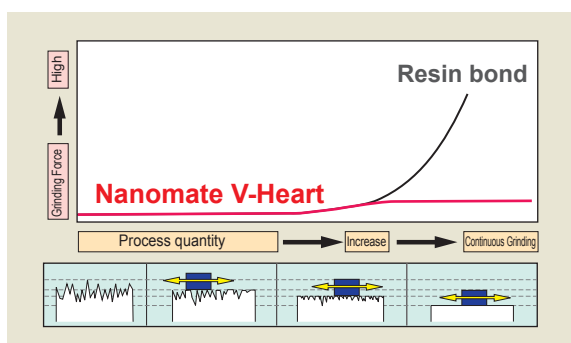
Achieves a flatness of less than $1\mu\text{m}$ on $\varnothing 300$ Si wafer and makes possible to grind hard-to-cut materials, including semi-conductor, electrics, and other materials.

Grinding Force

Low grinding forces result in reduction of each load applied on workpiece and grinding machine.



Grinding Force is 1/10 of resin bonding wheel



Nanomate Premium

For Silicon



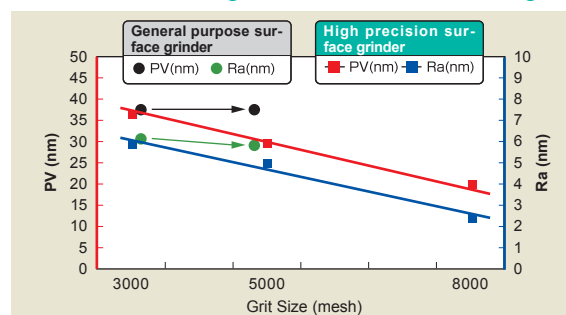
Nanomate
Premium

Suitable for mirror finish grinding of wafer and back side grinding of device wafer

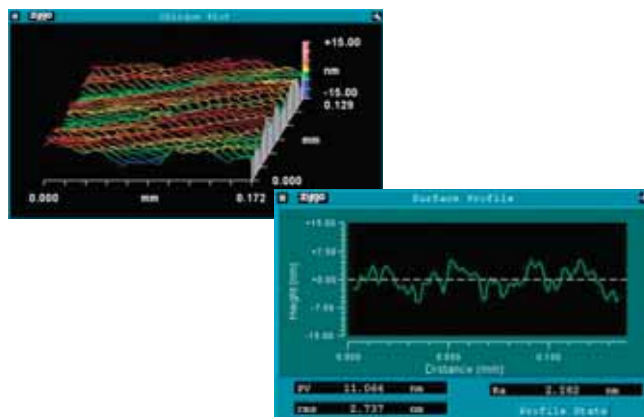
Super-fine diamond grit and super-fine ceramics revolutionized the conventional wisdom with regard to grinding wheels. Application of both acquired material technology and production technology has allowed super-fine grinding.

Its effectiveness to reduce a grinding damaged layer of brittle material such as polish-reduction of $\varnothing 300\text{mm}$ silicon wafer and prevent cracks on a thin layer device wafer.

Relation between grit size and surface roughness



Grinding result by SD8000 Nanomate



Nanomate Premium

For SiC finish process



Nanomate
Premium

Suitable for wafer grinding of semiconductor power device

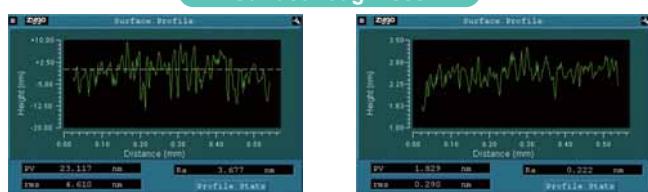
Combining diamond grit and vitrified bond with suitable ratio to obtain best grit clearance for efficient grinding. Continuous grinding of monocrystal SiC is now available.

Especially, superabrasive wheel can process with same feed rate as the one for silicon wafer grinding to obtain extremely smooth surface.

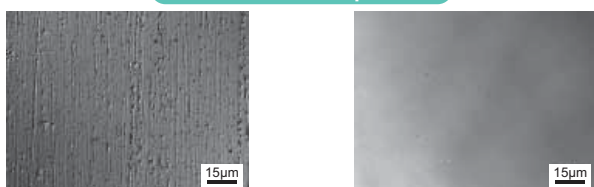
□ Grit size and work surface (SiC wafer)

- SD3000 (feed 40 μ m/min)
- SD8000 (feed 20 μ m/min)

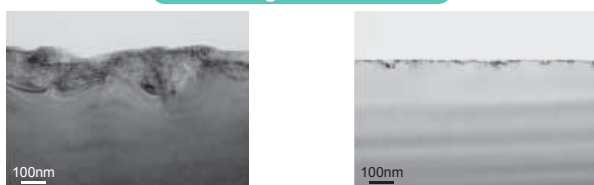
Surface roughness



Surface of workpiece



Damage of surface



For SiC and Sapphire rough process



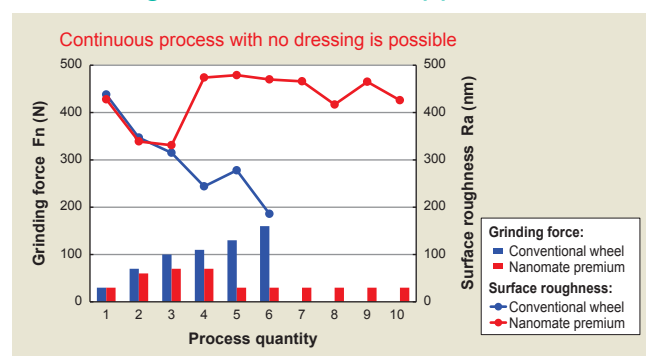
Nanomate
Premium

Suitable for rough and semi-finish grinding of semiconductor power device

Newly developed vitrified bond for rough process has high grit retention and pore which realize high efficient continuous process.

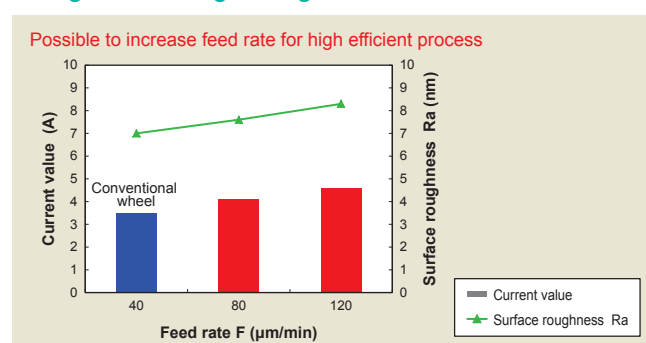
Suitable for hard-to-cut material such as sapphire and SiC and can feed 2 to 3 times compared to conventional wheel.

□ Grinding result of 4 inch sapphire wafer



Normal force and surface roughness (Spec : SD400)

□ High efficient grinding results of 3 inch SiC wafer



Current value and surface roughness (Spec : SD2000)

MT Bond Diamond & cBN Wheels



MT Bond Wheel - pursuing the ideal grinding wheel

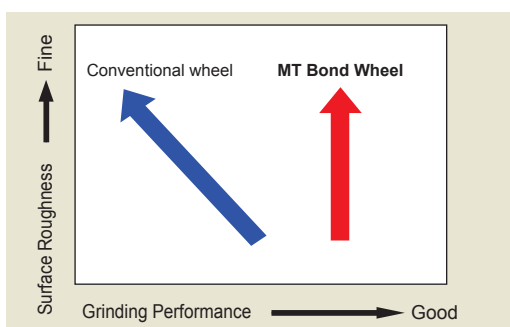
MT Bond is a new metal bond which is manufactured to reach optimum grinding ability, fusing the advantages of both resin bond and metal bond.

The Diamond Wheel efficiently grinds ceramic, carbide, cermet, and quartz, on the other hand, cBN wheel is for non-ferrous materials.

MT Bond Wheel is recommended for the surface grinding and creep feed grinding by profiled wheel, which sustains its grinding ability.

■ Suitable for various workpieces

MT10 and 20 are recommended for the grinding operation of various tools such as cemented carbide, cermet, and high speed steel. MT30, 40, and 50 are recommended for the surface grinding of glass, various ceramics, and steels.



□ Surface grinding

● Grinding conditions

Workpiece : Silicon Nitride

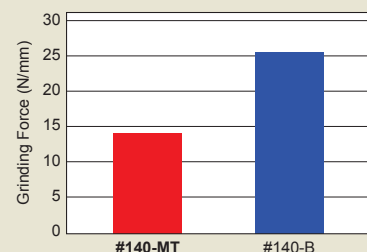
Wheel Speed : $V=1760\text{m/min}$

Work Speed : $F=10\text{m/min}$

D.O.C. : $a=20\mu\text{m}$

Result The grinding force (normal force) is 40% lower than the resin bond wheel

Data.1



□ Creep feed grinding

● Grinding conditions

Workpiece : Silicon Nitride

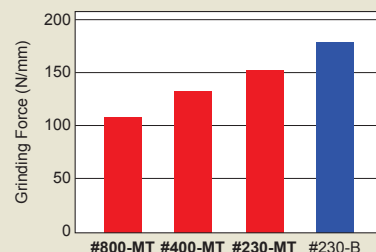
Wheel Speed : $V=1600\text{m/min}$

Work Speed : $F=60\text{m/min}$

D.O.C. : $a=1\text{mm}$

Result MT Bond Wheel shows 20% lower grinding force than resin bond wheel with the same grit size. The finer grit produces a lower grinding force (comparison is between grit sizes #230, #400, and #800).

Data.2



□ Grinding ability of each grades MT Bond

● Grinding conditions

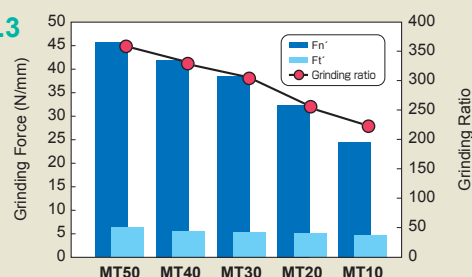
Workpiece : Silicon Nitride

Wheel Speed : $V=1,650\text{m/min}$

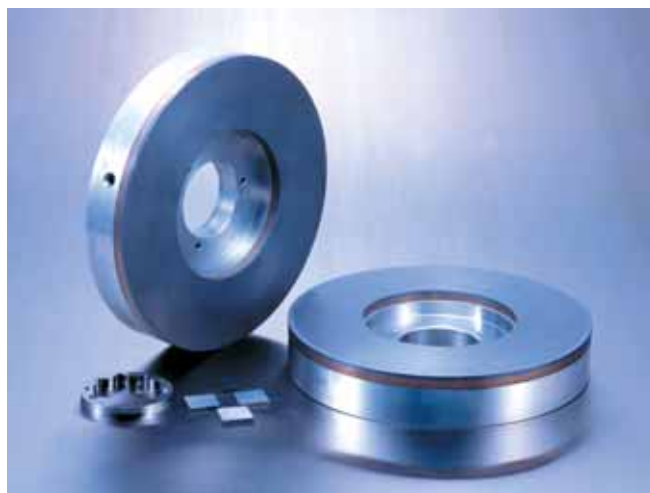
Work Speed : $F=10\text{m/min}$

D.O.C. : $a=20\mu\text{m}$

Data.3



MB SPARK



Double disc metal bond wheel for electro-discharge truing

MB SPARK

The next generation of double disc grinding systems

Suitable for surface quality improvement of elements used in automotive and household appliance in the progress of energy saving and miniaturization.

Extends the truing interval in combination with electro-discharge truing compared with conventional resin bond wheel.

■ Features

1. Metal bond wheel with excellent electro-discharge truing capability. Easy high-accuracy truing on a grinder.
2. Long lasting cutting performance and high-wear resistance.
3. Less industrial waste-stops sludge produced from wheel during truing.

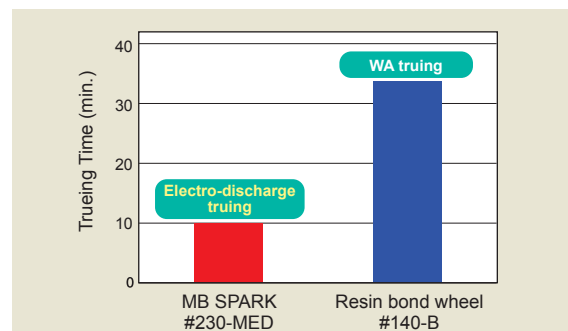
● Grinding Conditions

Grinder	Koyo KVD-300
Grinding Wheel	Ø305-75W-3X-Ø80H MB SPARK #230-MED Resin Bond Wheel #140-B
Workpiece	Oil pump component Powdermetal SMF4040
Wheel Rotation	Upper : 1500min ⁻¹ (C.C.W) Lower : 1500min ⁻¹ (C.C.W)
Total Stock Removal	0.2mm (both sides)
Rough Stock Removal	0.19mm (both sides)
Rough Grinding Speed	0.035mm/sec
Finish Stock Removal	0.01mm (both sides)
Finish Grinding Speed	0.015mm/sec
Spark out	2sec

□ High Truing Performance

- MB SPARK allows for shorter work time on grinder quick truing with high accuracy using special low-melting metal bond suitable for electro-discharge truing.
- Further benefits are attained with fine grit of superabrasive applied. Excellent flatness acquired in a short time frame.

● Comparison of Truing Performance



● 3 times longer tool life than conventional resin bond wheel

Electro-discharge Truing

Machine : Koyo Machinery

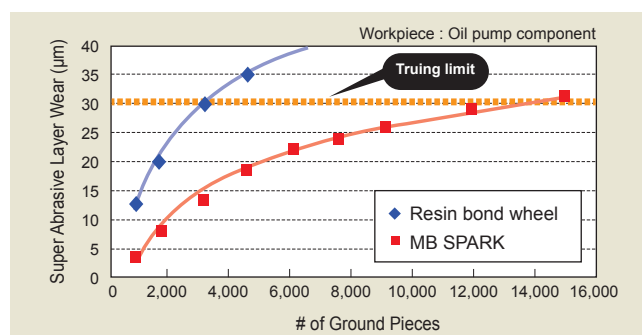
Discharge Electrode



□ Long Lasting Quality

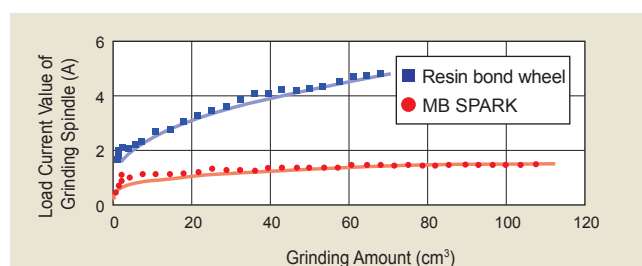
MB SPARK has higher wear resistance than conventional resin bond wheel and keeps flatness of super abrasive layer longer. Truing interval is extended and suitable for automated production line.

● Comparison of Grinding Capability



□ High Grindability

MB SPARK applies special metal bond suitable for double disc grinding. Its characteristic of high grit retention and surface retention of abrasive layer show excellent cutting ability to achieve improvement of process.



DPG Wheel

Patented Product



Divisible Cassettes Diamond/cBN Lapping Plate

DPG Wheel

Features

1. Environment

DPG (Diamond Pellet Grinding) Wheel is an environmentally friendly fixed abrasive tool, enabling replacing loose abrasive processing,

- 1) Reduce industrial waste dramatically
- 2) No clean-up with chloric organic solvent
- 3) Clean operating environment

2. High Efficiency

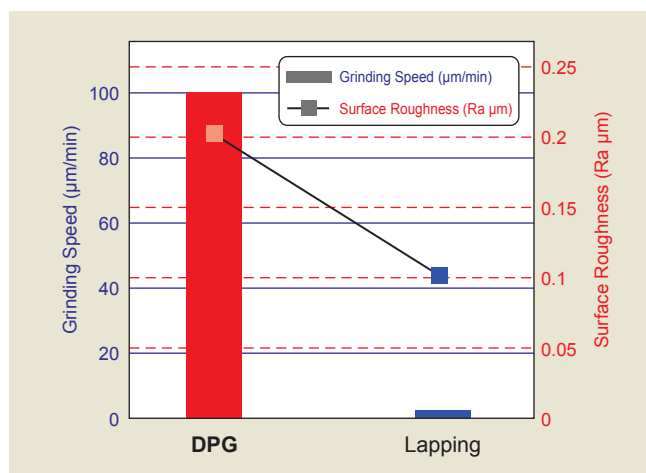
5 to 100 times faster grinding speed compared to loose abrasive lapping.

3. Cost Reduction

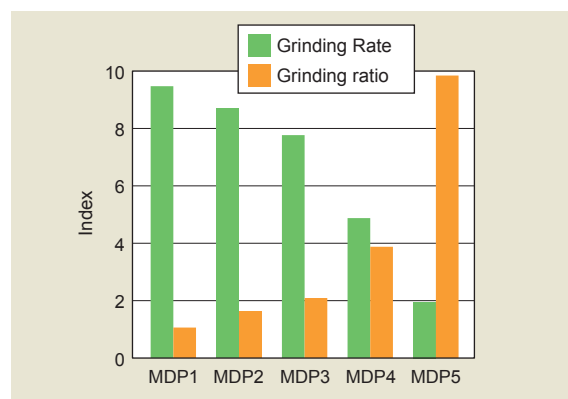
Reduce maintenance costs with long lasting plate and gear.

