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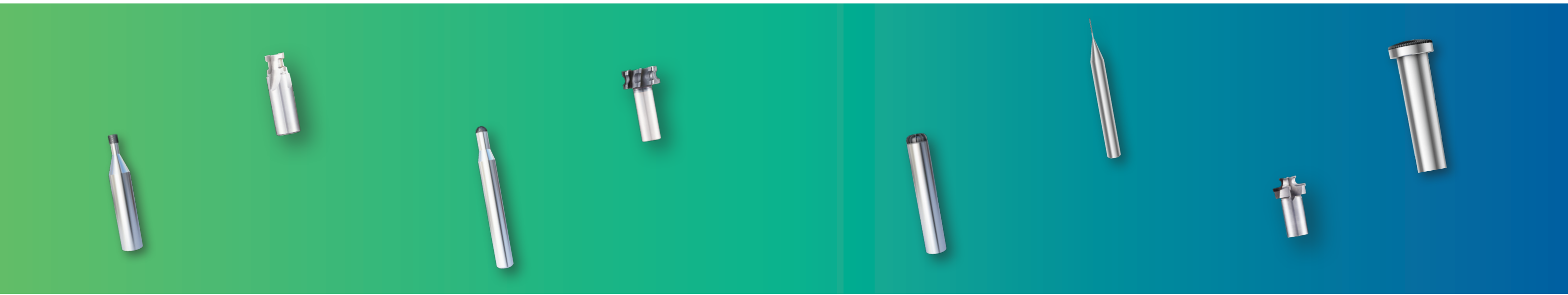
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# CONPROFE



## ***Superhard Cutting Tools Product Guiding -PCD Cutting Tools***



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## Connotation

Converging of Global Resources

Professional as Industry Leader

“ **CONPROFE** ”

## Company Overview

With its roots back to 2003, Conprofe is a Provider of Efficient, Green and Intelligent Manufacturing Solutions and Key Units. It has been holding on to the idea of "Converging of Global Resources, Professional as Industry Leader" in the past two decades. Revolving around "Efficient, Green and Intelligent Manufacturing", the company has achieved a giant leap from parts, units to machines and developed a product portfolio with three major industries - Precision Tools, Key Units and CNC Machine Tools, which covers eight categories of products, including Super-hard Tools, Tapping Tools, Precision Tool Holders, Ultrasonic Technologies, Green Technologies, Precision Units, Ultrasonic-Green CNC Machine Tools and Automation. Its customers have spread across diverse sectors, such as consumable electronics, semiconductors, automotive, aviation & aerospace, medical, education and general precision manufacturing, etc.

