



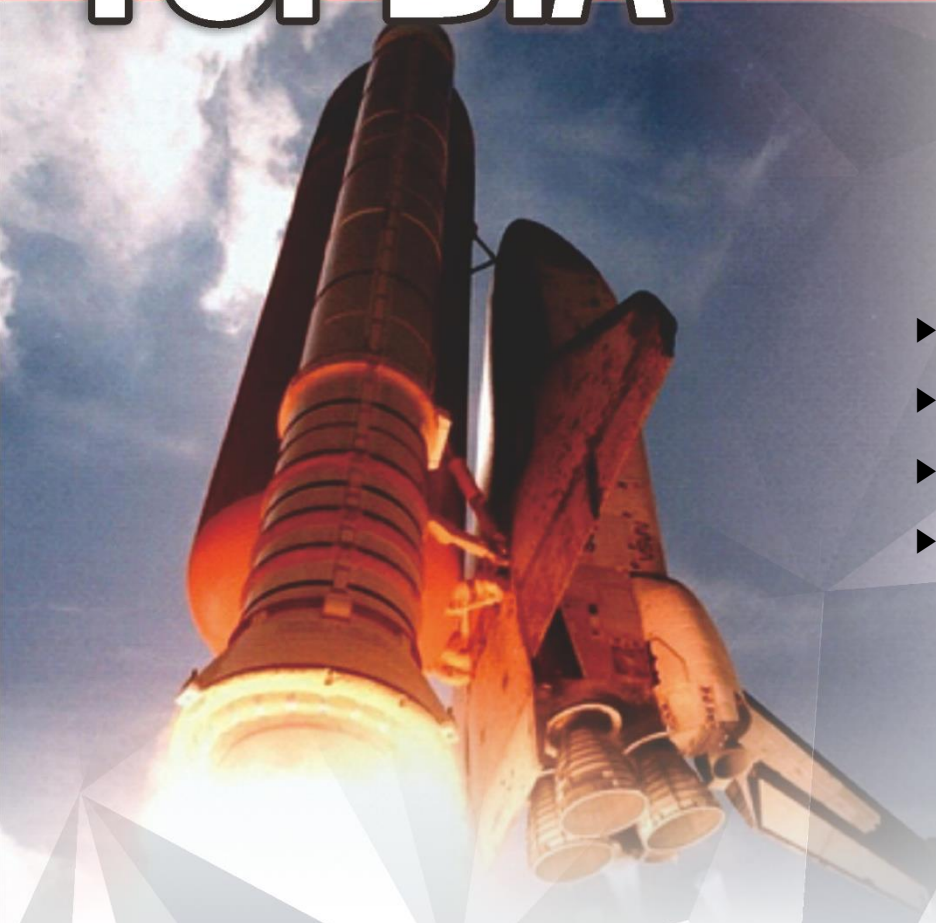
TOPDIA Tech

Diamond & Tools Specialty Company

Diamond

- ▶ Vitrified Diamond & CBN Wheel
- ▶ Resin Diamond & CBN Wheel
- ▶ Metal Diamond & CBN Wheel
- ▶ Electroplated Diamond & CBN Wheel

TOPDIA 탐다이아테크(주)

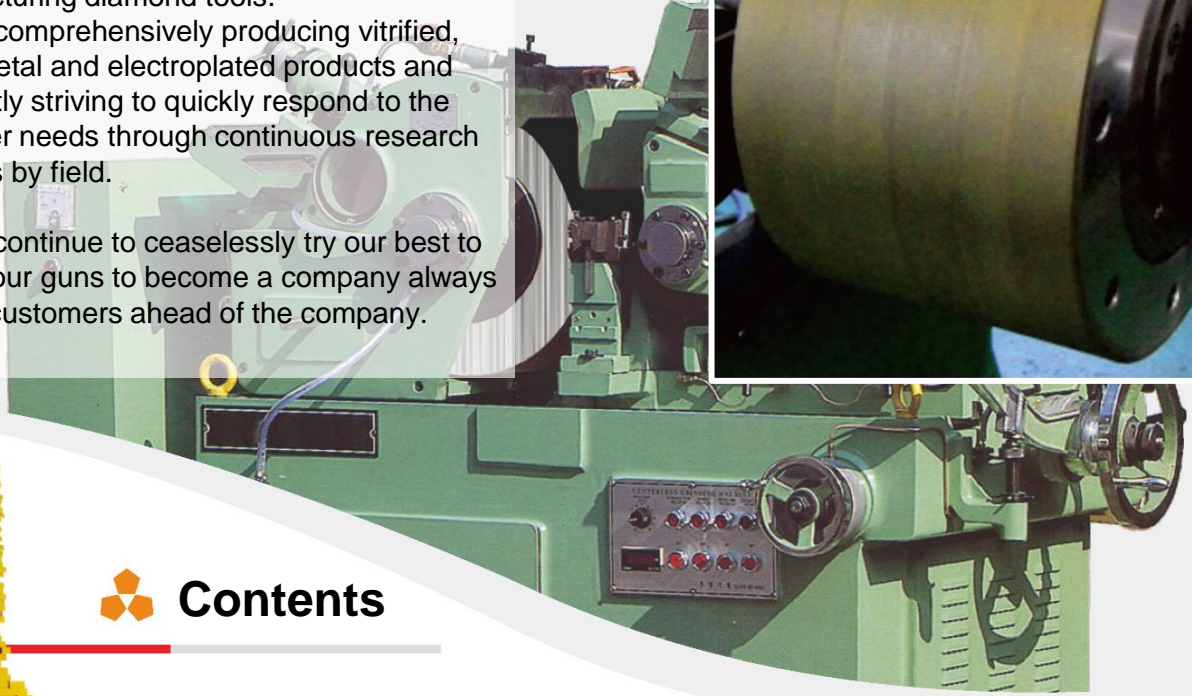
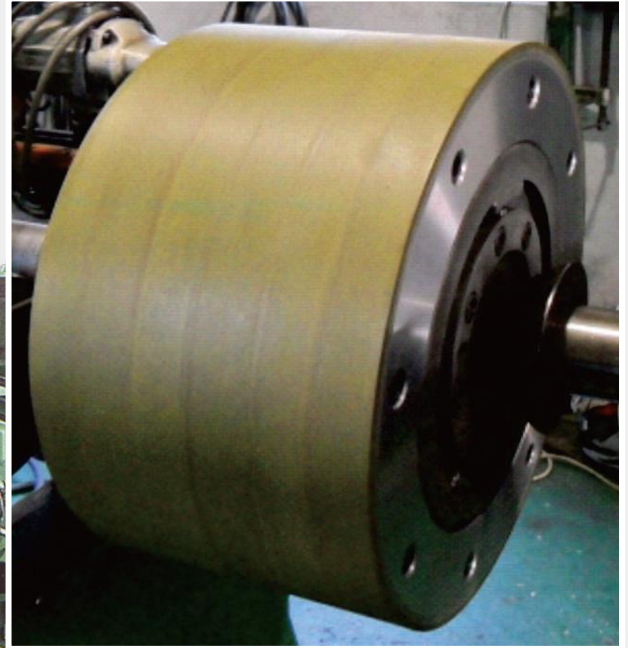