4. Process Reduction

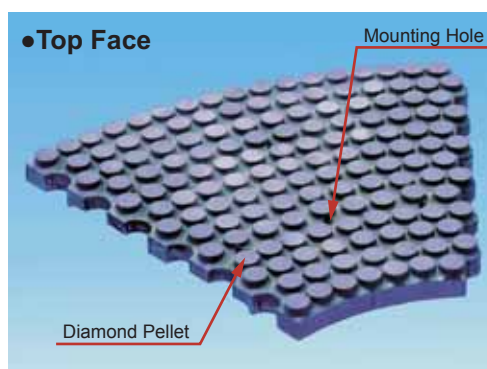
Integrate pre-grinding and lapping into one process



Grinding Performance of DPG wheel (MDP bond)



Cassette Plate (design registration)



① Reduction of replacing process for cassette plate

- No detaching base plate
- Divisible cassette fixed on base plate
- Short dressing time
(20 minutes : 9B, 1~2 hours : 16B)

② Pellet pattern keeps high accuracy grinding

- Divisible cassette designed for pellet layout
- Seams never interfere with the density of pellet distribution

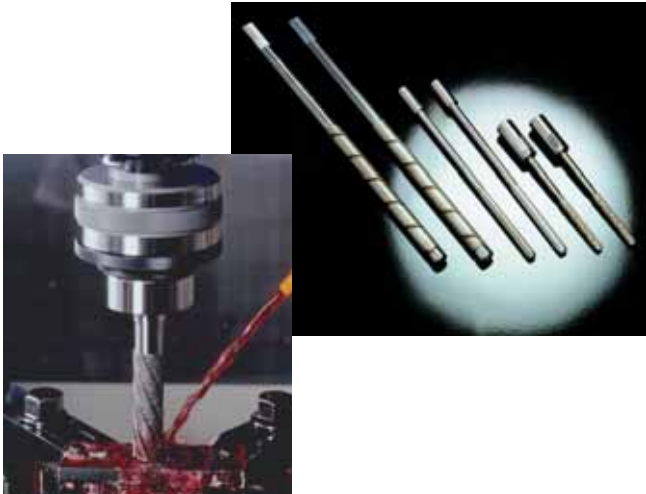
③ Free layout of coolant hole for top plate

- Coolant pool on clamp face

Size	Max. Dia.	Min. Dia.
4B	299	117
5B	389	213
6B	380	148
6B/9B	650	384
9B	637	218
12B	1058	360
13B	950	274
15B	1022	346
16B	1127	270
18B	1260	294
20B	1355	458
24B	1592	554
28B	1864	660

* Special sizes also available

Super Sizing



Highly efficient superabrasive reamer for high precision one-pass hole machining

■ Features

1. Capable of one-pass hole machining
2. High accuracy (roughness • roundness • cylindricity)
3. Reduction of rolled edge around lubricant hole or keyway
4. Skill is not required

■ Applications

- Hole finish machining of cast iron hydraulic component and automotive parts.

■ Possible Manufacturing Range

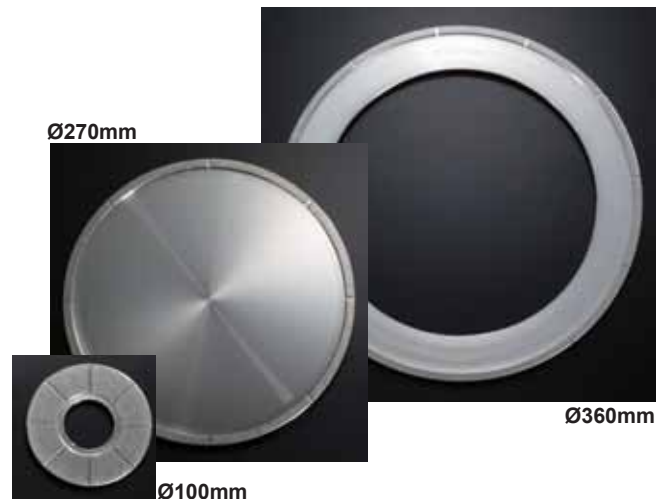
Abrasive	Diamond or cBN
Grit size	#60/80~#100/120
Tool dia.	Ø5~40 ±0.002mm
Run-out	0.005mm or less

* Some items even in its range cannot be produced depending on specifications.

■ Machining Application

Workpiece	: Hole finish machining of hydraulic components		
	: Dia. Ø18.5 H6 (+0.13,0)		
	: FC250 or equivalent		
Tool specification	: cBN80-P		
Tool size	: Ø18.5 0,+0.005		
Conditions	: Tool peripheral speed	7.6m/min	
	: Feed rate	26mm/min	
	: Removal stock	Ø0.01mm	
	: Coolant	Straight oil	
Results	: Hole roundness	0.002mm or less	
	: Hole cylindricity	0.004mm	
	: Roughness	Ry2.6µm	

CMP Conditioner



① High quality diamond

- Scratches caused by diamond crash can be minimized
- Uniformly-shaped diamond leads stable performance

② High precision body

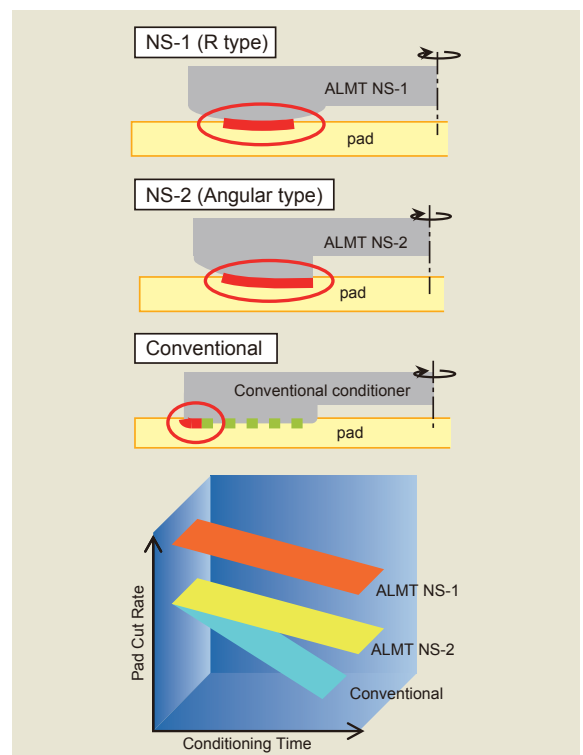
- Uniform contact with polishing pad

③ High precision electro-plating

- Complete single diamond layer
- Uniform distribution of the diamond grit creates the best surface condition of the pad and stable polishing performance

④ Dedicated production line

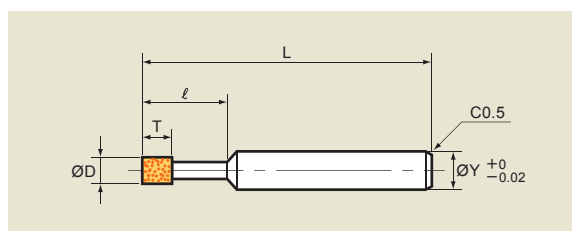
- CMP Conditioner is produced on a line isolated from other tools



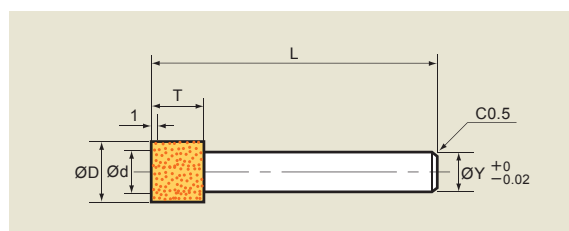
Diamond/cBN mounted points for internal grinding



W11



W12



CD code		D	T	ℓ	L	Grit #
W11003	SD	0.3	2	5	35	#800
W11004	SD	0.4	2	5	35	#400
W11005	SD	0.5	2	8	35	#400
W11006	SD	0.6	3	8	40	#200
W11007	SD	0.7	3	8	40	#200
W11008	SD	0.8	3	10	40	#200
W11009	SD	0.9	3	10	40	#200
W11010	SD	1.0	3	10	40	#200
	LD	1.0	3	15	40	#200
W11012	SD	1.2	5	10	45	#200
	LD	1.2	5	15	45	#200
W11013	SD	1.3	5	10	45	#200
	LD	1.3	5	15	45	#200
W11015	SD	1.5	5	10	45	#200
	LD	1.5	5	17	45	#200
W11017	SD	1.7	5	13	45	#200
	LD	1.7	5	20	45	#200
W11020	SD	2.0	5	13	45	#200
	LD	2.0	5	20	45	#200
W11023	SD	2.3	5	13	45	#200
	LD	2.3	5	20	45	#200
W11025	SD	2.5	5	13	45	#120
	LD	2.5	5	20	45	#120
W11030	SD	3.0	5	15	50	#120
	LD	3.0	5	22	50	#120
* W11060	SD	6.0	5	20	65	#120
	LD	6.0	5	27	65	#120

(Y=Ø3, But *Y=Ø6)

CD code		D	T	d	L	Y	Grit #
W12035	SD	3.5	5	—	60	3	#120
W12040	SD	4.0	5	—	60	3	#120
W12045	SD	4.5	5	—	60	3	#120
W12050	SD	5.0	5	2	70	3	#120
W12060	SD	6.0	8	3	70	3	#120
W12070	SD	7.0	8	4	70	6	#120
W12080	SD	8.0	8	5	70	6	#120
W12090	SD	9.0	8	6	70	6	#120
W12100	SD	10.0	10	7	100	6	#120
W12120	SD	12.0	10	9	100	10	#120
W12150	SD	15.0	10	12	100	10	#120

■ When ordering ■

- Please instruct CD code
- All items are in stock
- Special specifications available upon request.

Please instruct required sizes

(ex) W12050 SD L=100, Y=10,

- Code of mounted point

W12050 SD

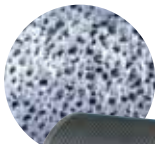
└─ D=Diamond
└─ B=cBN

Dresser

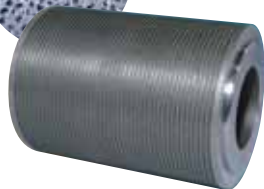


Rotary Dresser is a Diamond tool to form a conventional or cBN grinding wheels. Complex and Precise profile accuracy.

RZ Type



Our advanced and unique technology in high precision electro-deposition make it possible to accommodate complex and fine profiles. Diamond grits which fixed by reverse plating method are arranged randomly and its concentration is very high, so it is also suitable for longer life applications. Various optional specifications are also available.



SZ Type

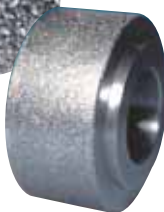


A rotary dresser with diamond grits arranged regularly made by the reverse plating method. Concentration of the diamond can be controlled according to requirements. The SZ Type provides efficient plunge dressing of large size rotary dressers.



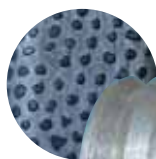
Z Type

The diamond grits of Z type rotary dresser are fixed on the precise body by use of electro-plating process. This type can be made relatively easily and is suitable for small lot production and trial production.



SX Type

SX type rotary dresser is produced by integration of our prominent technologies the original arrangement design of diamonds, the precise sintering technology and the excellent truing technology. Therefore SX type has a high valuation in grinding applications that require sharpness. It can also be effective in traverse dressing and contour dressing.



X Type

X type rotary dresser is a metal bond type impregnated with diamond grits. High performance is made possible by free selection of concentration and uniform distribution of diamond grits. This type is suitable for traverse dressing of our VITMATE and EG Wheel.



Rotary Dressers

□ Process grouping & possible production ranges

■ Process grouping

Item	RZ Type	SZ Type	Z Type	SX Type	X Type
Manufacturing Method	Electro-deposition	Electro-deposition	Electro-plating	Sintering	Sintering
Diamond Grit Distribution	Random	Regular	Random	Regular	Random
Applicable Grit Size	#20~#140	#16~#20	#30~#140	#16~#20	#30~#80
Profile	Complex Fine	Form	Form	Form	Cup Straight
Dress Method	Plunge	Plunge	Plunge Traverse	Plunge Traverse	Traverse
Principal use	● Bearing ● Injection Needles	● Shafts	● Gear Grinding	● Turbine Blades ● Camshafts	● Internal Grinding ● Centerless Grinding
Profile accuracy	◎	○	○	○	—
Surface Roughness	◎	○	○	○	△
Dressing Force	○	◎	○	◎	◎
Major Features	Highest precision/ Fine profile/Complex profile	Large diameter/ High dressing ability	Gear Grinding	Any concentration settable/ High dressing ability	Consistant dressing ability

■ Possible production ranges

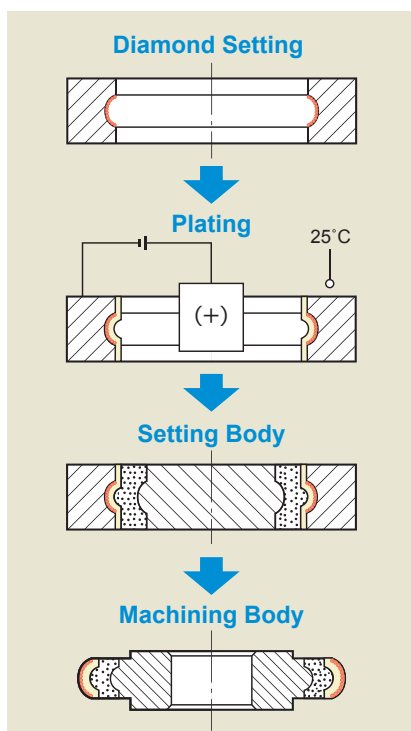
· Ranges vary depending on profile or specification etc

		50	100	150	200	250	300	(mm)
RZ Type	O.D.							Ø50~Ø200
	Width							200
SZ Type	O.D.							Ø50~Ø200
	Width							200
Z Type	O.D.							Ø10~Ø200
	Width							200
SX Type	O.D.							Ø20~Ø180
	Width							120
X Type	O.D.							Ø20~Ø300
	Width							150

□ Outline of Production Processes for Rotary Dressers

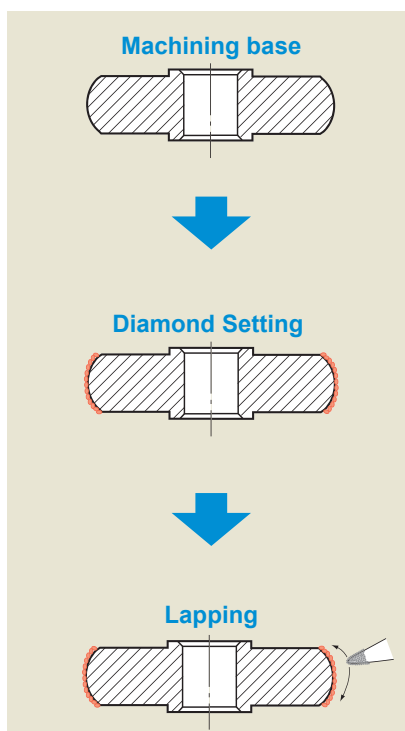
Electro-deposition Method / RZ · SZ Type

As the product is processed under room temperature, the accuracy is not changed by thermal expansion.



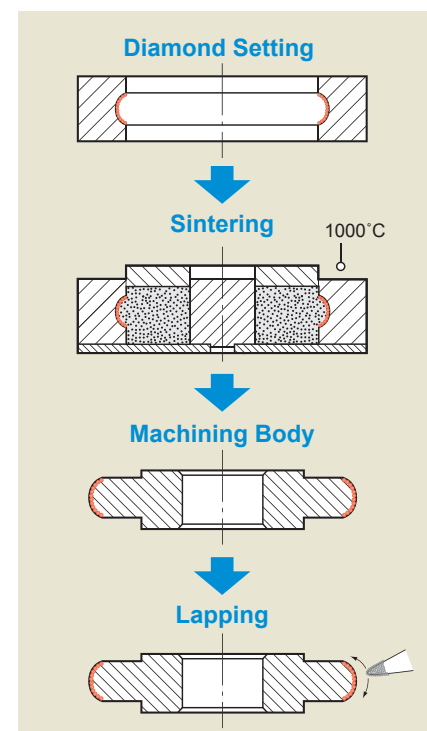
Electro-plating Method / Z Type

Diamond is fixed directly on the body and finished by on the surface of diamond layer.

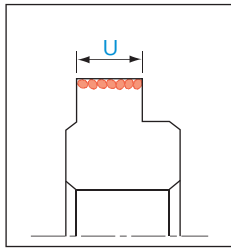


Sintering Method / SX Type

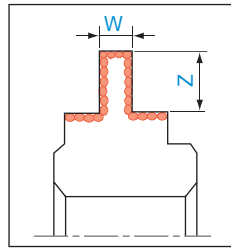
Surface of the diamond layer is lapped in the final process to achieve specified accuracy.



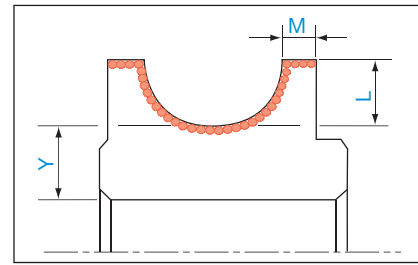
Tolerances of Rotary Dresser Designs (mm)



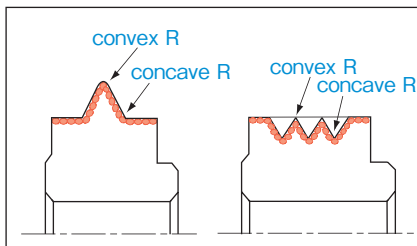
U Value	
RZ Type	≥ 10
SZ Type	≥ 10
SX Type	≥ 3
Z Type	≥ 3
X Type	≥ 3



W Value	
RZ Type	$\geq 0.5Z$
SZ Type	$\geq 0.5Z$
SX Type	$\geq 4Z$
Z Type	$\geq 4Z$
X Type	$\geq 2Z$

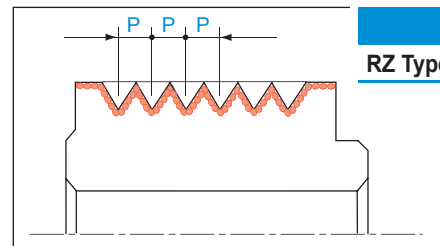


Y Value	M Value
RZ Type ≥ 10	$\geq L$
SZ Type ≥ 10	$\geq L$
SX Type ≥ 4	$\geq 0.5L$
Z Type ≥ 4	$\geq 0.5L$
X Type ≥ 4	$\geq 0.5L$



	*Convex R Value	*Concave R Value
RZ Type	≥ 0.1	≥ 0.03
SZ Type	≥ 0.2	≥ 0.15
SX Type	≥ 0.2	≥ 0.15
Z Type	≥ 0.3	≥ 0.3

*Value depending on diamond grain sizes



P Value
RZ Type ≥ 0.3

Accuracy of Rotary Dressers

Other tolerances available upon request

Item	Factor	Symbol	Accuracy (mm)	Illustration
Profile	Runout		0.005	
	Width	L	± 0.005	
	Radius	R	± 0.002	
	Step	S	± 0.001	
	Contour		0.002	
	Angle	θ	$\pm 2'$	
	Straightness	—	0.002	
	Pitch	P	± 0.002	
Body	Accumulative Pitch	nP	± 0.004	
	Bore	$\varnothing H$	$+ 0.005$ $- 0$	
	Parallel	//	0.002	
	Perpendicularity	\perp	0.002	
	Runout		0.002	

Optional Specifications of Rotary Dressers

Various options available upon request

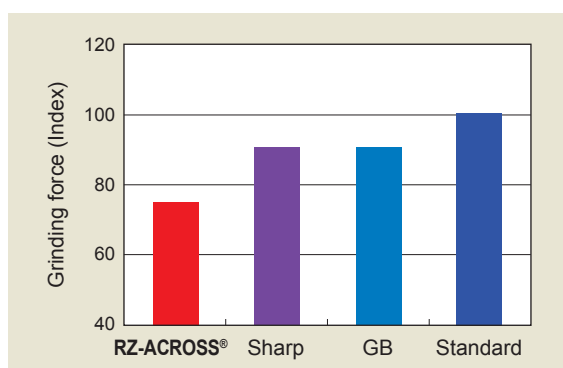
*Availability depending on profile or specification

Optional Specifications for RZ Type

1. Improved Dressing Ability (for fast dressing)

- **GB (controlled diamond concentration)**
High dressing rate with lower concentration by setting the glass balls for hard-to-concentration control electro-deposition type.
- **Sharp type (controlled diamond projection)**
Our unique process not by etching the bond layer realizes the diamond projection control without pulling-off the diamond grit.
- **RZ-ACROSS® (controlled diamond concentration)**
Improves the discharge of chips and coolant

■ RZ-ACROSS® Surface and Profile



2. Improving Wear Resistance (for longer life)

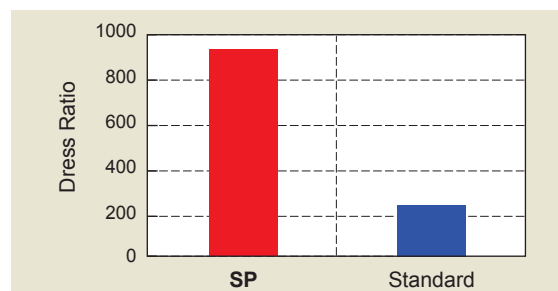
- **Strong**
Reinforcing the peak of convex portion by pre-shaped diamond stones leads stable accuracy and high wear resistance.