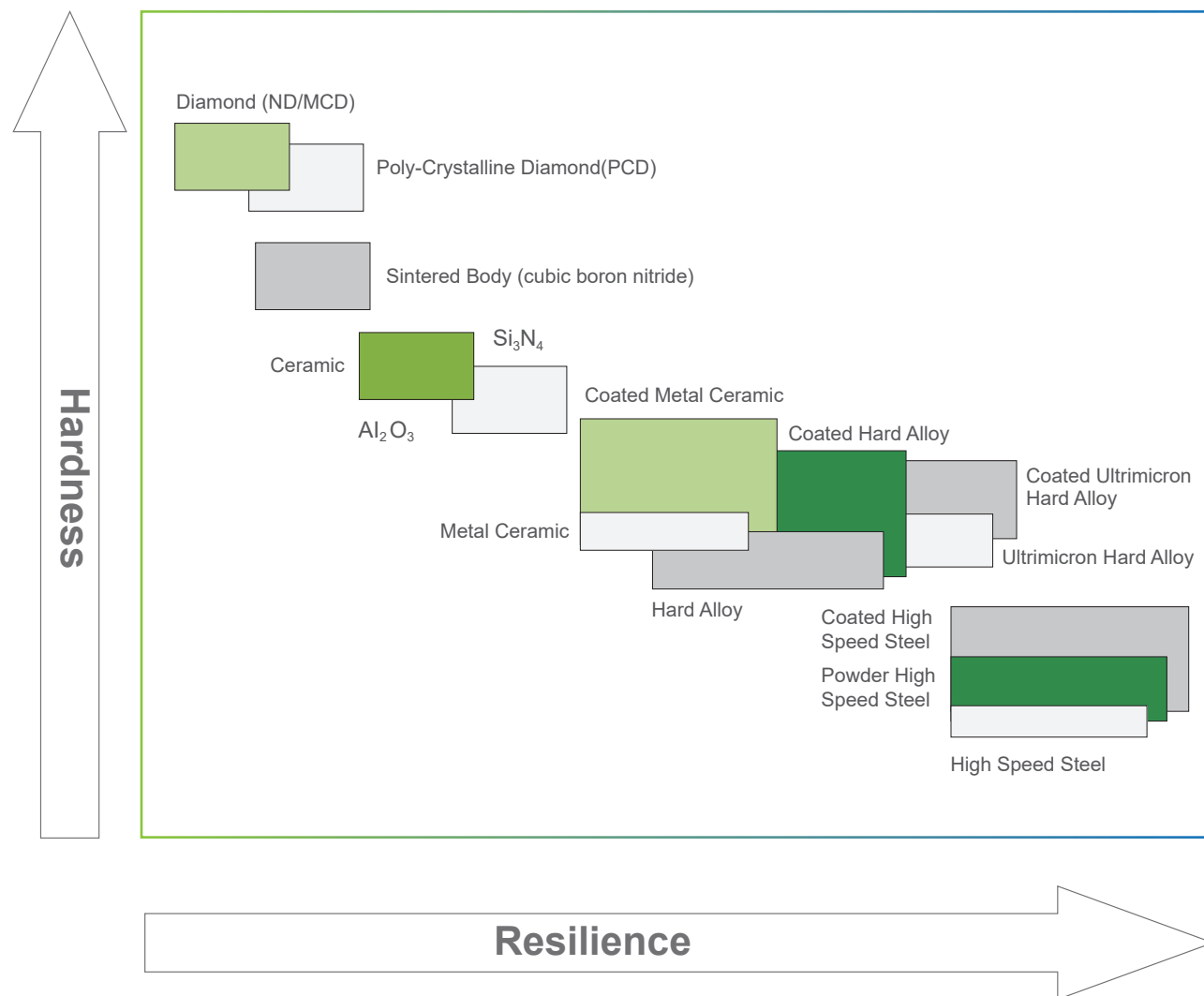
Conprofe perseveres in laying a solid foundation in the domestic market while keeping its eyes open to the world. Headquartered in Guangzhou Science City, the company has established sales and service centers in seven domestic regions and forged a network of R&D, sales and service based in Hong Kong, Taiwan, the United States, South Korea, India and Vietnam, etc. With its products being exported to over 70 countries and regions across six continents, Conprofe's integrated distribution of R&D, production, sales and service around the globe has gradually come into being.

Conprofe persists in innovation-driven developing strategy and owns two National High-tech Enterprises under the Group. The company's Frontier Technology Research Institute (FTRI) and Guangdong Province Engineering Technology Center (GPETC) has developed over 850 core technology patents. Its primary product technologies have reached an internationally advanced level, as assessed and acknowledged by experts led by members of the Chinese Academy of Engineering (CAE). Furthermore, Conprofe has successively been granted the Guangdong Scientific and Technological Progress Award (First Prize 2020, Second Prize 2021), Guangdong Patent Award (Silver), China Patent Award (Excellence) and has been honored as Enterprise with Significant Contribution to Guangdong's Supplies for COVID-19 Prevention and Control, Guangzhou Pioneering Private Enterprise, etc.





## Application Range of Superhard Materials



## PCD Materials

Diamond is the hardest and most wear-resistant material known in nature. Synthetic diamond is divided into two types, polycrystal and single crystal, which can be made by chemical vapor deposition (CVD) or high pressure and high temperature (HPHT) method. The polycrystalline composite sheet manufactured by high-temperature and high pressure way is the most common synthetic diamond material, usually abbreviated as PCD. PCD is a kind of diamond composite which is made from 1-30 micrometer diamond powder and catalytic cobalt. The element cobalt plays a role in improving the discharging performance and toughness of PCD.

### Physical Property of PCD Material

- » PCD material features high hardness, high compression resistance, good thermal conductivity and good wear resistance, thus achieving better machining accuracy and efficiency in high-speed cutting.
- » The hardness of PCD can reach 8000HV, 80 to 120 times harder than hardalloy.
- » The thermal conductivity of PCD is 700W/mK, 1.5 to 9 times harder than hard alloy, even higher than PCBN and copper, thus showcasing exceptional thermal conductivity.
- » The friction coefficient of PCD is generally only 0.1 to 0.3 (the friction coefficient of hard alloy is 0.4 to 1), so the PCD tool significantly reduces the cutting force.
- » The thermal expansion coefficient of PCD is only  $0.9 \times 10^{-6} \sim 1.18 \times 10^{-6}$ , which is only equivalent to 1/5 of the hardness, so the thermal deformation of the PCD tool is small and the machining accuracy is high.
- » PCD tools enable to minimize the tendency of a tool stick to non-ferrous and non-metal materials and formation of build-up edge on the tool tips during the machining.