Company Introduction

We, Top Diatech, are the pioneer in the diamond tool industry.

Top Diatech is a company specialized in manufacturing diamond tools. We are comprehensively producing vitrified, resin, metal and electroplated products and constantly striving to quickly respond to the customer needs through continuous research activities by field.

We will continue to ceaselessly try our best to stick to our guns to become a company always putting customers ahead of the company.



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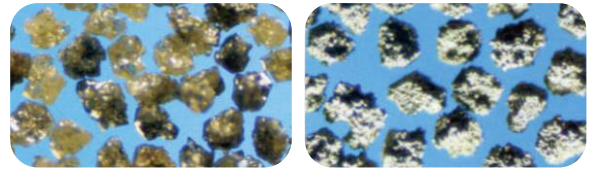


DIAMOND and CBN of Feature

1

DIAMOND

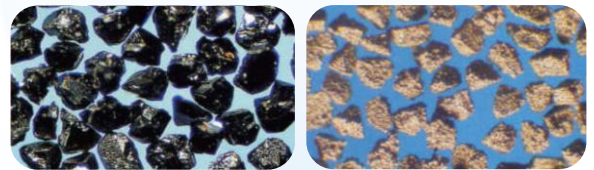
Diamond, as the hardest substance found in nature, has a hardness about 3~4 times harder in knop hardness than wheel grains such as silicon carbide or alumina, etc. But since it starts oxidizing from at about 600℃ in the air, which tends to speed up the abrasion of diamond by the grinding heat generated when machining the iron-based materials, it is not suitable to use for machining iron-based materials.



2

CBN (Cubic Boron Nitride)

CBN (Cubic Boron Nitride) is a non-existent substance in nature and has a hardness of 1/2 of diamond but almost twice as hard as silicon carbide (SiC) or alumina (Al₂O₃). Since CBN is excellent in thermal stability even at high temperature higher than 1300 ℃ and suitable to use in machining iron-based materials.



Enhancing the quality of metal structure during grinding metal materials

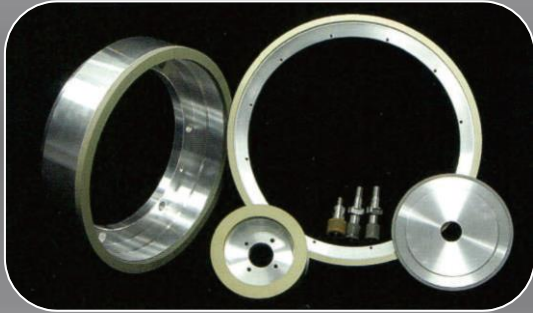
When general abrasive grits are used, wheel abrasion is rapidly accelerated as workpiece materials (heat-processing tool steel, dies steel) are very hard and high in abrasion resistance and a tensile stress is occurred on the surface of the workpieces by the frictional heat generated at the time of grinding. Such stress deteriorates the fatigue strength and damages to the metal structure by triggering grinding cracking and grinding burning but, on the contrary, CBN enhances the quality of the metal structure by keeping fine grinding blades and minimizes the frictional heat during grinding.

3

Scope of Application



▣ Vitrified-bonded Wheel



Vitrified-bonded wheel also called a ceramic-bonded wheel manufactured through a primary molding process and a secondary sintering process by mixing vitreous bond material, the ceramic ingredient, and auxiliary wheels with super-abrasives, is widely used in the specific industrial fields where a resin-bonded wheel or a metal-bonded wheel is hard to be applied in the difficult-to-cut materials such as ultra-light materials, ceramic material, HSS, SKD11, etc.

Features

1. Excellent abrasion-resistance
2. Excellent for-holding capability
3. Excellent grinding properties
4. A wide range of surface roughens
5. East truing and dressing
6. Excellent in free-cutting ability and applicable to strong workpieces
7. A lot of porosity furnished in the wheel to limit the generation of clogging and heat
8. Vitreous bond material easy to break due to its brittleness

Product Description

Vitrified-bond that is a bond using vitreous bond material is excellent more than resin bond in bonding force and can control the basic strength and chip discharging performance of the wheel by providing the change in the porosity and structure of the wheel according to manufacturers.

Applications

1. Diamond Wheel

- It is used to grind PCD, PCBN, ceramics, etc. Suitable for more precision grinding than resin wheels
- In general, it is mainly used in precision grinding of ultralight alloys, cermets and ceramics.

2. CBN wheel

It is used to grind iron-based materials such as automotive parts, bearing parts, parts of household appliances, tools, etc. Especially it is very excellent in high-speed and high-efficient grinding of camshafts and crank shafts.

▣ Electroplated-bonded Wheel



Electroplated-bonded wheel, as a wheel manufactured in the super-abrasive (DIA, CBN), nickel electroplating form of a single layer, is used in various industrial fields where complex shapes of difficult-to-grind materials such as ultralight materials, ceramic materials, HSS, SKD, etc. are required.