Optional Specifications for SX Type For Improving Wear Resistance

- **Super High Concentration**
By the unique pattern of diamond setting, maximum 100 pcs/cm² diamond stones provides longer life.
- **Strong**
Reinforcing the peak of convex portion by pre-shaped diamond stones leads stable accuracy and high wear resistance as same as RZ type.

Optional Specifications for Vitrified cBN Wheels (SP Type) Stable performance and longer life

- **SP**
Special development for high-wear-proof vitrified and cBN forming wheels performing stable dressing as well as long life. Available both for RZ and SX.



- **Polycrystalline Prism Diamond** Product : Crown dresser
Arranging isotropic polycrystalline prism diamond provides stable tool life and performance solving the problem of short life and instability caused by anisotropy and cleavage characteristic of mono-crystal diamond.

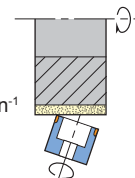


■ Dressing Example

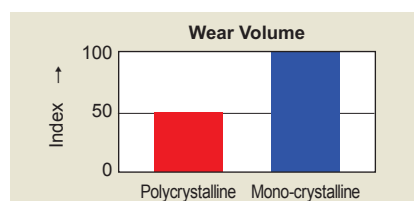
•Dresser : Monocrystalline, Polycrystalline

•Dressing Conditions

Wheel specs : cBN230G125V3 Ø30×20×5 1200min⁻¹
 RD specification : 0.4□ 2L 25pcs Ø25×18 250min⁻¹
 Dressing unit : Toolpet
 Feed rate : 240mm/min
 D.O.C. : 0.002mm/pass (Total 1.0mm in 500 dressing cycles)



•Results



*Mono crystalline shown with index of 100.

□ Inspection of Rotary Dressers

For higher accuracy . . .

Required accuracy of rotary dressers is becoming more strict, ranging from microns to submicrons. To ensure required accuracy, we have established an excellent inspection system with the most up-to-date equipment.

■ Description of Inspection

■ Inspection with transfer test pieces

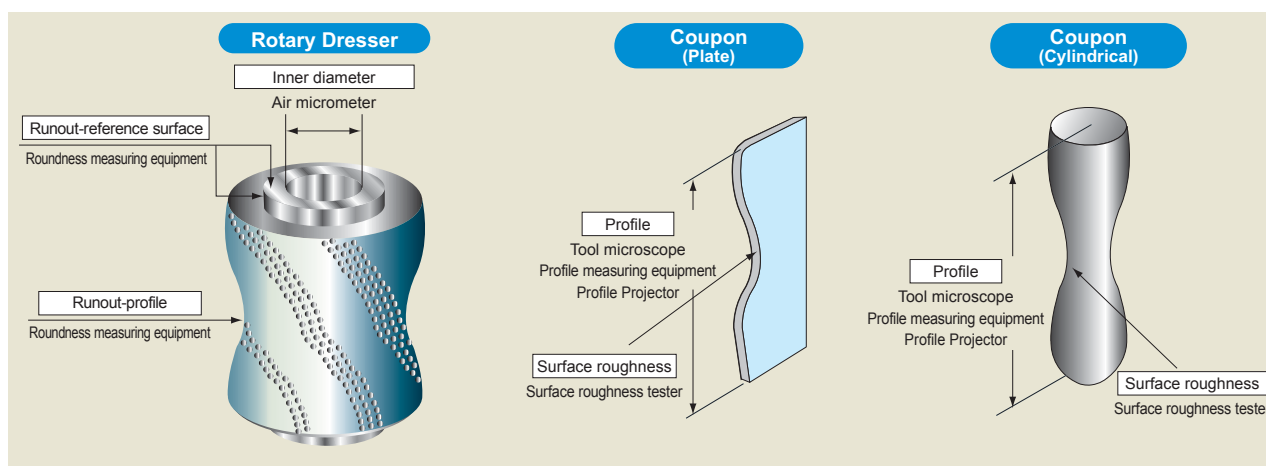
1. Measuring dimensional accuracy and profile
..... (tool microscope, profile measuring equipment, projector)
2. Surface roughness (surface roughness tester)

■ Body accuracy

1. Bore (Air micrometer)
2. Parallelism, squareness (Roundness measuring equipment)
3. Reference surface(control Ø) runout (Roundness measuring equipment)
4. Profile runout (Roundness measuring equipment)

■ Slip Test Results

An inspection sheet showing measurements taken by the transfer test is attached.



□ Recommended Dressing Conditions

■ Plunge Dress

	Conventional Grinding Wheel	Hard Conventional Grinding Wheel	cBN Wheel
Dress Direction	Down	Down	Down
Peripheral Speed Ratio	0.25~0.5	0.3~0.9	0.3~0.9
Dress Amount	0.02~0.03mm	0.02~0.03mm	0.01~0.015mm
Infeed Rate	0.5~1µm/rev.of wheel	0.1~0.5µm/rev.of wheel	0.01~0.5µm/rev.of wheel
Dress Out	0~3 sec.	0~3 sec.	0~3 sec.

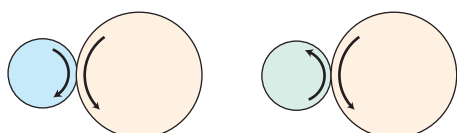
■ Traverse Dress

	Conventional Grinding Wheel	Hard Conventional Grinding Wheel	cBN Wheel
Dress Direction	Down	Down	Down
Peripheral Speed Ratio	0.25~0.5	0.3~0.9	0.3~0.9
Dress Amount	0.02mm	0.02mm	0.01mm
Infeed Rate	0.005~0.03mm/pass	0.003~0.005mm/pass	0.002~0.003mm/pass
Dress Out (Traverse cycles)	0~4times	0~4times	0~4times
Feed Rate	80~140mm/min	See below	See below

■ Feed Rate

Down Dressing

Up Dressing



Feed rate = C × RD width × grinding wheel revolution

$$\text{Peripheral speed ratio} = \frac{V_r}{V_s}$$

V_r (RD peripheral speed) = RD revolution (min⁻¹) × RD O.D. × π

V_s (grinding wheel peripheral speed) = grinding wheel revolution (min⁻¹) × O.D. × π

Operation	C
Standard	0.025~0.1
Efficient grinding High speed grinding	0.125~0.2
Centerless grinding	0.005~0.01

Technical Data

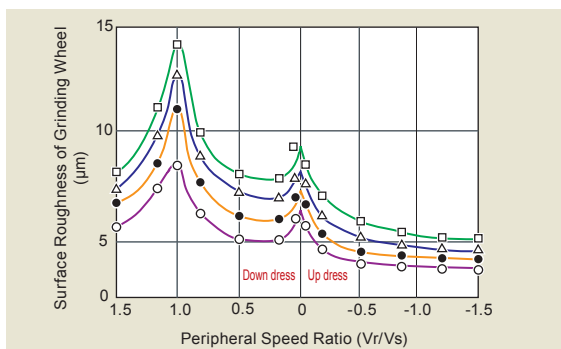
In dressing, the surface roughness of grinding wheels is influenced by elements such as:

1. Peripheral speed ratio (V_r/V_s), 2. Infeed per revolution of wheel (A_r), and 3. dress out (N_a).

1. Peripheral Speed Ratio

① Influence of Peripheral Speed Ratio on Grinding Wheel Surface Roughness

- Control of the grinding surface accuracy by up-dressing is easier than by down-dressing
- Higher feed rate creates more open grinding surface (grinding ability increases)



Test Conditions

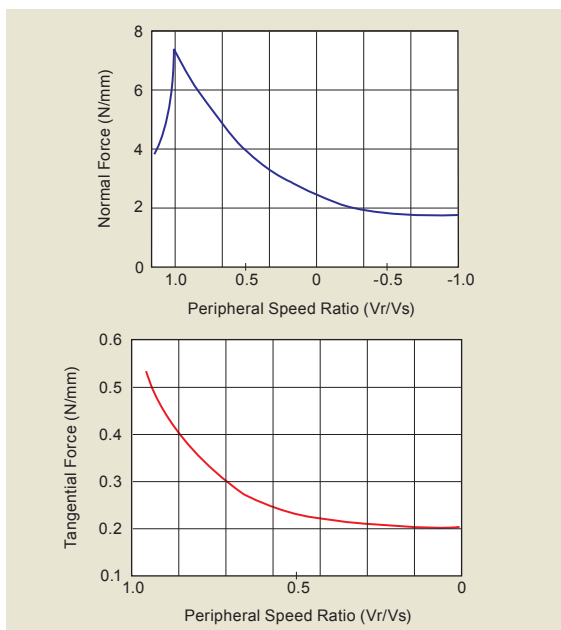
Grinding Wheel	WA60K
Rotary Dresser	#20/30
Grinding Wheel Peripheral Speed	$V_s=29\text{m/s}$
Dress Out	$N_a=0$

Infeed per rev. of grinding wheel

- $A_r = 0.18\mu\text{m/rev}$ (blue circle)
- $A_r = 0.36\mu\text{m/rev}$ (orange circle)
- $A_r = 0.54\mu\text{m/rev}$ (green triangle)
- $A_r = 0.72\mu\text{m/rev}$ (red square)

② Influence of Peripheral Speed Ratio on Dressing Force

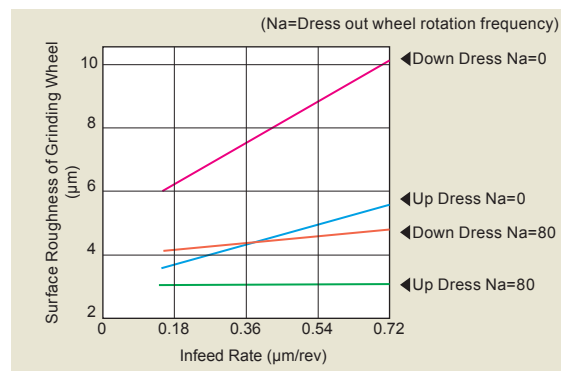
- Larger peripheral speed ratio allows higher normal force (increasing in grinding ability)
- Tangential force shows the same tendency as normal force, but the value is much smaller



2. Infeed Rate

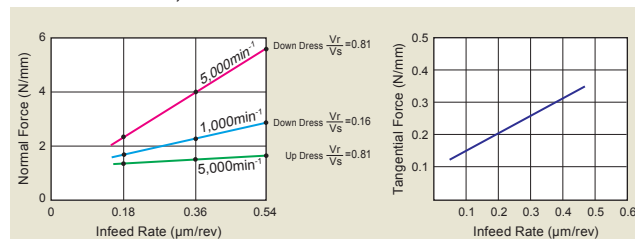
① Influence of Infeed Rate of Grinding Wheel Surface Roughness

- Higher feed rates create a more open grinding surface (grinding ability increases)
- Longer dress-out time diminishes sharpness of the grinding surface



② Influence of Infeed Rate on Dressing Force

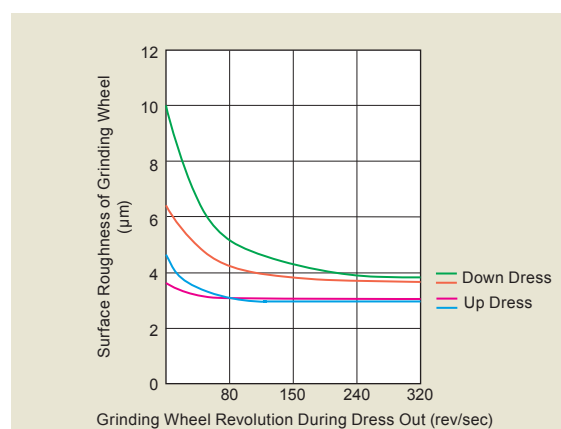
- Larger feed rate increases normal force (grinding ability increases).
- Tangential force shows the same tendency as normal force, but the value is much smaller.



3. Dress Out

Influences of Dress out on Grinding Wheel Surface Roughness

- Longer dress out time increases roundness of the grinding surface, but reduces sharpness.



Rotary Dresser for internal grinding machine

Straight Type



Model Number	S40-N	S40-C	S40-I
Profile			
Diamond layer	Disposition	CVD Prism	Inpregnated
Diamond size	100SPC	0.4×0.4	SD#40
Concentration	60pcs/Circumference	90pcs/Circumference	3.3ct/cm ³

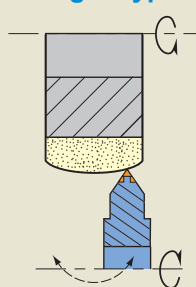
Cup Type



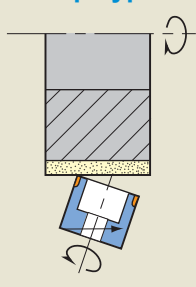
Model Number	C40-N	C40-C	C40-I
Profile			
Diamond layer	Disposition	CVD Prism	Inpregnated
Diamond size	100SPC	0.4×0.4	SD#40
Concentration	40pcs/Circumference	90pcs/Circumference	3.3ct/cm ³

Other sizes and specifications available upon request

Straight Type



Cup Type



Crown Dresser

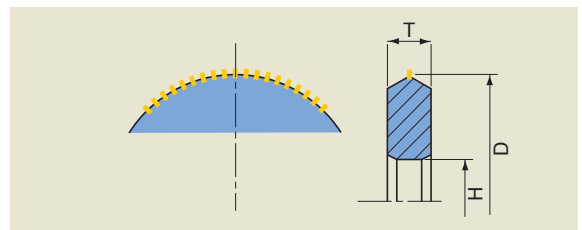
Features

1. CVD diamond provide high-wear-proof performance like monocrystal diamond.
2. Constant and stable active area with prism diamond.
3. Cost effective with no reworking.
4. Adjusting the diamond size and distribution enable to optimize the dressing performance.

Straight Type



	Size	CVD Size	Pitch
D	Ø35~180	0.2 [□] , 0.4 [□] , 0.6 [□] , 0.8 [□]	0.8~2mm
H	Ø 8~ 30		
T	6~ 20		

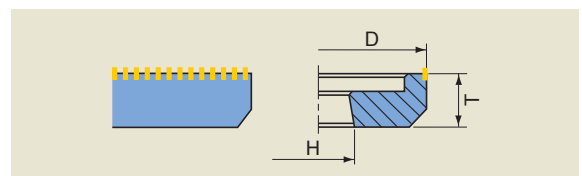


Cup Type



	Size	CVD Size	Pitch
D	Ø40~80	0.2 [□] , 0.4 [□] , 0.6 [□] , 0.8 [□]	0.8~2mm
H	Ø10~20		
T	15~20		

*Other sizes and specifications available upon request



Disc Dresser, CVD Ace Dresser

Diamond Disc Dresser



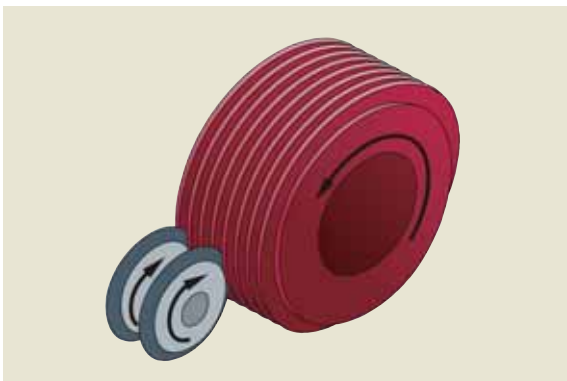
■ Features

Adopted precise electro-deposition and surface forming technique to obtain high accurate tooth profile forming

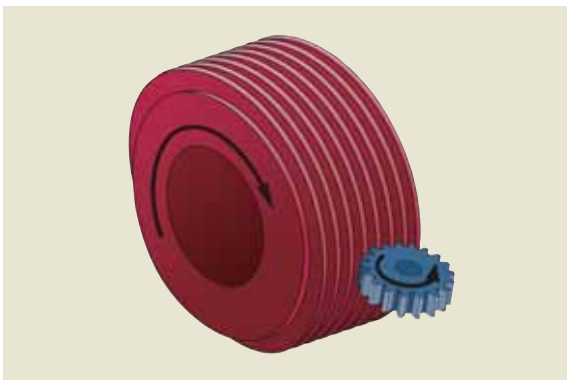
■ Application

- Tooth profile forming of gear grinding

Dressing for worm gear grinding wheel



Gear Grinding



CVD Ace Dresser

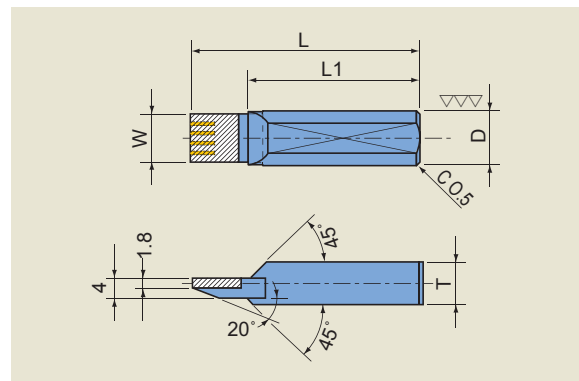


■ Features

1. Adopted CVD diamond for high-wear-proof like single crystal diamond
2. Prism diamond has fixed active area to maintain stable performance