### Advantages of PCD Cutting Tools

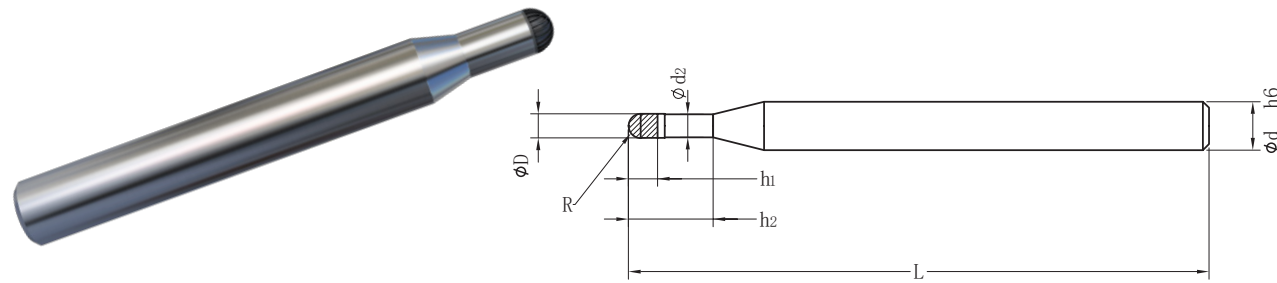
PCD Cutting Tools is hard alloy or steel cutter with PCD composite sheet as a welding part. There are some characteristics of PCD:

- » Super-High hardness and wear resistance;
- » High thermal conductivity, low thermal expansion coefficient, fast heat dissipation during cutting, low cutting temperature and small thermal deformation;
- » Small friction coefficient, reducing the roughness of the machined surface. When the PCD tool is used to machine aluminum alloy, there is few build-up edge and good machining dimensional stability and surface quality as well, due to the high diamond hardness, small affinity between the surface and the metal, and the front surface of the tool polished like a mirror. Machining various specifications of aluminum alloy parts with PCD cutting tool, its tool life reaches thousands to tens of thousands of pieces per tool, especially for the mass production of automobile and motorcycle parts. PCD tools are also widely used in high-speed machining of non-ferrous and non-metal materials in various sectors, for example, automotive, aerospace, electronics and wood.

# Introduction to Solid PCD Micro-edge Cutting Tools Series

## Solid PCD Micro-Edge Cutting Tools Standard Series

### ➤ Solid PCD Micro-Edge Ball End Mill



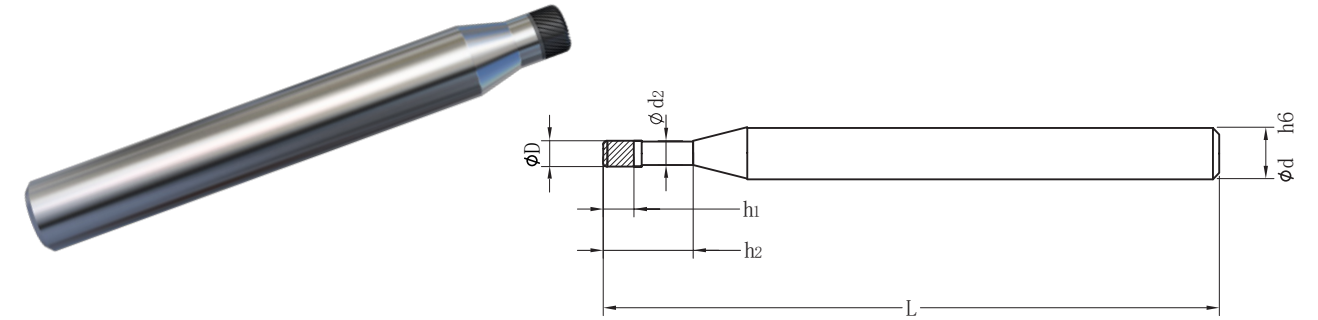
#### Specification Chart

Unit:mm

Blade Diameter(D)	R Angle (R)	Clearance Diameter (d2)	Effective Blade Length (h1)	Clearance Length (h2)	Total Length (L)	Tool Holder Diameter (d)
0.5	0.25	0.45	0.8	3	45	4
1	0.5	0.95	1.2	6	45	4
1.5	0.75	1.45	1.2	6	45	4
2	1	1.95	1.2	6	45	4
2.5	1.25	2.45	2.5	6	45	4
3	1.5	2.95	2.5	6	45	4
4	2	3.95	2.5	6	45	4
6	3	5.95	4	10	50	6
8	4	7.95	4	10	50	8