Features

1. Possible to manufacture even in the complex shapes
2. Good in the shape retention capability
3. Short product life of the wheel with an abrasive area consisting of a single layer
4. Maximum efficiency in removing materials
5. Maximum grinding performance as it has the largest amount of abrasive exposure

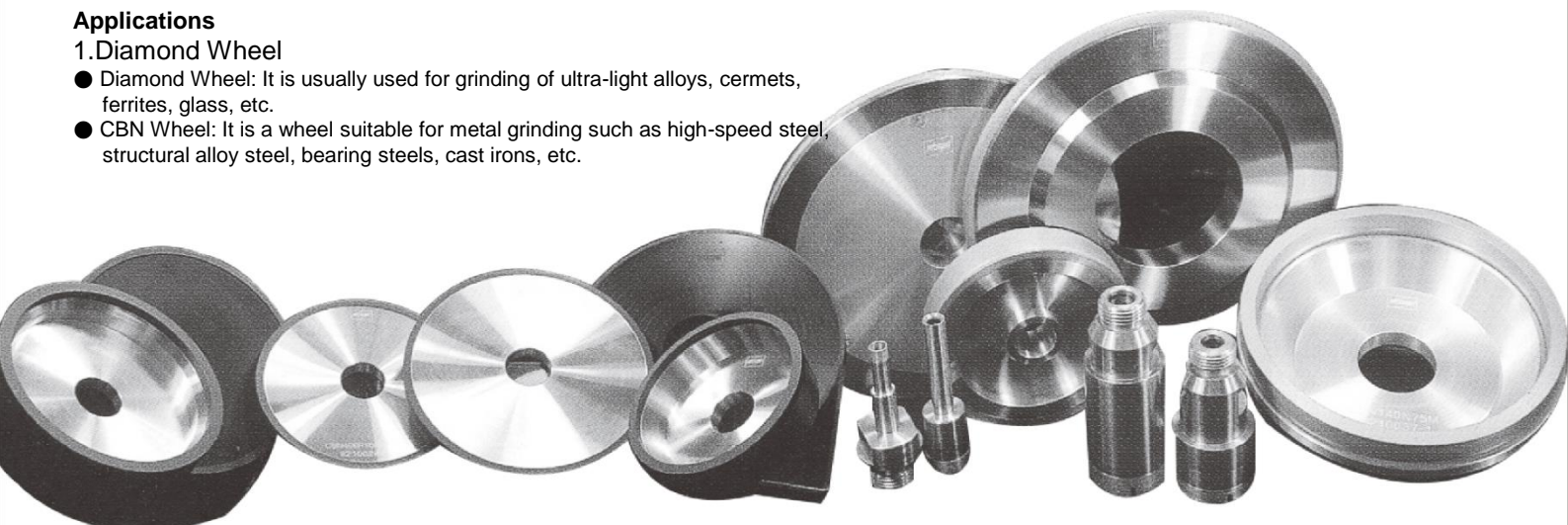
Product Description

Resin bond is a product manufactured by mainly using thermosetting materials like phenolic resin as a bond material. Since resin bond has excellent grinding abilities, surface roughness, chipping, etc. it is widely used for various materials including from difficult-to-machine materials such as ultra-light steel alloys, ceramics, glass and silicon, etc. and iron-based materials including high-speed steel and sintered ferrous metal alloys.

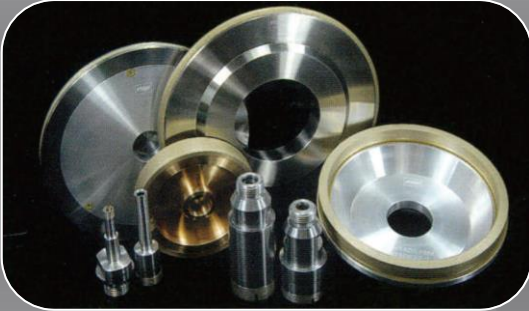
Applications

1. Diamond Wheel

- Diamond Wheel: It is usually used for grinding of ultra-light alloys, cermets, ferrites, glass, etc.
- CBN Wheel: It is a wheel suitable for metal grinding such as high-speed steel, structural alloy steel, bearing steels, cast irons, etc.



■ METAL-BONDED Wheel



Metal-bonded wheel, as a wheel manufactured by mixing metallic powder bond such as iron, copper, tin, tungsten, cobalt, etc. and DIA and CBN, is suitable for machining of difficult-to-cut materials, glass, etc. and used for profile and honing machining purpose as it is excellent in shape retention and abrasion resistance.

Features

1. Excellent in toughness, heat resistance, abrasion resistance, etc.
2. Excellent in the Interrupted grinding applications
3. Excellent in product life and shape retention capability
4. It required power higher than other bonded wheels

Product Description

Metal-bonded wheel is made of metallic powder as a bond such as copper, tin, iron, cobalt, etc. and excellent in grit retention and abrasion resistance

Applications

1. Diamond Wheel

● With excellent properties in heat resistance, abrasion resistance and shape retention ability, it is used for rough and semi-finishing grinding of glass, ceramics, ferrites, semiconductor, refractory materials, stones, etc. and has an excellent performance in grinding total shape and profile machining that the shape retention of the wheel is required.

2. CBN wheel

● It is used in inner and outer diameter grinding, forming grinding and creep feed grinding.

■ Vitrified-bonded Wheel



Vitrified-bonded wheel also called a ceramic-bonded wheel manufactured through a primary molding process and a secondary sintering process by mixing vitreous bond material, the ceramic ingredient, and auxiliary wheels with super-abrasives, is widely used in the specific industrial fields where a resin-bonded wheel or a metal-bonded wheel is hard to be applied in the difficult-to-cut materials such as ultra-light materials, ceramic material, HSS, SKD11, etc.