(mm)				
L	L1	D	W	T
50	38	11	10	9

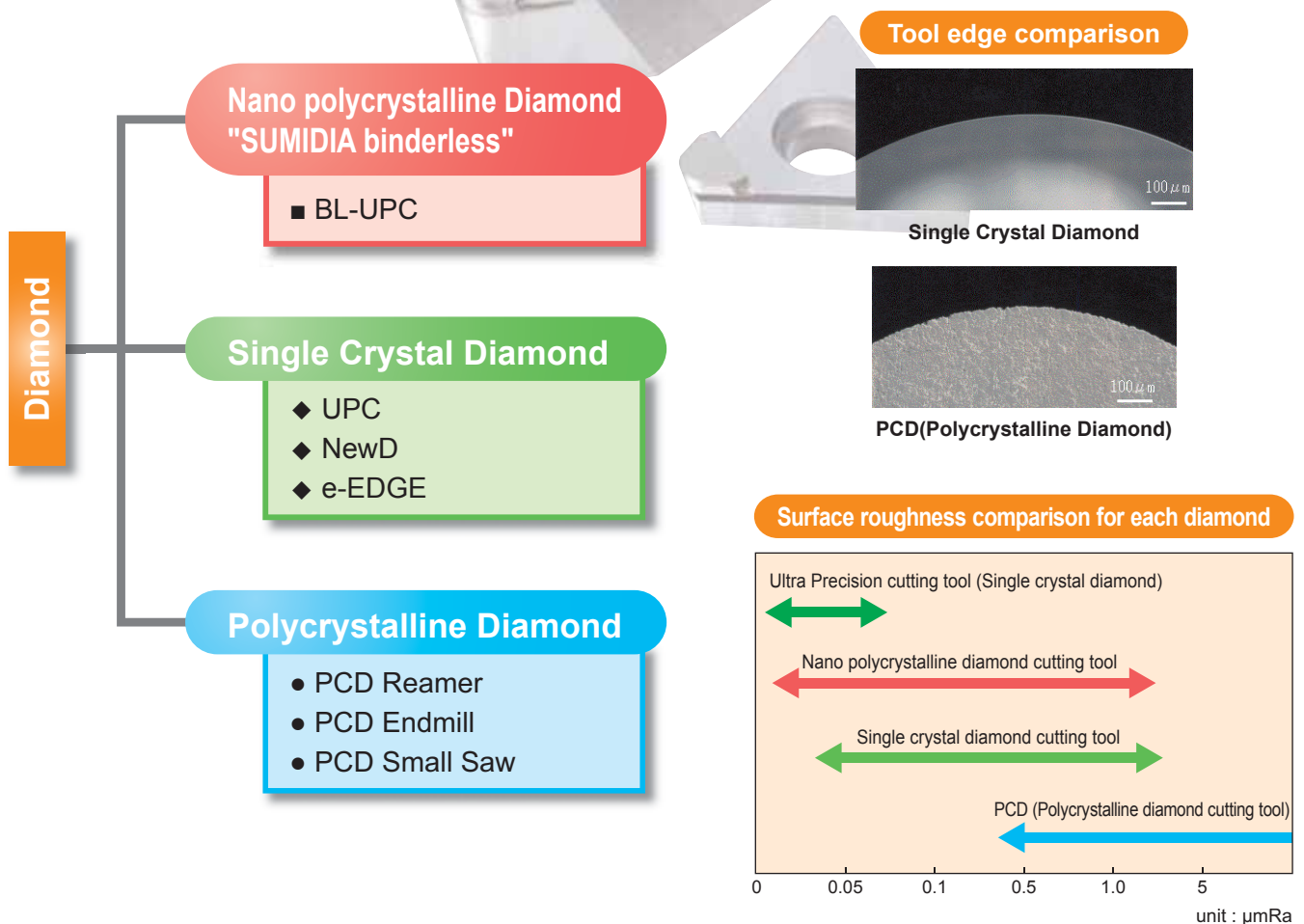
* Please contact us for special sizes



Cutting Tools



Diamond is superior to "hardness" and "thermal extensibility" as well as "sharp edge" created by polishing and that is the reason to be used as cutting tool material. Diamond cutting tools show ultra-precision, long tool life, high-efficiency and high precision cutting process through its features.



Ultra Precision Cutting Tools

Nano/Microforming Tools

Ultra-Precision Cutting Tool UPC®

A.L.M.T. Corp., as a leading manufacturer of ultra-precision diamond cutting tools, offers a broad range of nano- and micro-forming cutting tools to meet market needs.

Our many years of experience and extensive knowledge give us a comprehensive understanding of the optimal physical properties of single crystal diamond.

Our state-of-the-art development process yields the highest precision in tool edge measurement. As a result, our diamond cutting tools achieve high-precision microscopic cutting of workpieces in the order of nanometers.

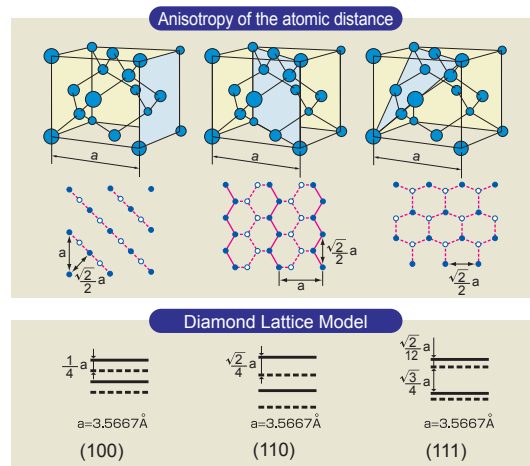


Identification and Measurement Technology

Identify the anisotropy of atoms in single crystal diamond and pursue the best crystal orientation

Creation of tools pursuing cutting edge sharpness in the order of nanometers starts with the screening and selection of single crystal diamond.

The lattice constant of diamond is always 3.5667 Å, but the distance between crystal faces varies, causing differences in the ease of cleavage and intrusion of impurities. Therefore, sorting of rough diamonds is important in addition to the identification of crystal orientation according to the machining conditions.



Diffraction image of (100) plane

Polishing and Measurement Technologies

Cutting edge polishing technology that produces nanometer-controlled movement

In order to accurately produce nanometer-controlled movement on a workpiece, a cutting tool requires a sharp cutting edge capable of producing nanometer-sized chips and high profile precision.

We have achieved this using our unique polishing and measurement technologies.

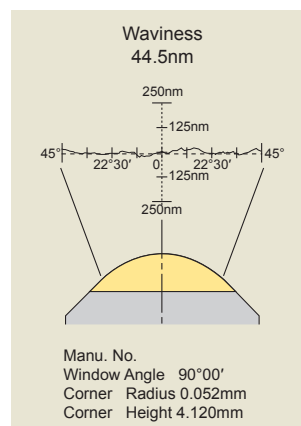
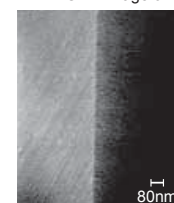


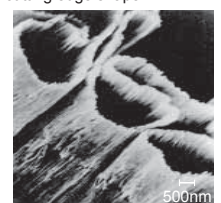
Chart of inspection using our originally-developed profile meter



SEM image of UPC-R cutting edge shape



Sharply-polished single crystal diamond cutting edge



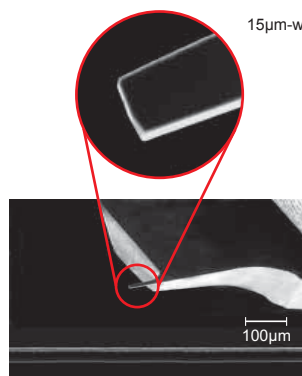
Nanometer-sized chips

Nano/Micro Processing Technology

Straightness and surface roughness unattainable with photolithography or ion-beam method

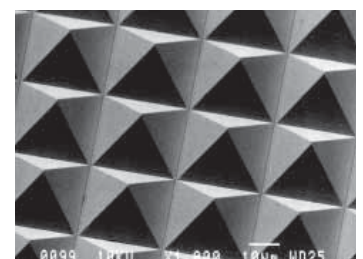
With its cutting edge sharpness in the order of nanometers, A.L.M.T.'s UPC-Nano series achieves a surface roughness and straightness that cannot be obtained by the photolithography or ion-beam method.

This technology is also effective for micrometer-order processing of high aspect ratio.



15µm-wide Nano endmill tip

Polished surface shown in the same magnification



Molds surface by microforming

SUMIDIA Binderless (Nano-Polycrystalline Diamond)

Ultra-Precision Cutting Tool / BL-UPC**Employs SUMIDIA® Binderless on the edge of UPC®****Achieves long tool life in mirror finish and fine machining of carbides****■ Features of SUMIDIA® Binderless**

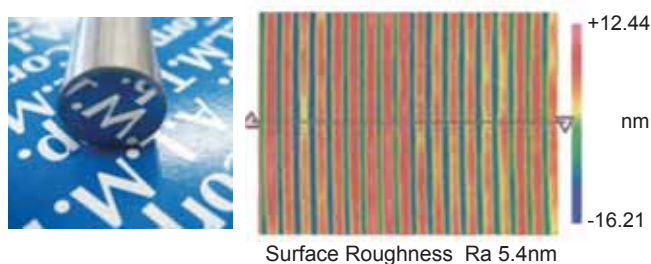
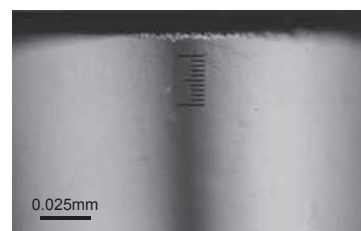
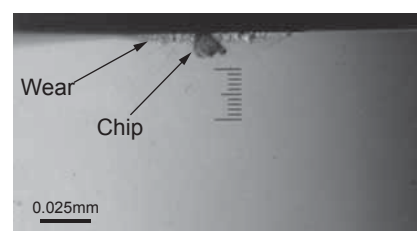
- Fine grains of several tens of nanometers are firmly and directly bonded together without binder.
- Harder than mono crystalline diamond.
- No anisotropy and specific cleavage.

■ Features of BL-UPC

- Superior chipping and wear resistance compared to single-/poly- crystal diamond.
- Sharp and precise cutting edge equivalent to UPC® (Single crystal diamond).
- Free from uneven wear caused by crystal orientation due to no anisotropy.

■ Applications

- Molds for carbide glass lenses
- Large molds for prism sheets and light guide plates
- Glass lenses
- Machining of other high-hardness and brittle materials

Surface roughness of cemented carbide**□ Sharp Cutting Edge Equivalent to Single Crystal Diamond****□ Flank Wear Comparison of Machined Carbide****BL-UPC****No Large Chipping Found****UPC® (Single Crystal Diamond)****Large Chipping Found****□ Comparison of Required Characteristics for Cutting Tool Materials**

Required Characteristics	Diamond		
	Single Crystal	Polycrystalline	Nano-polycrystalline
① High Hardness	◎	◎	◎
② High Temperature Hardness	○	○	◎
③ Suitable Toughness	×	△	○
④ High Thermal Diffusibility	◎	○	◎
⑤ Sharpness of Cutting Edge	◎	×	○

"SUMIDIA®" is a registered trademark of Sumitomo Electric Industries, Ltd.

UPC

For ultra fine grooving

UPC®-Nano groove

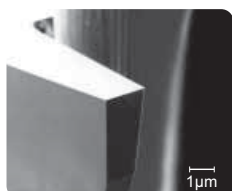
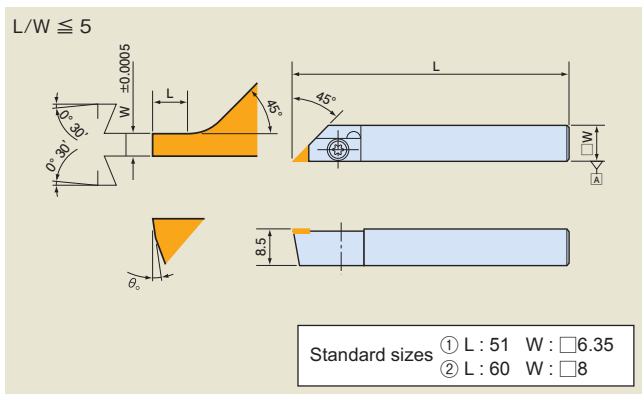


■ Features

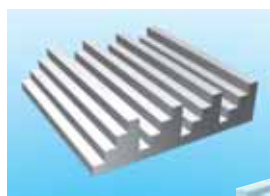
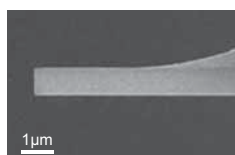
1. The world's smallest grooving tool with a cutting edge width of 0.9μm
2. Provides the world's highest dimensional accuracy of $\pm 0.5 \mu\text{m}$
3. High-precision-polished durable cutting edge
4. Enables high-precision fine grooving that cannot be achieved using the photolithography or ion-beam method

■ Applications

1. Hologram diffraction grating molds
2. Fine linear grooving
3. Molds with fine grooves
4. Optical sheet molds



Cutting edge of 900nm width



Endmill (Square type)

UPC®-Nano endmill

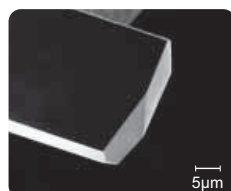
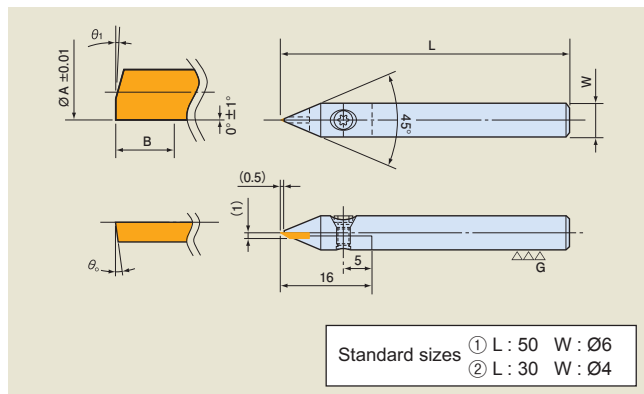


■ Features

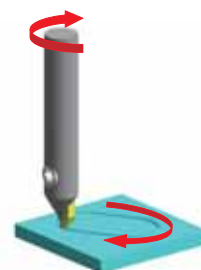
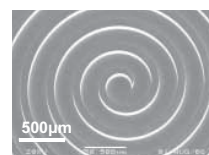
1. Enables the world's thinnest-in-its-class 30-μm wide flexible grooving
2. Enables machining with a high aspect ratio of 2.5 times the rotation diameter
3. High-precision-polished durable cutting edge
4. Enables high-precision fine grooving that cannot be achieved using the photolithography or ion-beam method

■ Applications

1. Hologram grating
2. Fine free curve grooving
3. LCD light guide plate molds
4. Micro machine parts grooving



Process example of Nano endmill



Endmill (Ball type)

UPC®-Nano ballendmill

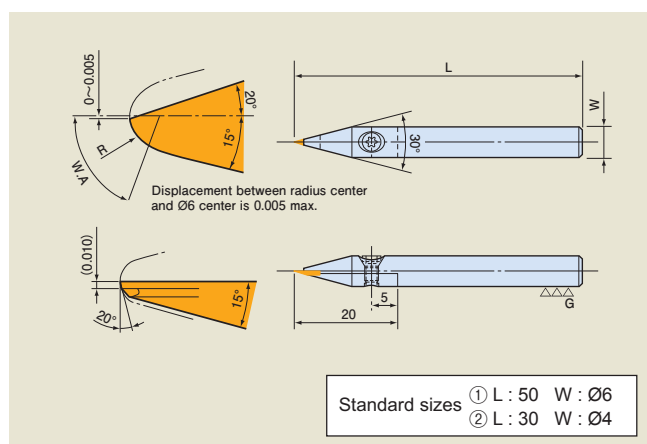


■ Features

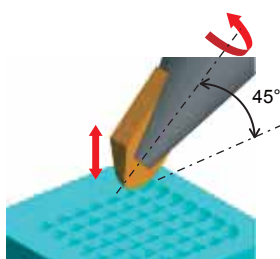
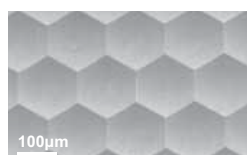
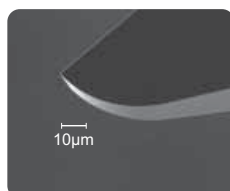
1. The world's smallest-in-its-class ballendmill with $R=30\mu\text{m}$
2. Provides the world's highest profile of 50nm
3. Enables high-precision 3-D machining with its extremely sharp cutting edge

■ Applications

1. Micro lens array
2. Free-form submillimeter lens
3. LCD light guide plate molds
4. Micro machine parts grooving



Process example of Nano ballendmill



Form type

UPC®-Nano Profile



■ Features

1. Enables flexible one-pass machining of free-form surfaces including elliptical and paraboloidal surfaces with a form accuracy of $1\mu\text{m}$ or less
2. Ensures high form accuracy in machining of paraboloidal and other free-form surfaces

■ Applications

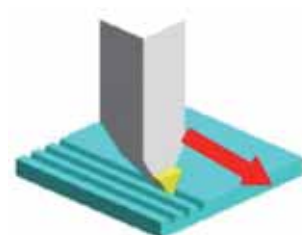
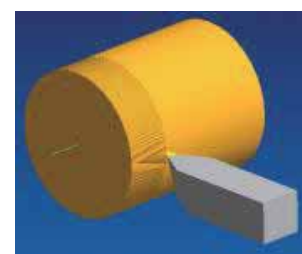
1. Optical sheet molds for LCD panels
2. Micro lens array molds
3. Various optical element molds



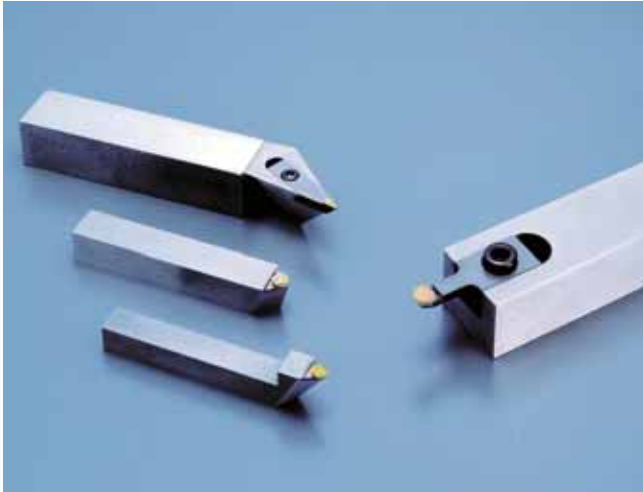
Elliptical cutting edge



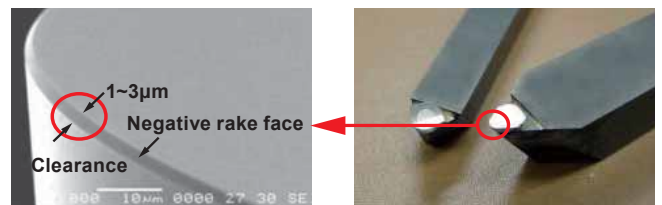
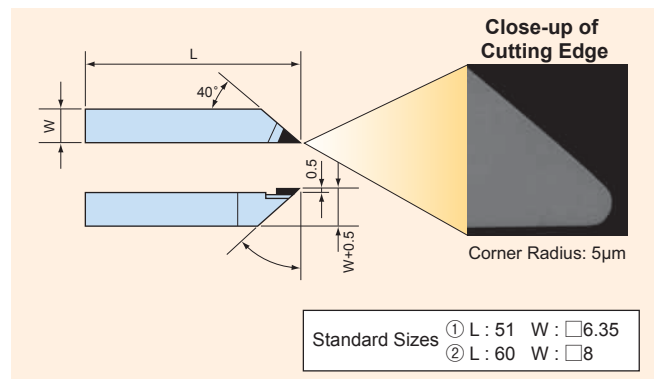
Parabolic cutting edge



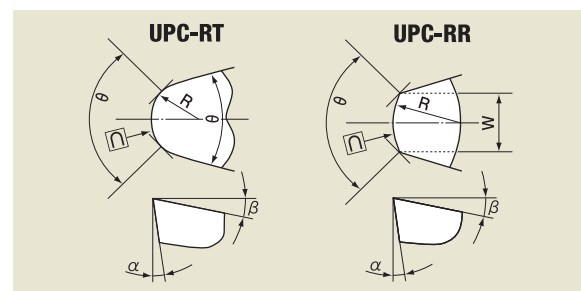
UPC®-R



Infrared lens, UPC cutting edge for cemented carbide

Uniform negative rake face on cutting edge
(patent pending)

Tool Nose Shape



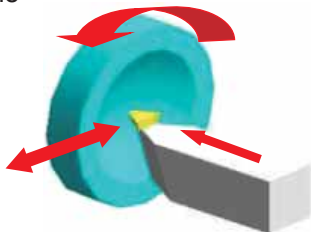
UPC-R shows extraordinary success in ultra precision spherical and aspherical cutting applications.