Features

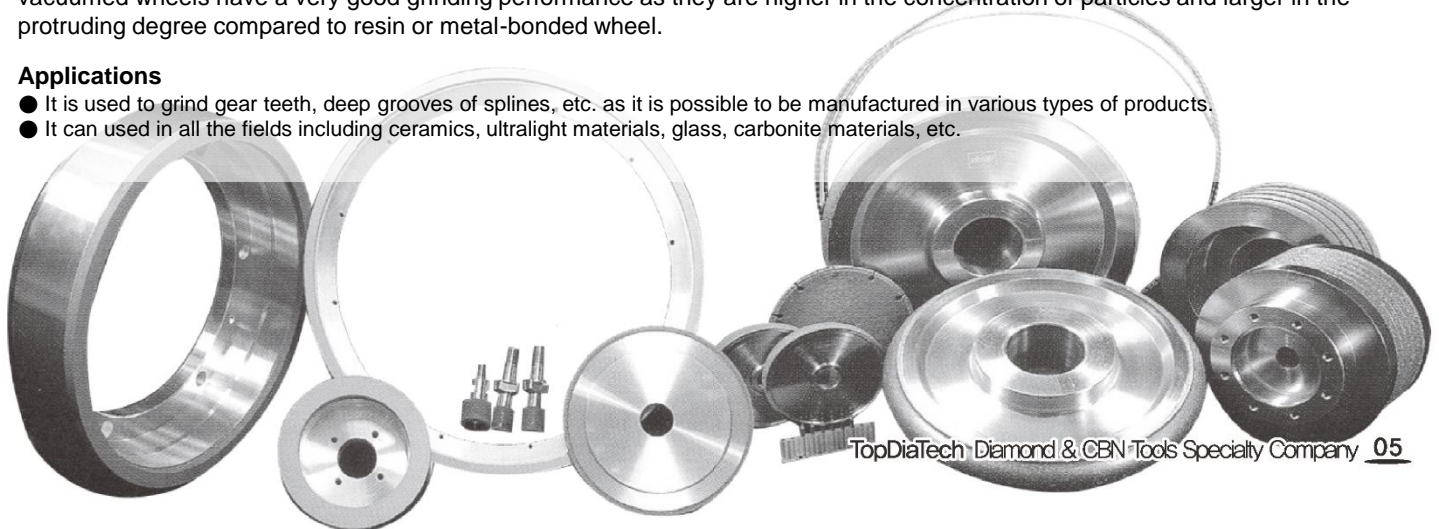
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8. Vitreous bond material easy to break due to its brittleness

Product Description

Electroplated-bonded wheel consists of the super-abrasives (DIA, CBN) of a single layer with the surface of the wheel in the form electroplated with nickel. Nickel is generally used in the electroplated bond wheel as it is very excellent in and has a suitable plating quality and bond strength. The electroplated-bonded wheel has no internal residual stress and is in a physically bonded condition as it is manufactured at room temperature. However, the vacuumed wheel bonded with brazing is far better in the bonded strength of diamond compared to an electroplated bonded wheel as it is manufactured by a chemical bond reaction. Both electroplated-bond and vacuumed wheels have a very good grinding performance as they are higher in the concentration of particles and larger in the protruding degree compared to resin or metal-bonded wheel.

Applications

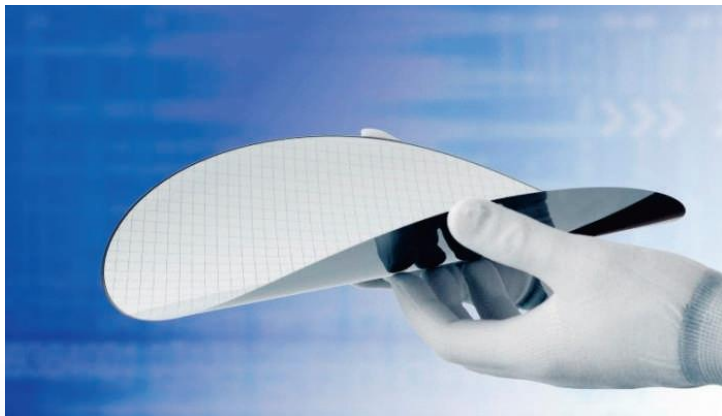
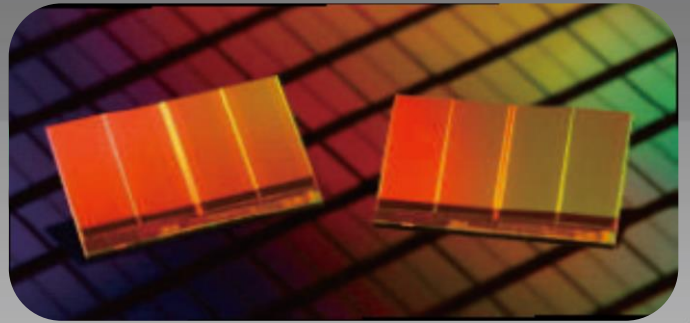
- It is used to grind gear teeth, deep grooves of splines, etc. as it is possible to be manufactured in various types of products.
- It can used in all the fields including ceramics, ultralight materials, glass, carbonite materials, etc.



Semiconductor back-grinding wheel



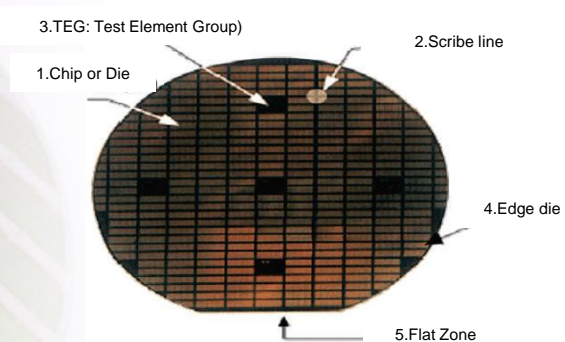
This is a grinding wheel required to adjust the height of thickness in the chip package process for patterned wafers completed in the FAB (Fabrication) process, the pre-process in the semiconductor process, to make it smaller, thinner and lighter. It is used to grind the back surface of workpieces when making them thin and lightweight to make chips like MCP (Multi-Chip Package) using a grinding wheel used to machine expensive workpieces like silicon wafers and sapphire wafers.



※ What is a wafer?

A wafer also called substrate is a thin disc used as a semiconductor material and thinly sliced round plate of a single crystal rod made of silicon or gallium arsenide, etc. The surface of the wafer is not only free from any defect or contamination but also requires a high degree of flatness. It should be precise enough to the level that no distortion of 2 micron or larger is allowed in a wafer with diameter of 6 inches as such a small distortion affects the accuracy of a circuit.

※ The structure of a wafer



Grit Size and Concentration

- ▶ Grit size refers to the size of an abrasive to be marked with mesh (#) for sizes from #16 through #400 and micron (μm) for sizes of #400 or larger.
- ▶ Concentration is marked 100% (25% of the total volume) when 4.4 carats are contained in 1cm^3 .
 - ① The higher concentration, the longer tool life and the better surface roughness but the grinding force will be dropped due to the increased number of abrasives contacted with a workpiece.
 - ② The lower concentration, the shorter tool life and the poorer surface roughness but, in general, the grinding force will be enhanced.
 - ③ The grinding force of the wheel with a rough abrasive will be enhanced and the wheel life will be improved.
 - ④ A rough abrasive deteriorates the surface roughness by creating large chips during grinding.

★Grit table

Grit Size	Size(μm)	FEPA	Application	Grit Size	MICRON	Application
#16/18	1180/1000	D/B 1180	GRINDING	#400	40-60	LAPPING
# 18/20	1000/850	D/B 1001		#500	30-40	
#20/25	850/710	D/B 851		#600	22-38	
#25/30	710/600	D/B 711		#800	20-30	
#30/35	600/500	D/B 601		#1000	15-20	
#35/40	500/425	D/B 501		#1200	10-20	
#40/45	425/355	D/B 425		#1500	8-16	
#45/50	355/300	D/B 356		#1800	6-12	
#50/60	300/250	D/B 301		#2000	5-12	POLISHING
#60/70	250/212	D/B 251		#2200	5-10	
#70/80	212/180	D/B 231		#3000	4-8	
#80/100	180/150	D/B 181		#5000	3-6	
# 100/120	150/125	D/B 151		#8000	2-4	
# 120/140	125/106	D/B 126		#12000	1-3	
# 140/170	106/90	D/B 109		#14000	0-2	
# 170/200	90/75	D/B 91		#28000	0-1	
#200/230	75/63	D/B 76		#60000	0-0.5	
#230/270	63/53	D/B 64		※ abrasive hardness (μm) \approx 15,000/M (M: MESH SIZE)		
#270/325	53/45	D/B 54				
#325/400	45/38	D/B 46				

Wheel Selection Guide

1. Select a correct bond
 - It is required to select a bonding material suitable for the characteristics of workpieces and the machine to be used with.
2. Select the diameter of the wheel and a wheel with correct width
 - It is required to select the diameter and width of the wheel suitable for the power, condition and rigidity of the machine.
3. Select a wheel with an appropriate grit size
 - Select the largest grit size within the range that the required surface roughness can be obtained to increase the grinding cost of the wheel
4. Select a wheel with an appropriate percentage of concentration
 - It is economic to select a wheel with the highest percentage of concentration within the power range of the grinder, which also enables you to do your work in the most efficient way.

How to order Diamonds and CBN wheels

- 1) Shape and dimensions: Refer to the catalogue when ordering a wheel certified by international standards.
In case of ordering of a wheel shape certified by special standards, its drawing and dimensions are required.
- 2) Abrasive type (Diamond, CBN)
- 3) Mesh Size: Refer to the Table of Grit Sizes
- 4) Hardness of Bond
- 5) Concentration
- 6) Bond type(B,V,M,E)
- 7) Quantity and delivery
- 8) Workpieces (Type, Material, Hardness, Required surface roughness, etc.)
- 9) Machine currently used (Machine name, Machine type and Horsepower)
- 10) Machining Conditions (RPM, Table speed, Cutting depth, Cooling method, other specific requirements, etc.)

Marking method of diamond and CNB wheels

SDC 140 N 100 B 250-W

① ② ③ ④ ⑤ ⑥ ⑦

Type of Abrasives	Grit Size	Grade of hardness	Concentration	Type of Bond	Bond Name	Dry/Wet
D : Natural diamond	#20 #400					
SD : Synthetic diamond	#30 #500					
SDC : Synthetic coating diamond	#40 #600		25 = 1.1ct/cc			
	#50 #800		50 = 2.2ct/cc			
CBN : Cubic Boron Nitride	#60 #1000	J : Soft	75 = 3.3ct/cc	B : Resin		D : Dry
	#80 #1200	L : ↑	100 = 4.4ct/cc	M : Metal		W : Wet
CBNC : Cubic Boron Nitride coating	#100 #1500	N : Mid	125 = 5.5ct/cc	V : Vitrified	Bond number	W/D : Mixed
	#120 #1800	P : ↓	150 = 6.6ct/cc	E/P : Electroplated		
TC : Tungsten carbide	#140 #2000		175 = 7.7ct/cc			
TS : Tungsten carbide+Steel	#170 #3000	R : Hard	200 = 8.8ct/cc			
ST : Steel	#200 #5000					
CRM : Ceramic	#230 #8000					
CM : Cermet	#270 #12000					
	#325 #14000					

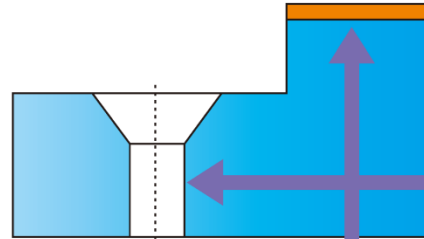
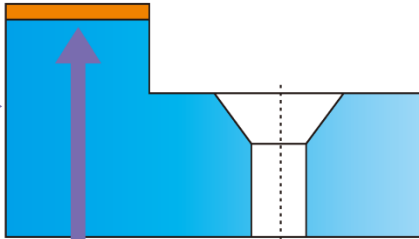
★ Concentration of wheels by bond type