Features

1. Achieves an edge arc profile of 50nm (0.05μm) over a wide working angle range of 90°.
2. The cutting edge is uniformly finished in high quality, achieving a surface roughness in the order of nanometers.
3. A record of the edge arc profile measured with our originally-developed measuring instrument (with a resolution of 5nm) is attached to the product for thorough quality control.

Applications

1. Camera lens molds for CD, DVD, and BD players
2. Lens molds for digital cameras
3. Camera lens molds for smartphones, PCs, and tablets
4. Infrared lens
5. Spherical and aspherical mirrors for lasers and X-rays
6. Various spherical and aspherical lenses
7. Profile processing using an ultra-precision processing machine



Dimensions & Limit Precision

Type		Contour \square			Corner Radius R	Tool Edge Angle θ	Tool Width (RR)	Clearance Angle α	Rake Angle β
		$\theta \leq 90^\circ$	$\theta \leq 120^\circ$	$\theta \leq 150^\circ$					
UPC-R	Ultraprecision SS	0.05μm	0.1μm	0.20μm	0.002 ~ 200	min 15°	0.5 ~ 5	0°~20°	-30°~10°
	Precision S	0.25μm	0.5μm	1μm					

UPC®-F



Exhibits its potential in high-efficiency ultra-precision cutting into plane and cylindrical shapes

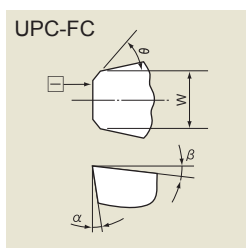
■ Features

1. Drastically reduces or dispenses with running-in processing time.
2. You can obtain uniform, high-quality worked surfaces by setting the roundness (sharpness) of the cutting edge according to the work material and processing conditions.

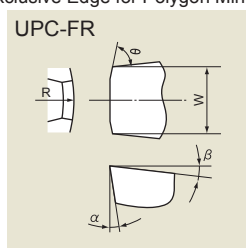
■ Applications

1. Laser reflective mirrors
2. Polygon mirrors
3. Photosensitive drums of copying machines
4. Plane and cylindrical mirror finishing

□ Cutting Edge



Exclusive Edge for Polygon Mirrors



□ Dimension and Highest Accuracy

Type	Tool Edge Angle θ	Tool Width	Clearance Angle α	Rake Angle β	Side Rake Angle γ	Rake Face R
UPC-FC	45°~80°	1.0~4.0	0°~5°	-5°~0°	0°~15°	—
UPC-FR	10°~45°	2.0~4.0	2°~5°	0°	0°	30~40mm



UPC®-T



Ideal for fine grooving such as that for Fresnel lenses

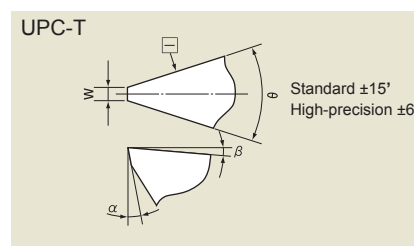
■ Features

1. The cutting edge is uniform and extremely sharp, free from chipping and undulation.
2. Guarantees the cutting edge shape in the order of submicrons.

■ Applications

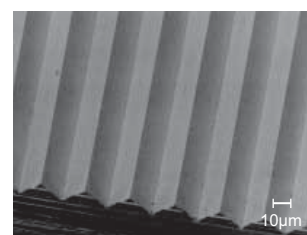
1. LCD light guide plate molds
2. Fresnel lens molds
3. Optical sheet molds
4. Various diffraction grating molds
5. Other fine grooving

□ Cutting Edge



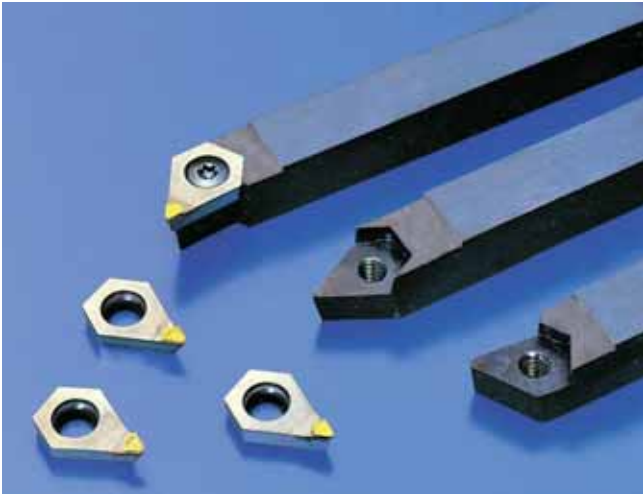
□ Dimension and Highest Accuracy

Type	Tool Edge Angle θ	Angle Tolerance	Leading Edge Width	Clearance Angle α	Rake Angle β
UPC-T	Ultraprecision SS	less 45°	±6'	min 0.2μm	0°~15°
	Precision S	min 45°	±15'	Sharp Corner	



Molding of LCD display optical waveguide

New D Tools



NewD Tools

Achieves stable and long tool life by measuring and optimizing the crystal orientation.

■Features

1. Less dispersion in tool life, which is a weakness of single crystal diamond tools, and 1.5 to 2 times longer tool life than conventional tools on average.
2. The combination of our originally-designed inserts and holders enables easy and precise tool setting like indexable inserts.
3. There are inserts for straight cutting and those for curved-surface copying. The form accuracy of the latter is $5\mu\text{m}$.
4. The rake face is free from adhesions and accumulation of chips and maintains the high quality of worked surfaces even during continuous use.
5. The diamond is firmly attached by a unique brazing method.
6. Exhibits high durability even during interrupted cutting.
7. Unlike the conventional type with a retaining cap, there is no retaining cap to hold the diamond, enabling chips to move smoothly on the rake face, improving the machining accuracy.

■Applications

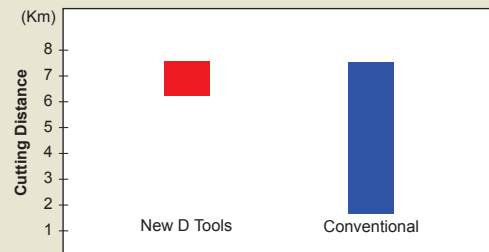
- Automotive components (pistons, aluminum wheels, compressors, commutators, etc.)
- Plastic lenses, resin parts
- HDD parts
- Aluminum die cast alloys, other non-ferrous metals

□Performance of New D Tools

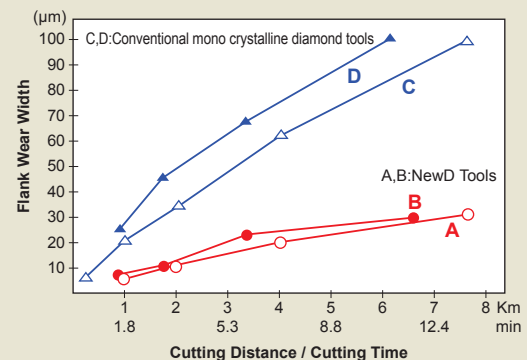
●Conditions (Data 1, 2)

Cutting Speed	565m/min	Feed Rate	0.2mm/rev
Depth of Cut	0.12mm	Coolant	Alcohol oil mist
Work Material	High-silicon aluminum alloy (Si:18%)		

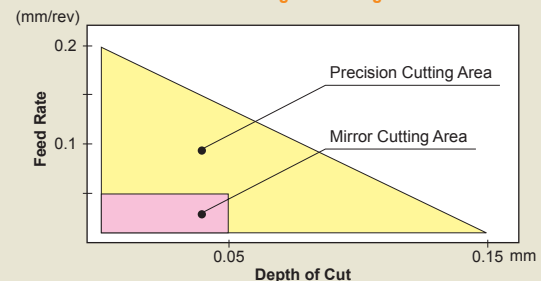
Data 1 Tool Life and Stability Comparisons (Interrupted Cutting)
(Cutting Distance When the Flank Wear Width is $30\mu\text{m}$)



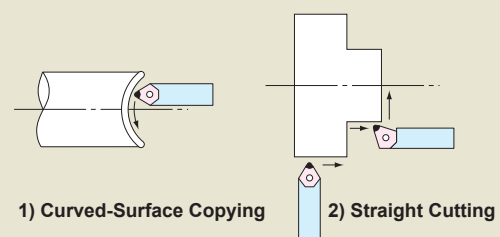
Data 2 Tool Life Comparison for Interrupted Cutting



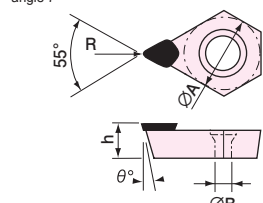
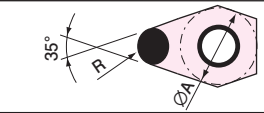
Data 3 Recommended Range of Cutting Condition for New D Tools



●Example of Cutting



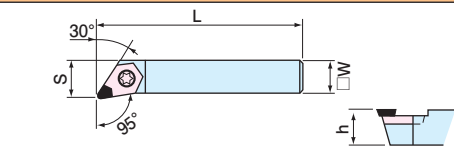
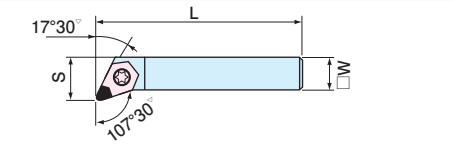
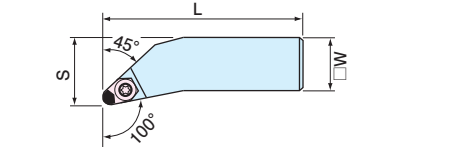
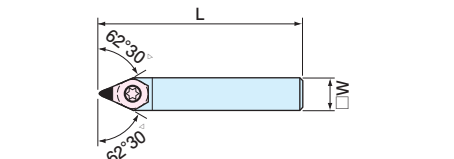
□ Insert Types (inventory items)

Insert Specifications	Types		Corner Radius	Clearance Angle θ	I.C. $\varnothing A$ (mm)	I.H. $\varnothing B$ (mm)	Thickness h (mm)	Holder
	Long Life Type	*1 Precision Type						
When ordering NWD - Chip CD NWD-C L 3 02 Corner radius R0.2 Tool angle 55° I.C. $\varnothing 9.525$ Long life type (Precision type is "P") 	NWD-CL302	NWD-CP302	R0.2	7°	$\varnothing 9.525$	$\varnothing 4.4$	$+0.2$ $4-0$	NDH-R1□ -L1□ -N1□ NDH-QR1□ -QL1□
	NWD-CL305	NWD-CP305	R0.5					
	NWD-CL308	NWD-CP308	R0.8					
	NWD-CL310	-	R1.0					
	NWD-CL316	-	R1.6					
	NWD-CL320	-	R2.0					
	NWD-PL302	NWD-PP302	R0.2	11°	$\varnothing 6.35$	$\varnothing 2.8$	$+0.2$ $3-0$	NDH-R0□ -LO□ -NO□
	NWD-PL305	NWD-PP305	R0.5					
	NWD-PL308	NWD-PP308	R0.8					
	NWD-PL202	NWD-PP202	R0.2					
	NWD-PL205	NWD-PP205	R0.5					
	NWD-PL208	NWD-PP208	R0.8					
	*2 For aluminum wheels			7°	$\varnothing 9.525$	$\varnothing 4.4$	$+0.2$ $5.5-0$	NDH-R20V -L20V -R25V -L25V
	NWD-CL416	NWD-CL416-AW	R1.6					
	NWD-CL420	NWD-CL420-AW	R2.0					
	NWD-CL425	NWD-CL425-AW	R2.5					

*1 : Precision type/cutting edge contour precision 5 μ m or less

*2 : Special process to cutting edge

□ Holder Types (inventory items)

Holder Specifications	Types		Size (mm)				Insert
	Right Hand	Left Hand	W	L	S	h	
	NDH-R06	NDH-L06	6	50	6.5	6	NWD-PP2□□
	NDH-R08	NDH-L08	8	60	8.5	8	-PL2□□
	NDH-R10	NDH-L10	10	80	10	10	NWD-CL3□□
	NDH-R12	NDH-L12	12	100	12	12	-PL3□□
	NDH-R16	NDH-L16	16	125	16	16	-CP3□□
	NDH-QR10	NDH-QL10	10	80	13	10	-PP3□□
	NDH-QR12	NDH-QL12	12	100	15	12	
	NDH-QR16	NDH-QL16	16	125	19	16	
	NDH-R20V	NDH-L20V	20	150	25	20	NWD-CL416
	NDH-R25V	NDH-L25V	25	150	32	25	-CL420
							-CL425
	Free						
	NDH-N06		6	50	-	6	NWD-PP2□□
	NDH-N08		8	60	-	8	-PL2□□
	NDH-N10		10	80	-	10	NWD-CL3□□
	NDH-N12		12	100	-	12	-PL3□□
	NDH-N16		16	125	-	16	-CP3□□

Please inquire for specifications except the above in the case of an order

When ordering
NDH - Holder CD NDH-R 0 6 □6 Right Hand (Left Hand is "L")

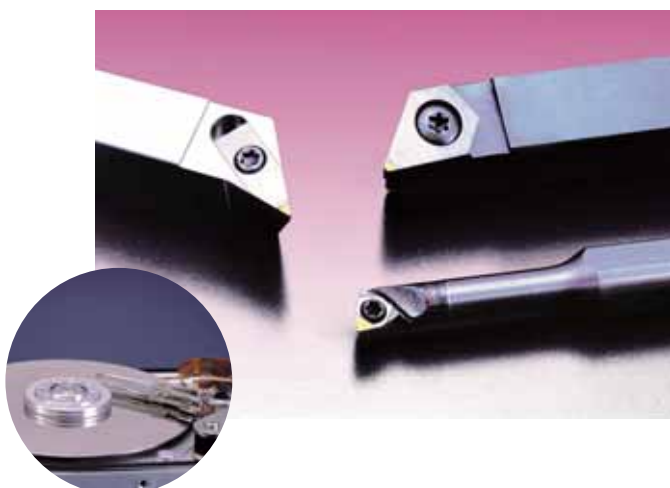
NewD e-EDGE

Patent granted

To meet customer's demands for low cost and green operation, we introduce the NewD e-EDGE for multi-purpose single crystal cutting tool for aluminum.

■ Features

1. Low cost / high performance
2. Special holder for HDD aluminum die cast part and internal cutting in stock
3. Special inserts for existing holders
4. Sharp cutting and very good cutting heat diffusibility (compared to poly crystalline diamond)



Ultrasonic vibration cutting system

Ultrasonic vibration cutting device

EL-50Σ

Product of Taga Electric Co.,Ltd.



■Features of EL-50Σ

1. High frequency around 41kHz makes 1μm or more elliptical vibration
2. Ultra precise technique of automatic tracking for elliptical vibration route with lower than 1nm precision
3. Small vibrator can be attached to ultra precision machine or machining center
4. Work with AC 100V and no need for special installation work

□Specifications outline

Main specifications of EL-50Σ

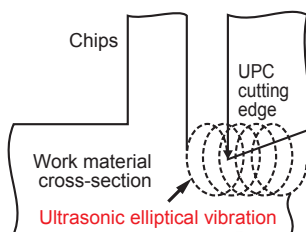
Frequency	41kHz ±1.5kHz
Oscillation of elliptical vibration	1μm-p~4μm-p variable Actual value of oscillation stability : 2nm or less
Max. ultrasonic power	45Wmax
Main controller sizes	W433×H140×L473 14Kg 1unit
Sizes of ultra precision bipolar amplifier	W200×H261×L400 16Kg 2units
Oscillation sizes	W74×H50×L160 1Kg 1unit
Applicable tools	UPC for EL-50Σ

Ultra precise diamond cutting of harden steel, cemented carbide and glass is possible with dedicated UPC

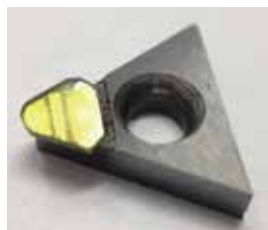
■Features of elliptical vibration cutting

1. Mirror finish cutting of harden steel and stainless
2. Stable mirror finish cutting of cemented carbide and glass
3. High accurate corner cutting

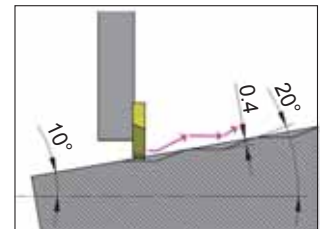
Image of ultrasonic elliptical vibration cutting



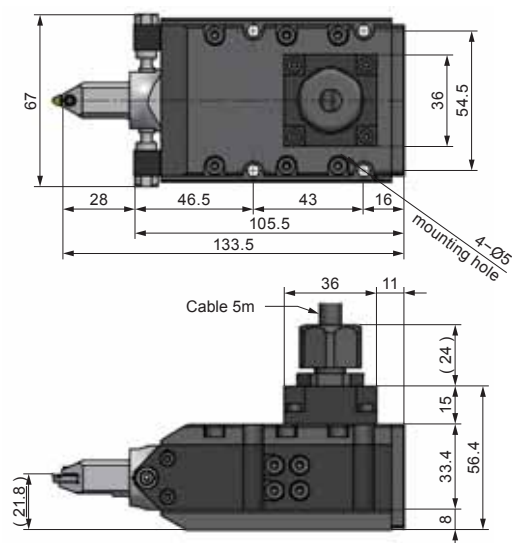
UPC for EL-50Σ



□Process application for mirror finish of harden steel(STAVAX 52HRC)



□Outer drawing of vibrator



Mirror finish of cemented carbide



Ultra precision cutting of optical glass



Ultrasonic vibration cutting device is jointly developed by Nagoya Univ. and Taga Electric Co.,Ltd.