Concentration	Abrasives (Cts)	Bond
200	8.8	Vitrified
175	7.7	Vitrified
150	6.6	Vitrified/Resin
125	5.5	Vitrified/Resin/Metal
100	4.4	Vitrified/Resin/Metal
75	3.3	Resin/Metal
50	2.2	Resin/Metal
25	1.1	Metal

Standard Shapes of Diamond & CBN Grinding Wheels

It shows the segmented shapes of standard grinding wheels for reference purpose when manufacturing customized products. (For example: Combination of 6A2C with 6A2H)

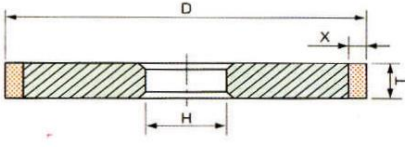
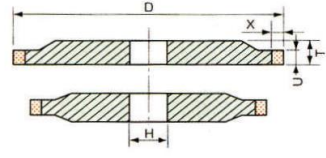
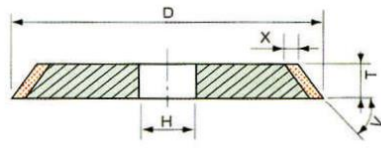
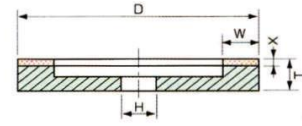
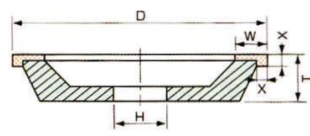
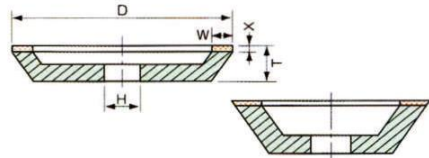
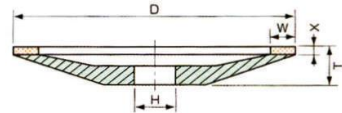
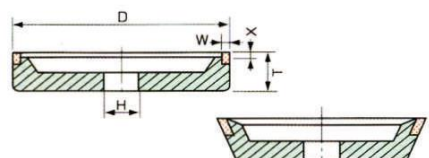
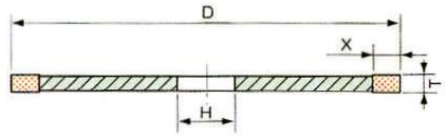
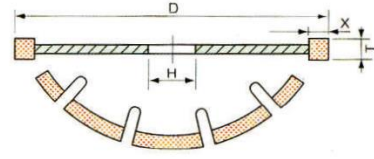
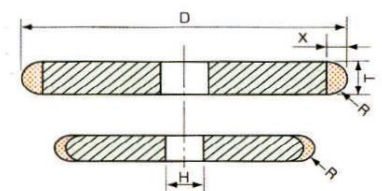
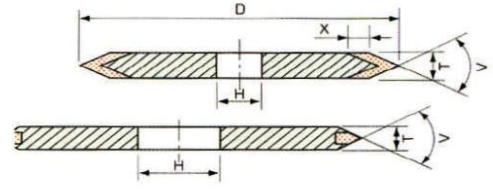
Ex : 6AC2



SHAPE OF BODY	SIDE VIEW OF ABRASIVE PARTS	LOCATION OF ABRASIVE PARTS	MODIFICATION ALTERATION
1	A J	OUTSIDE 1	STEP TYPED HOLE B
2	AH K	SIDE 2	DISH TYPED HOLE C
3	B L	BOTH SIDES 3	STRAIGHT TYPED HOLE H
4	C LL	INSIDE TAPER 4	STRAIGHT SCREWED HOLE M
4	CH M	OUTSIDE TAPER 5	AN EXTRA OF ONE SIDE P
6	D P	OUTSIDE PARTS 6	AN EXTRA OF BOTH SIDE R
9	DD Q	INSIDE PARTS 7	SEGMENT S
11	E QQ	WHOLE 8	SOLT-SEGMENT SS
BELOW 45° OVER 90° 12	EE S	EDGE 9	SCREWED HOLE R
BELOW 45° 14	F U	INSIDE 10	ABRASIVE ZONE IN O
	FF V		OPPOSITE DIRECTION OF ABRASIVE ZONE V
	G Y		INSERT DIRECTION OPPOSITION Y
	H		

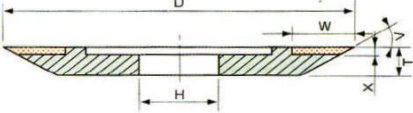
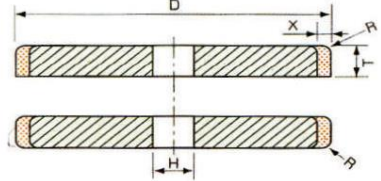
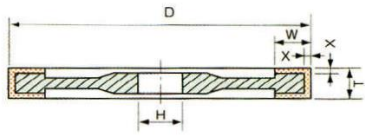
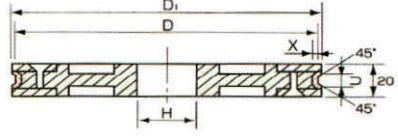
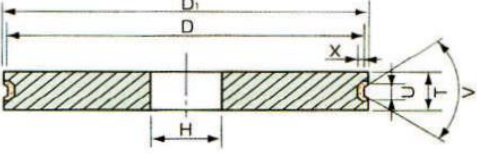
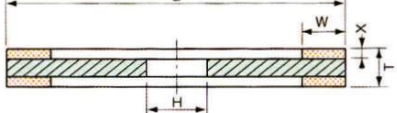
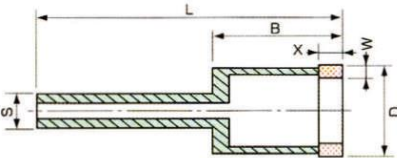
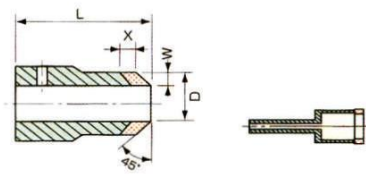
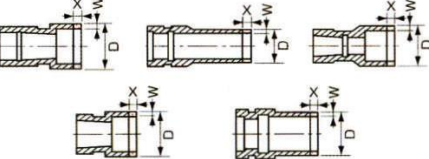
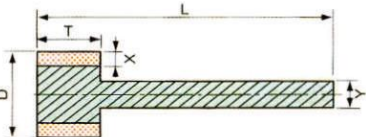
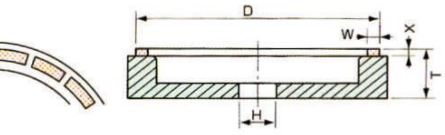
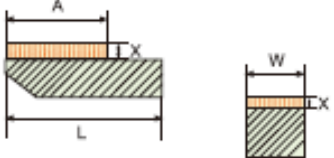
Cross-Sectional View of Diamond and CBN Wheels