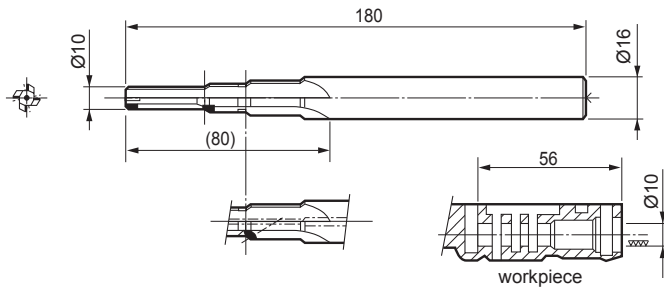
PCD Rotating Tool



■ Features

1. Multiple parts can be machined in a single pass by using an integrated formed step tool.
2. Adoption of diamond offers significantly-improved tool life (10 times or longer than that of carbide ones).
3. Excellent machining surface can be obtained even with cutting speeds at over 300m/min.
4. Stable cutting is possible even when using emulsion-type water-soluble coolant. (Semi-dry cutting is also possible according to your environment.)

□ Application of PCD reaming (Reaming of automotive hydraulic regulator valves)



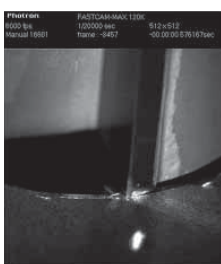
Item	PCD Reamer	Carbide Reamer
Cutting Speed (m/min)	120	120
Feed Speed (mm/Rev)	0.2	0.2
Machining Allowance (mm/dia.)	0.4	0.4
Coolant	water-soluble	oil-based
Surface Roughness (μmRz)	3	8
Circularity	5	10
Running Cost Ratio	0.5	1

■ Data 1 Improvement of Productivity by Breaking Chips

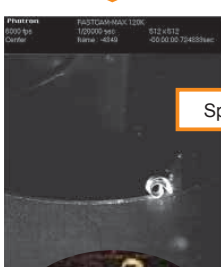
Negative Land Specification Cutting Edge



The breaker function is enhanced to prevent a reduction in productivity due to problems caused by chips. Solutions are proposed according to the type of chip problem.



Without chipbreaker



Split cutting chips

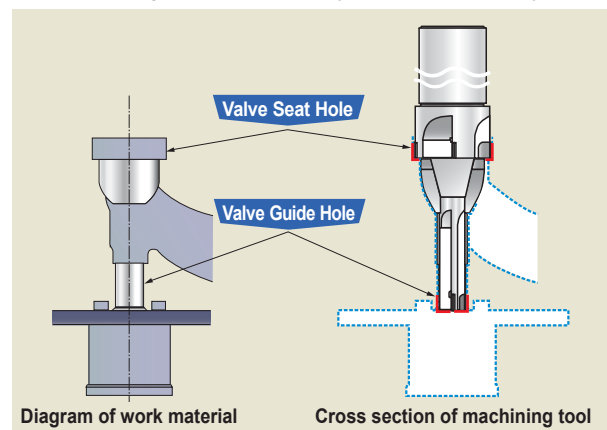
Chips curl thickly and split



With chipbreaker

■ Data 2 Capable of both high-efficiency and high-precision machining

The coaxiality and cylindricity of the cutting edge have greatly improved due to high shank rigidity (carbide) and grinding technology on cutting edge. The high run-out precision leads to stable machining, and consequently, reduction of the cycle time.



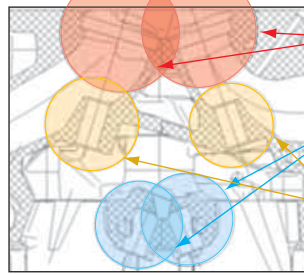
● Difference of Performance Between Shank Materials

Machining Results	1tooth	4teeth (steel)	4teeth (carbide)
Machining time (s)	52	26	13
Circularity (mm)	0.01	0.05	0.03
Coaxiality (mm)	0.01	0.07	0.05

● Machining conditions

Workpiece	Cylinder head, valve seat, guide hole
Material	Aluminum alloy casting AC4B
Machines	Horizontal machining center
Tool Size	Ø11-Ø36-L150
#of Rotations (min^{-1})	3500
Cutting Speed (m/min)	395
Feed Rate (mm/rev)	0.3
Machining Allowance (mm/dia)	0.5
Coolant	Emulsion type water-soluble

Machining Process



Process 1

Finishing of Valve-and-Sheet Fitting Holes

Process 2

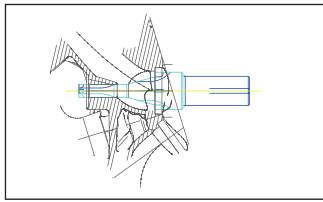
Finishing of Hydraulic Lash Adjuster (HLA) Holes

Process 3

Finishing of Intake and Exhaust Valve Guide Holes

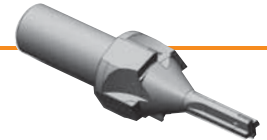
Process 1 Finishing of Valve-and-Sheet Fitting Holes

The high rigidity of the shank and accuracy of the cutting edge achieves coaxiality and cylindricity.



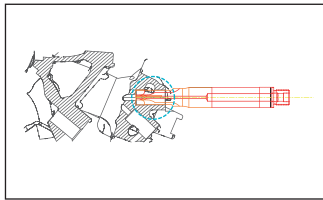
Specifications for Finishing of Valve-and-Sheet Fitting Holes

Cutting Conditions	Processing machine : Horizontal machining center	
	Spindle Speed (min ⁻¹)	6,000
	Feed Rate (mm/rev)	0.48
	Feed Rate (mm/min)	2,880
	Stock Removal (mm/dia.)	0.6
Coolant		Emulsion-type water-soluble oil



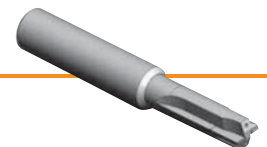
Process 2 Finishing of Hydraulic Lash Adjuster (HLA) Holes

Optimized design for machining of thin-wall parts and stop holes improves chip removal and achieves a high cylindricity.



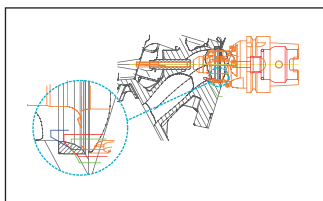
Specifications for Finishing of Hydraulic Lash Adjuster (HLA) Holes

Cutting Conditions	Processing machine : Horizontal machining center	
	Spindle Speed (min ⁻¹)	5,000
	Feed Rate (mm/rev)	0.34
	Feed Rate (mm/min)	1,540
	Stock Removal (mm/dia.)	0.5
Coolant		Emulsion-type water-soluble oil



Process 3 Finishing of Intake and Exhaust Valve Guide Holes

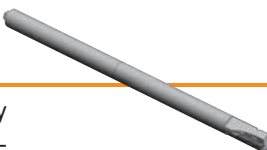
Since the overhang (L) is long and the diameter (D) is small, consequently L/D is large, the coaxiality and cylindricity of tools are controlled with high accuracy to improve the self-guide effect during reaming. Additionally, chip evacuation is improved by the guide shape and coolant design. As a result, the tool life is increased to 10 times as long as that of carbide.



Machined Part

Finishing of Intake and Exhaust Valve Guide Holes

Cutting Conditions	Processing machine : Horizontal machining center	
	Spindle Speed (min ⁻¹)	3,250
	Feed Rate (mm/rev)	0.1
	Feed Rate (mm/min)	325
	Stock Removal (mm/dia.)	0.1
Coolant		Emulsion-type water-soluble oil



Results

Material	Tool Life (No. of Holes)	Price Ratio	Cost Ratio	Coaxiality	Inner Diameter Variance
Carbide	1,200	1	1	—	—
A.L.M.T. PCD Tool	12,000	3	0.8	10μm	3μm/10,000hole

Tools for cylinder head machining

■ Features

- Optimised tool balance for high-feed machining.
- Effective direction of internal coolant supply.

■ Advantages

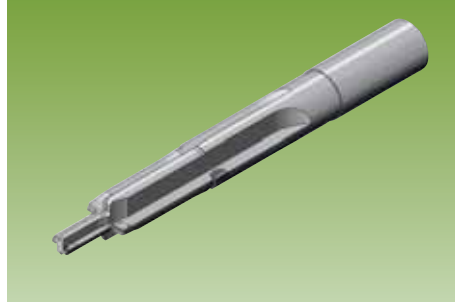
- Improvement of the feed rate and machining quality.
- Reduction of tool costs per machining.

PCD Reamers with multi-edge shapes.

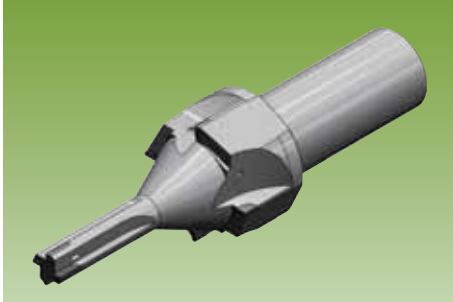
■ For Solenoid Hole Machining



■ For Spark Plug Hole Machining



■ For Guide-and-Sheet Hole Machining

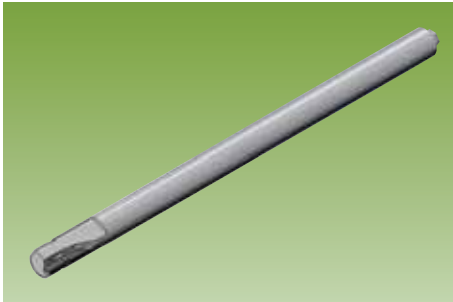


■ For Spring Sheet Hole Machining

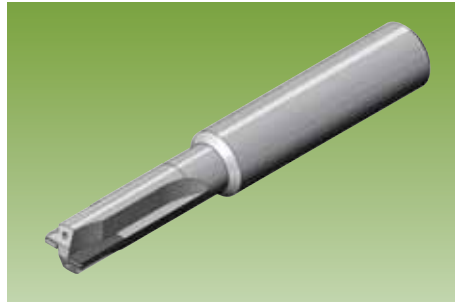


PCD Reamers with high precision cutting edge and high rigidity of the shank.

■ For Valve Guide Hole Machining



■ For Lash Adjuster Hole Machining



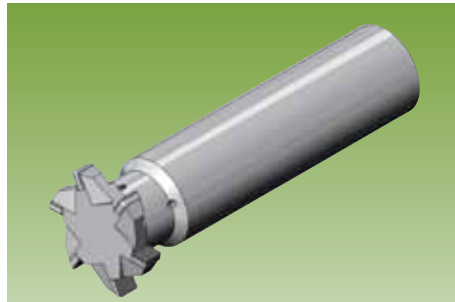
PCD endmills that enables high-feed rate machining using the high rigidity of the shank

■ For Camshaft Bearing (Half R) Machining



PCD endmills that enables high-feed rate machining using the multi-edge structure

■ For Cam Oil Hole Grooving



Special Tools for Automotive aluminum parts Machining

■ Features

- Tool designed dynamic balance for higher cutting speed
- Reduce the machining time and the tool cost by our special tool adapted for high feed, integrate machining processes.

■ Advantages

- Integration of processes, Shorter cycle time
- Elimination of variance in quality due to tool sets
- To minimize quality variation due to tool setting

With a run-out adjustment function

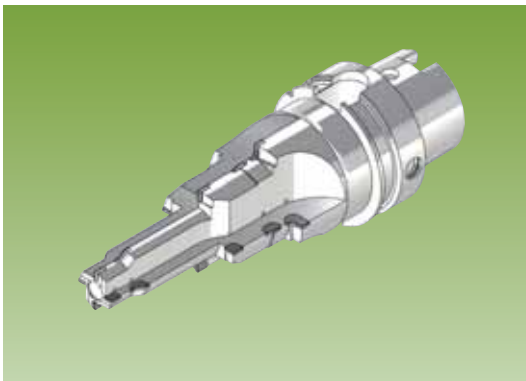
■ Mechanical Clamp Monoblock



Enables high-efficiency high-precision machining using the rigidity of the shank

Enables higher feed machining using multi teeth set on the small body

■ Monoblock



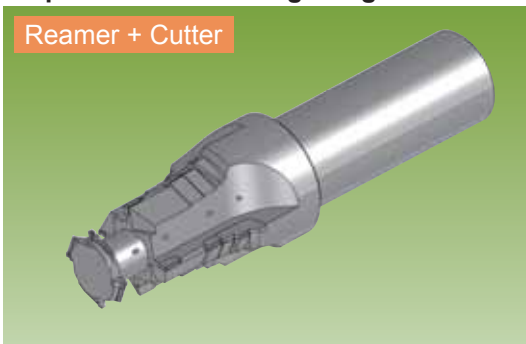
■ Face Milling Cutter



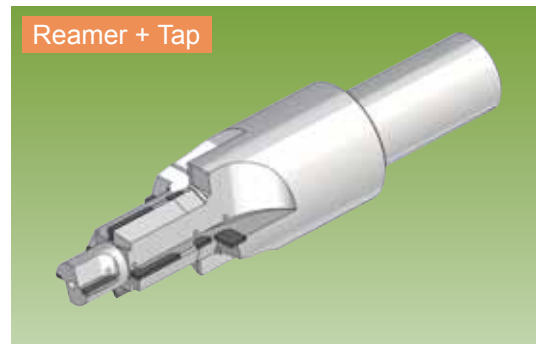
Achieves high-efficiency machining by a structure that integrates several processes

■ Special Process Integrating Tools

Reamer + Cutter



Reamer + Tap



PCD Small Saw



High accurate and efficient cutting or grooving process for resin and non-ferrous materials are required recently. PCD Small Saw was developed to meet with this requirement.

■Features

- Longer tool life compared to conventional tools due to superior wear resistance of cutting edge
- Better cutting edge and higher feed rate compared to thin blade

Due to the reason above, followings are expected

- Improve surface quality (burr less and burining is not much)
- Improve productivity
- Reduce tool cost

■Possible production range

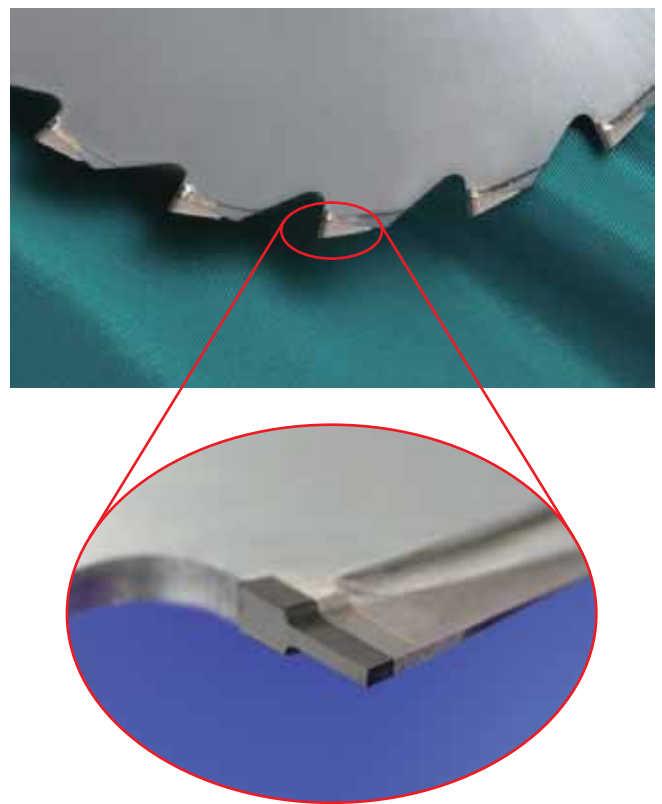
- Outer dia. : $\varnothing 20 \sim 76.2 \text{ mm}$
 - Blade thickness : $0.2 \sim 1.0 \text{ mm}$
- (Some exception depending on tool specification.)