Specifications for WHEEL

1A1		3A1/ 14A1	
1V1		6A2	
11C9/ 11Y9		11A2/ 11B2	
12A2		6A9/ 11V9	
1A1R		1A1RSS	
1F1/ 1FF1		1EE1 /1E6Q	

Cross-Sectional View of Diamond and CBN Wheels

Specifications for WHEEL

4B2		1Q1/ 1L1	
9U1		1DD6Y	
1FF6Y/ 1EE6Y/ 1LL6Y/ 1DD6Y		9A3	
3A2		3V2T	
3F2		DW	
6A2S		HH1	

Conditions for effective Use of Diamond and CBN Wheels

1) Peripheral speed $V = \pi \times D \times N$

■ As wheel performance greatly affects grinding efficiency, surface roughness and wheel life depending on the peripheral speed, it is recommended to use a wheel at the optimal peripheral speed.

■ Please refer to the optimal peripheral speeds in the table below.

※ Peripheral speed of a wheel is affected by the outer diameter (D) and the number of revolutions (N) of the wheel.

BOND	Diamond Wheel		CBN Wheel	
	Dry	Wet	Dry	Wet
Vitrified(V)	700 ~ 1200	1200 ~ 1800	800 ~ 1200	1200 ~ 2400
Resin(B)	700 ~ 1200	1200 ~ 1800	900 ~ 1500	1200 ~ 2400
Electroplated(E)	700 ~ 1200	1200 ~ 2400	900 ~ 1400	1200 ~ 2400
Metal(M)	500 ~ 1000	900 ~ 1200	900 ~ 1200	1200 ~ 1800

■ Various workpieces and peripheral speeds

Workpieces	Wheel	Speed(μm/min)
Steel	CBN	500 ~ 1800
Carbide	DIAMOND	500 ~ 1500
Ferrite	DIAMOND	1500 ~ 2000

Workpieces	Wheel	Speed(μm/min)
Silicone	DIAMOND	500 ~ 1400
Glass	DIAMOND	1500 ~ 1900
Ceramic	DIAMOND	1500 ~ 2000

2) Cutting depth

The depth of cut varies depending on the grinding conditions or the type of a workpiece. Select cutting depth appropriately in a way to maintain the grinding wheel life to the maximum and reduce machining cost and refer to the depth of cut commonly used in the table below.

Diamond Tools Mesh	Depth of Cut
#100 ~ 120	0.02 ~ 0.03mm
#140 ~ 170	0.01 ~ 0.02mm
#230 more than	0.01mm and less

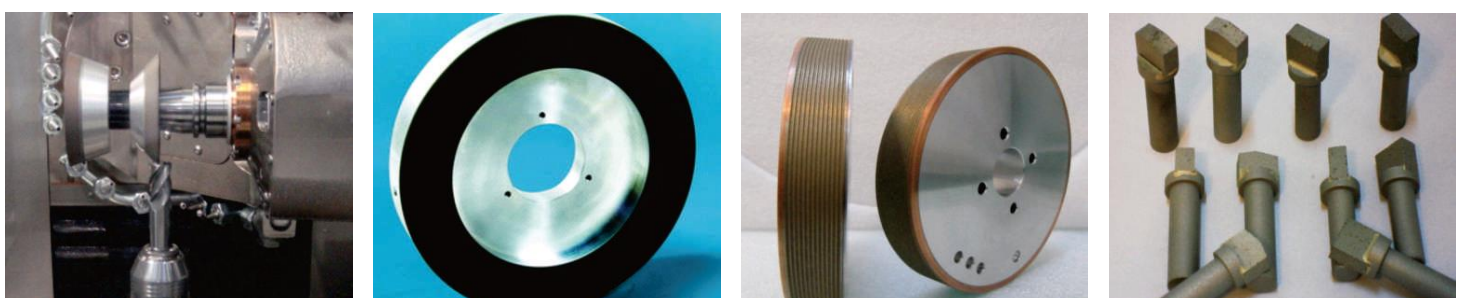
Surface	Depth of Cut(μm/min)
Rough	20 ~ 30
Lapping	10 ~ 20
Polishing	5 ~ 10

3) Grinding fluid

As a simple way to improve the performance of the grinding wheel, choose wet grinding method rather than dry method if possible, which improves the surface roughness and minimizes the possible damage to workpieces by heat generated during grinding work. In general, a mixture of water and anti-rust additive is used in diamond grinding wheels but it degrades the grinding performance when reacted with water in CBN abrasives. Even the effect of non-water soluble grinding fluid on CBN grinding wheels is excellent but, in case that water-soluble fluid is used, it is required to mix the fluid containing a large amount of extreme-pressure additives and oil with water at a ratio of 1:20 before use.

4) Maintenance of machine

As the vibrations in the spindle or the table of a machine may worsen the surface roughness of workpieces by the cracks, falling off and abnormal flaking off the bonded layer, sufficient maintenance is required to be performed regularly. In addition, horsepower enough to stabilize the peripheral speed and cutting depth of grinding wheels is supplied to achieve the optimal grinding efficiency. Supply of insufficient horsepower to machines may result in deteriorating the peripheral speed and causing abnormal wearing of grinding wheels and degrading grinding efficiency.



Surface roughness by grit size of abrasives

Surface roughness depends on the grit size of abrasives. Due to such characteristics, there will be differences in surface roughness according to the skill of the operator and the conditions the machine is used even though same grinding method is used. Following table shows the comparison of surface roughness between abrasive grit sizes.

Mesh size	Roughness			RESIN Maximum height Rmax(μm)	Metal Maximum height Rmax(μm)	
	Maximum height Rmax(μm)	Average of center line Ra(μm)	Average of 10 points Rz(μm)			
#140/170	3.3	0.54	2.9	3.3	4	
#170/200	2.8	0.48	2.5	2.8	3.3	
#200/230	2.4	0.41	2.2	2.4	2.8	▽
#230/270	2.0	0.34	1.8	2.0	2.3	
#270/325	1.6	0.27	1.4	1.6	2.0	▽▽
#325/400	1.4	0.24	1.3	1.4	1.7	
#400/500	0.8	0.14	0.7	0.8	1.0	▽▽▽
30-40(#500)	0.6	0.10	0.5	0.6	0.8	
22-36(#600)	0.4	0.07	0.4	0.4	0.6	
15-25(#800)	0.3	0.05	0.3	0.3	0.4	
10-20(#1200)	0.2	0.03	0.2	0.2	0.3	▽▽▽▽
8-16(#1500)	0.1	0.02	0.1	0.1	0.2	

◆ Surface Roughness Conversion Table

Maximum height Rmax(μm)	Center Line Average	Average roughness at center line	10-point Average	Average roughness at center line	Maximum height Rmax(μm)	Center Line Average	Average roughness at center line	10-point Average	Average roughness at center line
0.1	0.02	0.02	0.1	1	2.0	0.34	0.38	1.8	20
0.2	0.03	0.04	0.2	2	2.4	0.41	0.46	2.2	24
0.3	0.05	0.06	0.3	3	2.8	0.48	0.53	2.5	28
0.4	0.07	0.08	0.4	4	3.2	0.54	0.61	2.9	32
0.5	0.09	0.10	0.5	5	3.6	0.61	0.29	3.2	36
0.6	0.10	0.11	0.5	6	4.0	0.68	0.76	3.6	40
0.7	0.12	0.13	0.6	7	4.5	0.77	0.86	4.1	45
0.8	0.14	0.15	0.7	8	5.0	0.85	0.96	4.5	20
0.9	0.15	0.17	0.8	9	5.5	0.94	1.05	5.0	55
1.0	0.17	0.19	0.9	10	6.0	1.02	1.14	5.4	60
1.2	0.20	0.23	1.1	12	7.0	1.19	1.33	6.3	70
1.4	0.24	0.27	1.3	14	8.0	1.36	1.52	7.2	80
1.6	0.27	0.30	1.4	16	9.0	1.53	1.71	8.1	90
1.8	0.31	0.34	1.6	18	10.0	1.70	1.90	9.0	100

※ Use the values in the above table as reference to conversion values of surface roughness.

Truing and Dressing

1) Truing

As a process of making a grinding wheel round and concentric with its spindle axis, this process uses to modify the shape and trembling of grinding wheels by grinding and abrading the abrasives and bond layer through the truing process.

※ Truing by using an ordinary stone (C type or A type)

Select a stone slightly harder in the bonding force if you want to use a grinding stone coarser than the particles of grinding wheel by 2 class in order to do truing more effectively. The way to select ordinary stones is as follows:

Grit size of grinding wheel	Ordinary grinding stones for truing purpose	
Coarser than #80	C 46	WA 60
#100~200	C 60	WA 120
#230~325	GC 120	WA 200
Finer than #400	GC 200	GC 300 more
Finer than #1000		

- ▶ Resin-bonded wheels: Use of grinding stones, copper bars, copper plates, cast irons
- ▶ Vitrified-bonded wheels: Grinding stones
- ▶ Metal-bonded wheels: Grinding stones
- ※ Product performance is degraded if Fe is used during DIA abrasive truing.

2) Dressing

1. As the grinding wheel becomes unusable after truing is completed due to the poor abrasive crystal protrusion, it is recommended to make the grinding wheel possible to effectively grind by protruding the abrasive area outside of the bond layer after removing the bond.

※ If truing and dressing are effectively completed,

- Products with suitable surface roughness and shape are produced
- grinding power is reduced down to the minimum.
- No damages to the surface by heat or trembling mark is left.
- The rate of removing materials is increased while grinding cost is reduced.

2. It is desirable to use a stick of grit abrasives finer than those in grinding wheels by 1~2 class in order to effectively protrude abrasives out of the bond layer.

Grit size of grinding wheel	Ordinary grinding stones for truing purpose
Coarser than #80	WA 120
#100~200	WA 200
#230~325	Lapping stick
Finer than #400	Lapping stick

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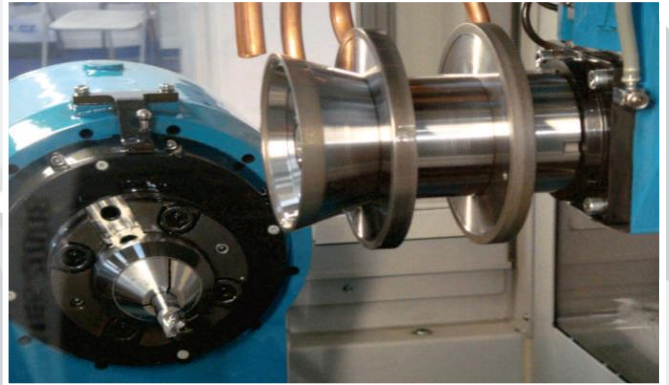
- ▶ Vitrified Diamond & CBN WHEEL
- ▶ Resin Diamond & CBN WHEEL
- ▶ Metal Diamond & CBN WHEEL
- ▶ Electroplated Diamond & CBN WHEEL

TOPDIA 탑다이아테크(주)

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Diamond