■Process example

- Work material : Compound material of copper and resin ($\varnothing 40 \sim 24 \text{ mm}$ width)
Outer grooving process
- Machine : Designated slicer
- Specification : $\varnothing 20 \text{ mm} \sim 0.4 \text{ mm}$ (blade thickness) - 6 (number of blade)
- Conditions : Cutting speed : 377 mm/min
D.O.C : 1.5 mm
Feed rate : 3 m/min (0.083 mm/blade)
- Result : Achieved 50 times tool life compared to conventional cutting tool

□Enlarged picture of edge



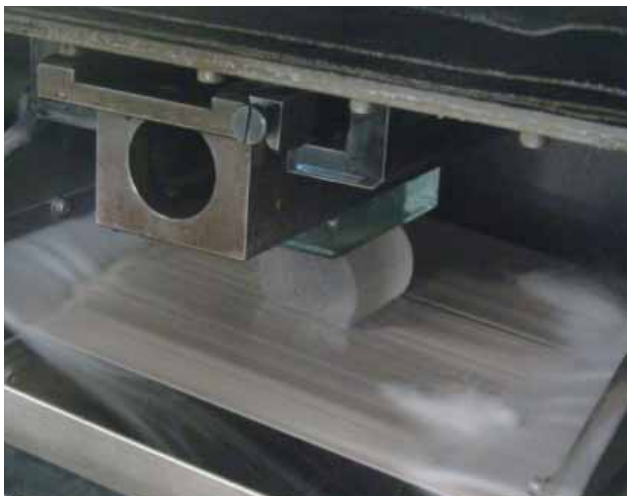
Diamond Wire Saw



Fixed Abrasive Diamond Wire

Patent granted

PWS® Precision Wire Saw



■ PWS Features (PWS-R • E)

- High-precision, high-efficiency (cutting speed: 2 to 10 times the loose abrasive wire)
- Improved working environment (a water-soluble machining fluid can be used)
- Significantly improved material (separation and collection of the chips)
- Specifications can be selected according to needs and applications

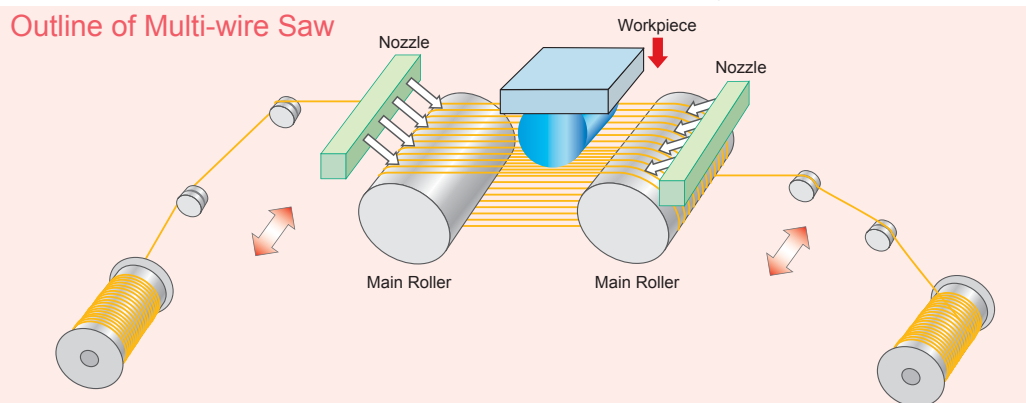
■ Applications

- Brittle materials such as sapphire, glass, ceramics and quartz
- Magnetic material such as neodymium and ferrite magnets
- Silicon for semiconductors and solar cells
- More difficult to cut materials, SiC and various substrates

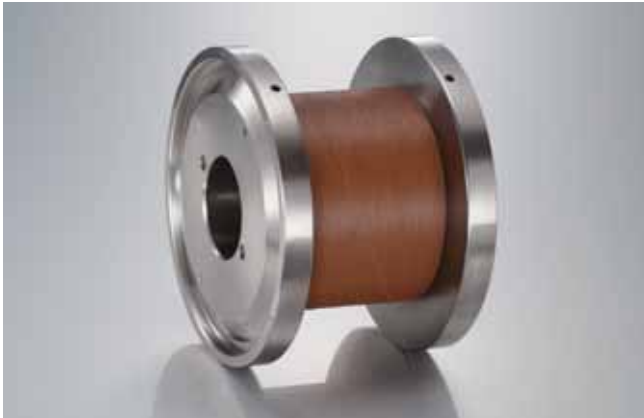
□ Standard specification for Fixed Abrasive Diamond Wire Saw formula

Type	Diameter	Average Diamond Size	Production Length
PWS-R	$\varnothing 0.255 \pm 0.01$	40–60 μm	~100km
PWS-E	$\varnothing 0.250 \pm 0.01$	30–40 μm	~ 50km
	$\varnothing 0.190 \pm 0.01$	30–40 μm	~ 50km

*For longer products, and other specifications, please contact us



PWS-R (Resin Bonded Type)

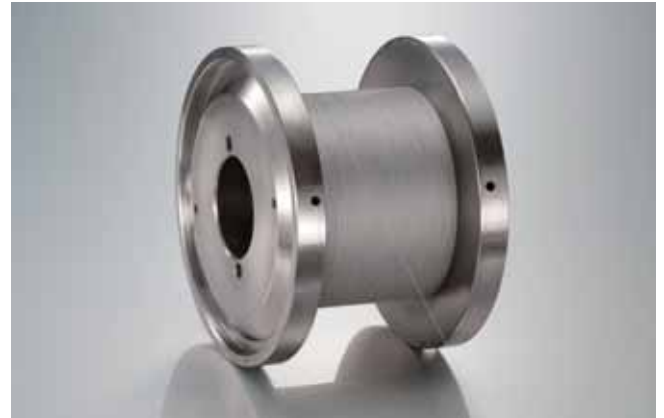


PWS-R Type Surface

■ PWS-R Features

- High finishing quality of cut surface
- Ideal for slicing a variety of materials

PWS-E (Electroplated Type)



PWS-E Type Surface

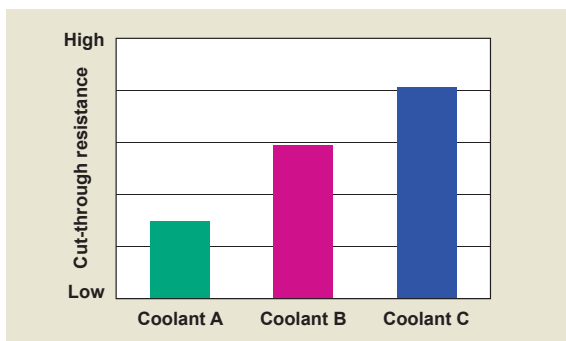
■ PWS-E Features

- High cutting efficiency due to high diamond retention

□ Case Processing

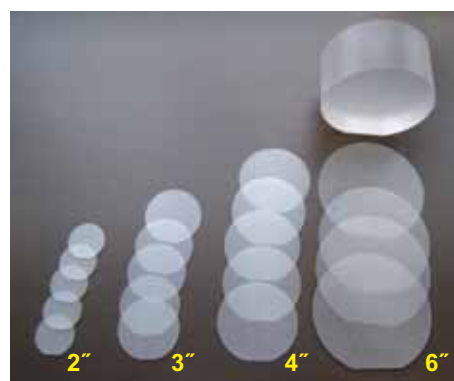
Specifications : PWS		PWS-R	PWS-R	PWS-E
Evaluation System		Multi-wire saw	Multi-wire saw	Multi-wire saw
Work Materials	Material	Neodymium magnets	Sapphire	Sapphire
	Dimension	W(50×4columns)×H(25×4high)×L(50×2columns)mm	Ø50mm×L200mm	Ø50mm×L200mm
Cutting Condition	Wire Speed	max 800m/min	max 400m/min	max 400m/min
	Work Feed Speed	0.6mm/min	Ave 0.1mm/min	Ave 0.3mm/min
	Wire Running Direction	Reciprocate running	Reciprocate running	Reciprocate running
	Wire Tension	35N	35N	35N
	Coolant	Water-soluble	Water-soluble	Water-soluble
Cutting Results	Surface Roughness (Ra)*	on and less than 1.5µm	on and less than 0.4µm	on and less than 0.5µm
	Waviness (WCM)*	on and less than 20µm	on and less than 30µm	on and less than 30µm
	Total Thickness Variation (TTV)	on and less than 10µm	on and less than 10µm	on and less than 10µm
	Average Wafer Thickness	0.74mm	0.6mm	0.6mm
	Kerf-loss	0.26mm	0.26mm	0.26mm
PWS Specification	Diamond Abrasive Size	40-60µm		30-40µm
	Outer Diameter	Ave. 0.250mm		Ave. 0.250mm

*Total length of cutting direction was measured.

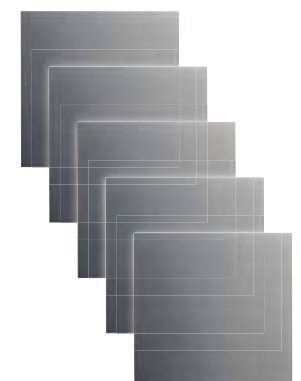


Cutting resistance varies depending on the coolant.
Please contact us for assistance in selecting the optimal coolant.

● Workpiece : Sapphire



● Workpiece : Monocrystalline silic



CPG Series

For PCD Tool Grindig

CPG Series Compact Tool Grinders

Suitable for super hard tool Grinding

■ Features

1. Incomparable rigidity

Diamond and cBN grinding require 10 times grinding pressure compared to cemented carbide grinding. CPG series employ precise angler bearing for grinding spindle and pivot and frame itself is originally designed rigidly.

2. Excellent grinding accuray

Super rigid and accurate grinding spindle realize sharp cutting edge.

3. High efficient operation

Quick setting for cutting edge angle and relief angle with oscillating location adjustment of wheel with workpiece sight. Leaning mechanics with centering grinding point and highly precise projector for high efficiency operation environment.

CPG-310

*Painted color of grinder is image and standard color is green



■ Options

- Ø250mm projector
- Angle measurement projector
- D.O.C. digital meter
- Turning angle digital meter

■ Main specifications

- Ø150mm projector
- Constant pressure (grinding) unit
- Coolant unit
- Holder (QC-21) and Table
- Rapid forward/backward unit

High Operativity and High Output

- Constant pressure unit is user friendly and helps to find suitable grinding condition.
- Oscillating width adjustment is operated easily by steering.
- X20 projector for centering and profiling.

CPG-200



Basic grinding machine for low volume production

- Adequate precision and rigidity as compact tool grinder
- X20 projector for centering and profiling

■ Options

Special power-up units for CPG Series

D.O.C. digital unit

• CPG-310

Digital Display of D.O.C. by linear scale (min.1μm)

• CPG-200

Digital Display by combination of ball screw mechanism length measuring encoder (min.5μm)



Turning angle digital Display

Turning angle measuring encoder (min.1min.)



Coolant Tank (120ℓ)

Improved filtering system with paper filter



■ Accessories

Special jigs to guarantee grinding accuracy for CPG Series (genuine parts)

• Brake truing unit BT-2



• 3-D vise



• On machine dressing unit CT-1 (CPG-310)



• Holders



• Jig for cylindrical grinding



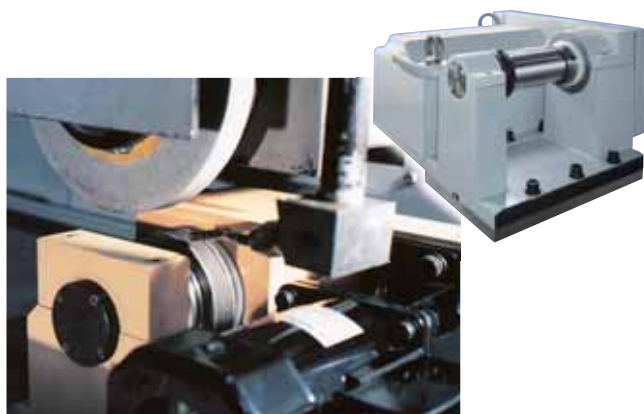
• Jig for radius grinding



• Jig for edge honing



Grinding wheel profile forming unit

Rotary Dresser drive unit**■Features****1. High precision**

Employed high precision pivot adjusted run-out of outer and edge to less than 2μm

2. High rigidity

Make spindle dia. as big as possible and employ angular bearing

3. Easy to use

- Fix with T-slot to surface grinding machines
- No need to take out joint for removing

□Specifications of drive unit Spindle unit (SU type) is separately sold

Spec	Type	SGS-30	SGS-50	SGS-100
Rotation speed (60Hz)		300rpm	2,500rpm	2,500rpm
Electric motor		90W/200V	400W/200V	750W/200V
Weight (kg)		22	55	67
Spindle		SU-30	SU-50	SU-100
Dresser dia. and width (mm)		Ø90×30	Ø150×50	Ø150×100

Truing Unit Brake Dresser**■Features**

The brake dresser removes run-out with pressing force between dresser and diamond wheel as well as peripheral speed difference

Coolant ODIUP**■Features**

Water soluble grinding coolant specialized to replace from loose abrasive to fixed abrasive

■Applications

- PWS (Fixed) Diamond Wire
- DPG (Diamond Pellet Grinding) wheel

Ultra precision dressing system

TACUMINO Dress**■Features**

- World's smallest class
- High-speed rotation up to 20,000
- Detect contact of wheel and dresser with submicron range

1. Decrease product defects drastically with high precision dressing

AE sensor system benefits accurate dressing

2. Reduce dressing time drastically

AE sensor system removes useless dressing

3. Increase tool life drastically

Increase number of dressing by reducing useless dressing

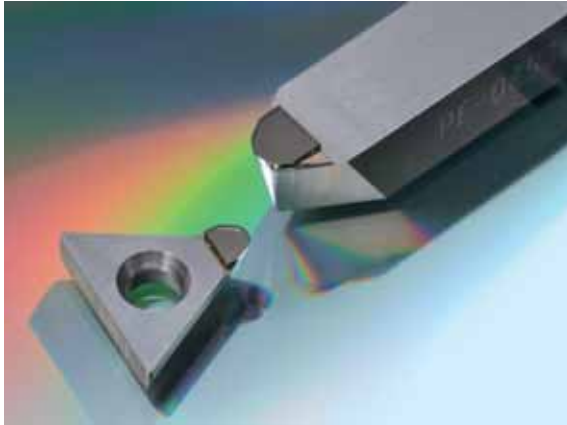
[Selling agency] Sumitomo Electric Tool Net

Introduction of Customer Solution Center (CSC)

Propose most suitable condition of cutting / grinding process

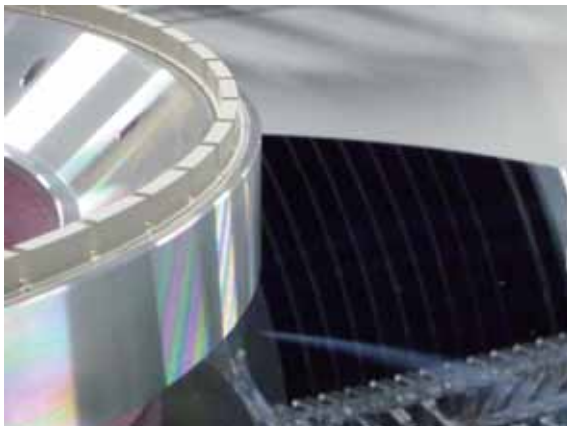
Customer Solution Center (CSC) proposes best solution for your problem by gathering know-how of analysis, evaluation and experience that have cultivated over the years as a manufacturer.

□Grinding to Cutting



Propose high precision and high efficiency cutting process that realizes space saving and clean environment.

□Free abrasive to Grinding



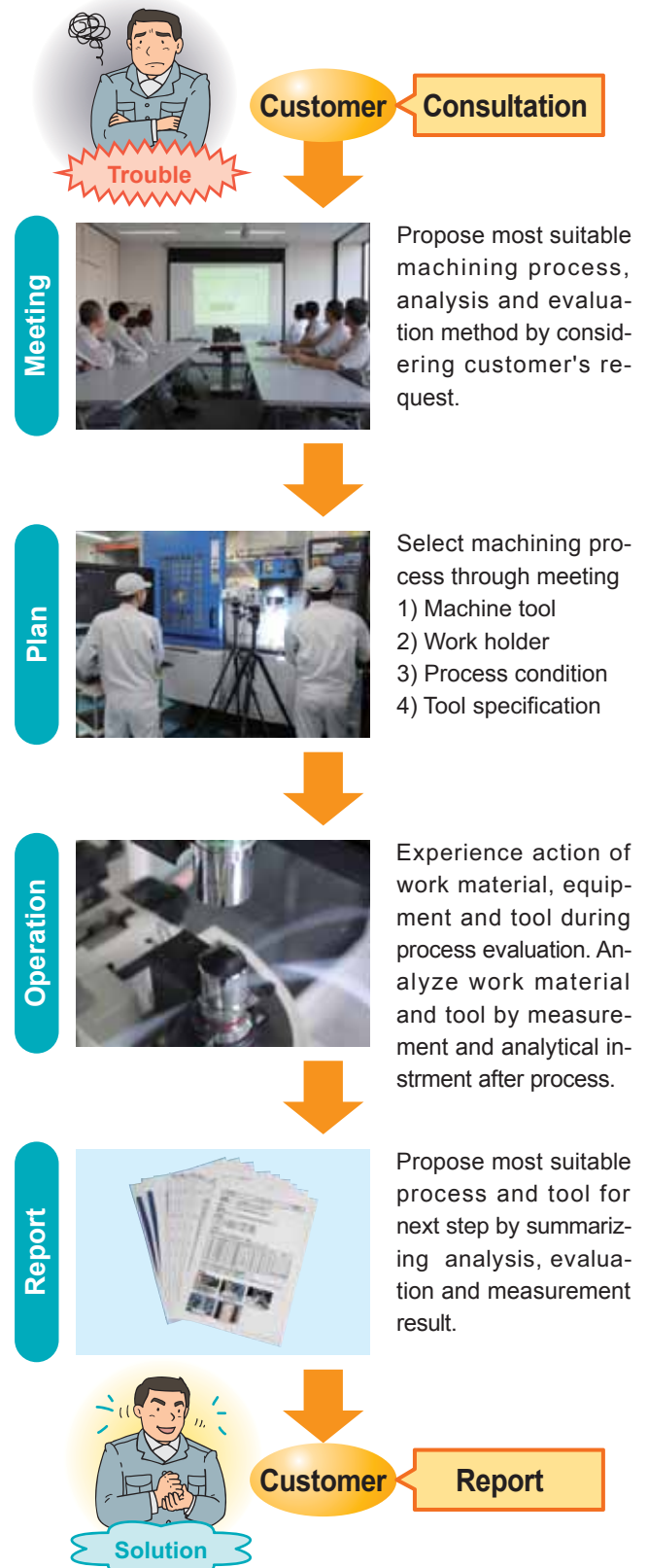
Propose high precision and high efficiency grinding process lead to low damage to work material under clean environment that realize improvement of working condition and washability of work material as well as reducing industrial waste.

□Measurement to analysis and evaluation



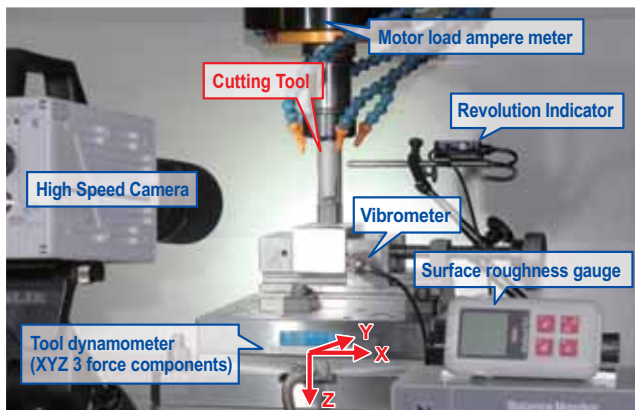
Propose evaluation method after process.

Work flow from request to report

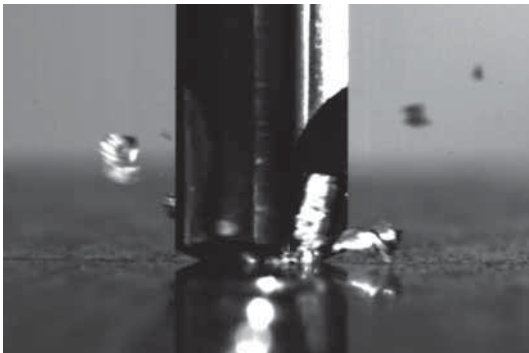


Cutting process evaluation system

Record chip status during cutting process by high speed camera. Observe and analyze cutting status by tool dynamometer.

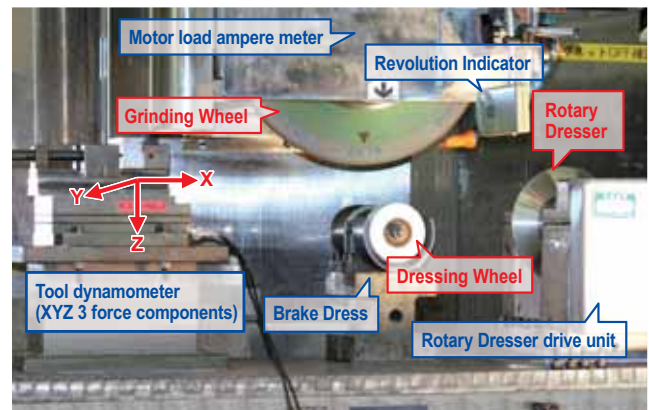


□ Photo by high speed camera

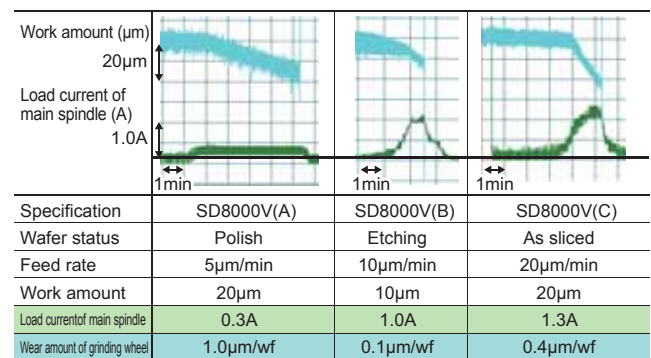


Grinding process evaluation system

Load truing and dressing system on machine. Observe and analyze grinding status under various grinding condition.



□ Grinding process example of each specification



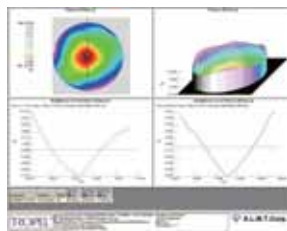
Analysis and evaluation

● Analysis of flatness and waviness : 3-D flat face analysis unit : TROPEL

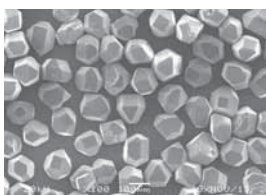


Measure and analyze wafer surface up to 200mmD.

- Measurement accuracy : 0.1μm
- Measurement range : 100μm

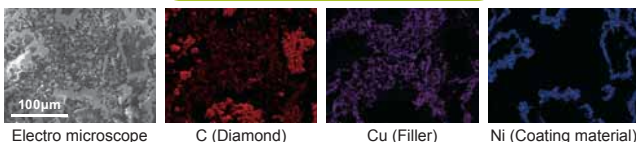


● Observation by high magnification and component analysis : EDX-SEM



Observe and analyze up to 200mm for diameter, 10mm (straight type) and 40mm (cup type) for height.

Surface × 500 Surface analysis

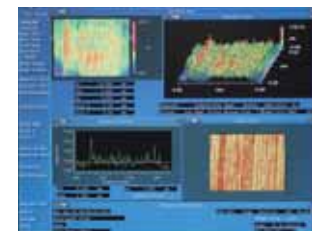


● Surface analysis : 3-D surface analysis unit Zygo



2-D and 3-D surface status are obtained by nondestructive inspection.

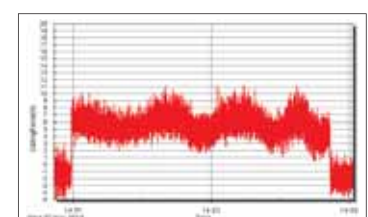
- Analysis ability of height direction : 0.1nm
- Vertical scanning speed : 4μm/sec



● Cutting/Grinding resistance : Tool dynamometer (by Kistler)



Process characteristic are grasped by comparing 3 force components.



Safety Precautions

Please read through user manual and inspection sheet of Diamond and cBN grinding wheel, PCD cutting tool, grinding machine and coolant before using for your safety. User manual needs to be kept in the distance that user can reach anytime. Accident or injury may be occurred by misusage. The extent of danger and damage may be caused by misusage are categorized in 2 steps and stated below.



Warning : Misusage may cause death or serious injury



Caution : Misusage may cause slight injury or physical damage



Prohibited matters



Precautions



Protective equipments are required

Safety precautions of Diamond and cBN wheels in use

1. Work environment / Work clothes / Protective equipment

Warning

- ! Wheel guard must be properly attached
- ⊘ Only authorized people attend around machine and do not stand at rotation direction
- ! Must wear dust-proof glasses, safety shoes, safety hat and appropriate clothes

Caution

- ! Ventilate to remove mist coolant and dust
- ! Must wear dust-proof mask and ear plug
- ! Clean floor around grinding machine
- ! Instruct moving range of table of grinding machine etc. on the floor
- ⊘ Do not put anything or stand within its moving area
- ⊘ Do not operate in the area of inflammable object because wheel sparks in use

2. Before use

Caution

- ! Check wheel sizes to match with requirement of grinding machine
- ! Check appearance (crack, fracture, breakage etc.) after cleaning wheel
- ! Wash corrosion inhibitor in case wheel body is ferrous material
- ! Clean wheel mounting portion of spindle
- ! Clean flange and chuck to confirm no damage, warp and bend etc.
- ! Check warp and bend on wheel
- ! Read user manual and confirm wheel is for appropriate usage

3. Attachment

Warning

- ! Turn off a switch when wheel is attached to spindle
- ! Attach wheel guard appropriately

Caution

- ! Check scratch and dust etc. around or inside of mounting portion of wheel, flange and chuck
- ! Remove small scratch etc. by sandpaper
- ! Hold wheel with enclosed cushion material to prevent crack etc. in case of vitrified bond wheel
- ! Wheel and flange need to be smoothly attached

- ⊘ Do not attach with force by hammering etc.

- ⊘ Do not operate to change inner dia

Please instruct us if necessary

- ! Screw flange by equable torque at the position of diagonal line

- ! Check overhang length does not surpass limitation

Important notice

- ⊙ May balance on machine after being attached to the machine
- ⊙ May loose attachment of wheel and flange to screw by checking run-out of reference face close to abrasive layer

4. Trial run

Warning

- ! Check work material is firmly attached and operation of feed mechanism work correctly
- ! Check wheel is firmly attached and operation of feed mechanism work correctly
- ! Check rotation direction of wheel
- ! Check irregular sound or vibration by no-load operation around 1-3 mins

Caution

- ! Check coolant is correctly supplied

5. Grinding operation

Warning

- ⊘ Do not touch wheel when rotating
- ! Make completed stop when irregular sound or vibration occurred
- ! Turn off a switch only after stopping coolant supply
- ! Do not touch or put object to stop rotating wheel
- ! Turn off a switch when wheel is taken out from spindle

Caution

- ! Be careful of excess cutting especially dry tool cutting
- ! Confirm feed, D.O.C. and cycle time by trial run
- ! Check burning or chatter mark on work material
- ! Be careful of overload

6. Storage and handling

Caution

- ! Check crack, scratch, breakage, burning etc. on working face
- ! Store dry area and prevent drop-off and crash etc.
- ! Apply corrosion inhibitor to ferrous wheel body to store
- ⊘ Do not operate to change wheel shape. Please instruct us if

necessary

Safety precautions of Circular Saw in use

1. Work environment / Work clothes / Protective equipment

⚠ Warning

- ❗ Designated wheel guard must be properly attached
Otherwise, in case tool is broken, serious injury may occur
- 🚫 Only authorized people attend around machine
Do not approach to the area of rotation direction and moving area of machine table
- 👤👁 Must wear dust-proof glasses, safety shoes, safety hat and appropriate clothes
Sleeve or bottom of clothes need to be tight not to occur serious injury
- 👤👂 Must wear dust-proof mask and ear plug
- ❗ Do not operate in the area of inflammable object because tool sparks in use

⚠ Caution

- ❗ Ventilate to remove mist coolant and dust
- ❗ Clean floor around machine

2. Before use

⚠ Warning

- ❗ Please use within peripheral speed stated

⚠ Caution

- ❗ Check tool sizes to match with requirement of the machine
- ❗ Remove edge protection and store it in the case
- ❗ Check crack and breakage etc. after washing corrosion inhibitor
In case no irregular is confirmed, please attach edge protection
Protection removes risk of crack or injury of user
- ❗ Check warp and bend
- ❗ Clean mounting portion of main spindle
- ❗ Clean flange and check scratch, warp, bend, irregular balance etc.

3. Tool attachment

⚠ Warning

- ❗ Turn off a switch when tool is attached to main spindle
- ❗ Check scratch and dust etc. around mounting portion of tool and apply sandpaper if necessary to remove
- ❗ Apply edge protection when tool is attached
- 🚫 Do not attach with force by hammering etc.
- 🚫 Do not operate to change hole diameter
Please instruct us if necessary
- ❗ Screw flange by equable torque at the position of diagonal line
- ❗ Remove edge protection after attaching

4. Trial run

⚠ Warning

- ❗ Check tool is firmly attached and operation of feed mechanism work correctly
- ❗ Check work material is firmly attached and operation of feed

mechanism work correctly

Tool or work material breakage may occur injury

- ❗ Check rotation direction of tool
It may occur injury if it is not correct
- ❗ Check irregular sound or vibration by no-load operation around 1-3 mins

5. Cutting operation

⚠ Warning

- 🚫 Do not touch tool when rotating to remove risk of serious injury
- ❗ Make completed stop when irregular sound or vibration occurred to remove risk of injury
- ❗ Cutting operation needs to be processed after reaching allowable rotation
- ❗ Turn off a switch of main spindle after completion of cutting process
- ❗ Do not touch or put object to stop rotating tool
- ❗ Turn off a switch when tool is taken out from main spindle

⚠ Caution

- ❗ Confirm feed, D.O.C. and cycle time by trial run
- ❗ Be careful of overload
- ❗ Check burning or chatter mark on work material

Important notice

- 🕒 Please consult us in case cutting condition or tool specification is not correctly chosen

6. Storage and handling

⚠ Warning

- ❗ Attach edge protection
Touching directly to cutting edge may occur injury
- ❗ Impact to tool may occur crack or breakage etc.

⚠ Caution

- ❗ Check irregular wear, breakage, crack, peeling etc. on working face
- ❗ Store dry area and prevent drop-off and crash after anti-corrosion treatment and edge protection etc.
- 🚫 Do not operate to change tool shape
Please instruct us if necessary

Safety precautions of PCD reamer and endmill

⚠ Warning

- 👤 Put safety cover and protection glasses etc.
- ❗ Do not touch sharp cutting edge by hand
- ❗ Check tool hand and rotation direction of machine

Network

Technical & Reliable Network for A.L.M.T.Corp.

Based on the domestic production subsidiaries with high technologies, the sales network close to the local and overseas markets and the manufacturing affiliates overseas, A.L.M.T.Corp. serve society both at home and abroad with reliable products

Domestic production network (Diamond Tool)

A.L.M.T. DIAMOND Corp. (Harima)
Diamond • cBN wheel, cutting tool /
Rotary Dresser / Wear-resistance products

A.L.M.T. DIAMOND Corp. (Shizuoka)
Diamond Tools

Awaji Diamond Industrial Co.,Ltd. (Sumoto)
Diamond drawing dies /
Wear-resistance products

Domestic production network (Functional Material)

A.L.M.T. TECH Inc. (Sakata)
Heatspreader products / Tungsten •
Molybdenum products

A.L.M.T. TECH Inc. (Toyama)
Tungsten • Molybdenum powder, stick, plate

A.L.M.T. TECH Inc. (Itami)
Electric Contacts, Heavy metal,
Heatspreader products, Ceramic products

A.L.M.T. TUNGSTEN Corp. (Toyama)
Powdery products / Cemented carbide

Domestic Sales Network

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FAX : +81-3-5418-1811

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● Kita-kanto Office

● Atsugi Office
● Nagoya Office

● Mikawa-anjo Office
● Hamamatsu Office

● Hokuriku Office
● Osaka Office

● Hiroshima Office
● Kyushu Office

Other catalogues

Diamond tool catalogues are available for various markets

■ For semiconductor



■ For drawing wire



Tyrolit ULTRA series (conventional wheel)

■ Automotive • bearing
CSS ULTRA



■ Gear (general),
MIRA ULTRA



■ Gear (honing),
MIRA



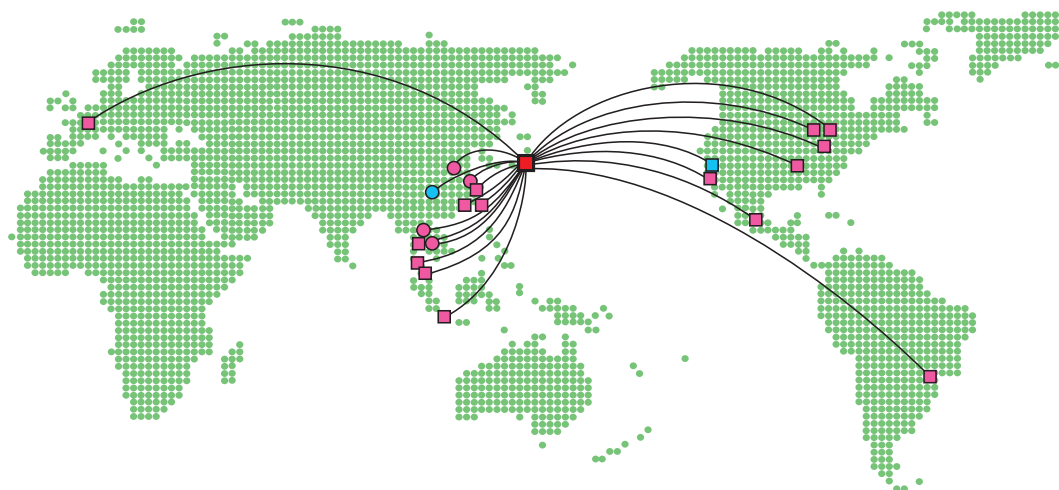
■ Turbine (general),
STRATO ULTRA



■ Turbine (viper grinding),
VIPER ULTRA



Global Network



Global Network (Diamond Tool)

□ : Sales ○ : Production, Sales

<North America>

- **Sumitomo Electric Carbide, Inc. (Chicago)**..... (Sales of Diamond tools)
1001. Business Center Drive, Mt. Prospect, IL 60056-2181, U.S.A.
Tel: +1-847-635-0044 Fax: +1-847-635-9335
- **Sumitomo Electric Carbide, Inc. (Detroit)**..... (Sales of Diamond tools)
14496 Sheldon Road, Suite 230, Plymouth, MI 48170, U.S.A.
Tel: +1-734-451-0200 Fax: +1-734-451-5338
- **Sumitomo Electric Carbide, Inc. (Cincinnati)**..... (Sales of Diamond tools)
4450 Carver Woods Drive, Cincinnati, OH 45242-5545, U.S.A.
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- **Sumitomo Electric Carbide, Inc. (Huntsville)**..... (Sales of Diamond tools)
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- **Sumitomo Electric Carbide, Inc. (Torrance)**..... (Sales of Diamond tools)
21241 S.Western Avenue Suite 200 Torrance, CA 90501, U.S.A.
Tel: +1-800-950-5202 Fax: +1-310-782-0211

<Central America>

- **Sumitomo Electric Hardmetal de Mexico, S.A. de C.V. (Mexico)**
..... (Sales of Diamond Tools)
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Aguascalientes, AGS., 20290, Mexico
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<South America>

- **Sumitomo Electric Hardmetal do Brasil Ltda.**.... (Sales of Diamond tools)
Rua Maestro Agide Azzoni 67, Chácara da Barra, Campinas,
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<Europe>

- **Sumitomo Electric Hartmetall GmbH (Germany • Dusseldorf)**
..... (Sales of Diamond tools)
Konrad-Zuse-Strasse 9, D-47877 Willich, Germany
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<Asia>

- **A.L.M.T. Henan Whirlwind Diamond Wheel Co.,Ltd. (China • Henan)**
..... (Manufacture and sales of Diamond wheels)
200 Renmin Road, Changge City, Henan Province China 461500
Tel: +86-374-6108758 Fax: +86-374-6108859
- **A.L.M.T.Diamond Dies (SUZHOU) Co.,Ltd. (China • Suzhou)**
..... (Manufacture and sales of Diamond drawing dies)
Unit 25D,25E of Suchun Industrial Square, #428 Xinglong Street
Suzhou Industrial Park, Jiangsu, P.R. China 215021
Tel: +86-512-62836195~7 Fax: +86-512-62836176

- **Sumitomo Electric Hardmetal Trading (Shanghai) Co.,Ltd.**
..... (Sales of Diamond tools)
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- **Sumitomo Electric Hardmetal Trading (Shanghai) Co.,Ltd. (Guangzhou)**
..... (Sales of Diamond tools)
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- **Taiwan Hong-yu Precision Tools** (Sales of Diamond tools)
13 FA3., No.156, Sec.1, Zhongshan Rd., Banqiao Dist.,
New Taipei City 220, Taiwan
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- **A.L.M.T. Asia Pacific Pte. Ltd. (Singapore)**
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- **A.L.M.T. Asia Pacific Pte. Ltd. (Malaysia)**
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Resort City, 43300 Seri Kembangan, Selangor Darul Ehsan Malaysia
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- **A.L.M.T. (Thailand) Co.,Ltd. (Thailand • Wellgrow)**
..... (Manufacture of Diamond Tools)
90/2 Moo 9 Wellgrow Industrial Estate Bangna-trad Road.,
T.Bangwua A.Bangpakong Chachoengsao 24180 Thailand
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- **A.L.M.T. (Thailand) Co.,Ltd. (Thailand • Korat)**
..... (Manufacture of Diamond drawing dies)
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Nakhonratchasima 30380 Thailand
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- **PT. Sumitomo Electric Hardmetal Indonesia (Indonesia)**
..... (Sales of Diamond tools)
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Global Network (Functional Material)

□ : Sales ○ : Production, Sales

<North America>

- **Sumitomo Electric U.S.A.,INC. (Los Angels)**
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21241 South Western Avenue, Suite 120 Torrance, CA 90501, U.S.A.
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<China>

- **Chengdu Lianhong Molybdenum Co.,Ltd (Chengdu)**
..... (Manufacture and sales of Molybdenum products)
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