Not Customized

### ➤ Solid PCD Micro-Edge Ball End Nose Mill



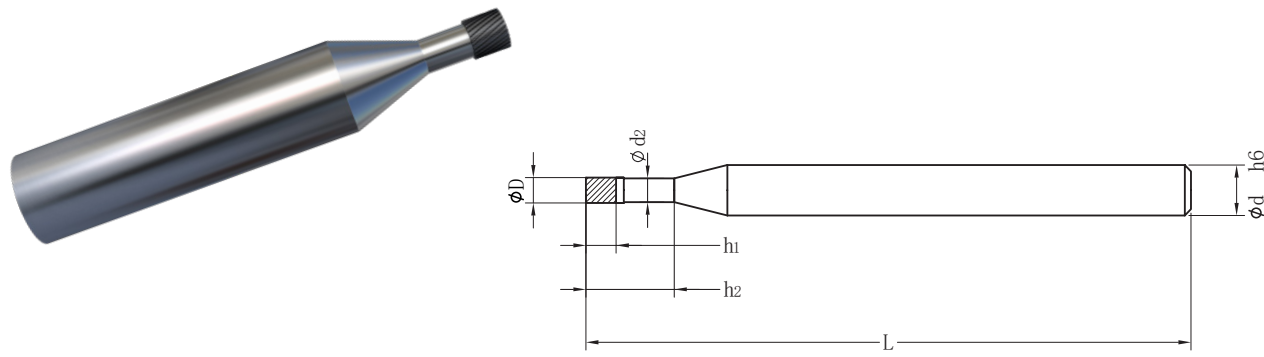
#### Specification Chart

Unit:mm

Blade Diameter(D)	R Angle (R)	Clearance Diameter (d2)	Effective Blade Length (h1)	Clearance Length (h2)	Total Length (L)	Tool Holder Diameter (d)
0.5	0.05	0.45	0.8	3	45	4
1	0.05	0.95	1.2	6	45	4
1.5	0.1	1.45	1.2	6	45	4
2	0.1	1.95	1.2	6	45	4
2.5	0.15	2.45	2.5	6	45	4
3	0.15	2.95	2.5	6	45	4
4	0.2	3.95	2.5	6	45	4
6	0.5	5.95	2.5	10	50	6
8	0.5	7.95	2.5	10	50	8
10	1	9.95	2.5	10	50	10
12	1.5	11.95	2.5	10	50	12
16	2	15.95	2.5	10	60	16
20	5	19.95	2.5	10	60	20

Not Customized

➤ Solid PCD Micro-Edge Flat End Cutter



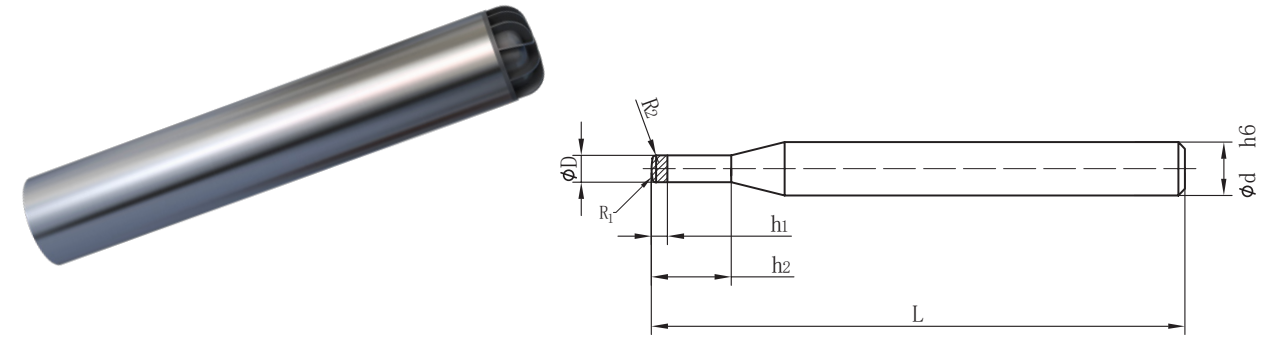
Specification Chart

Unit:mm

Blade Diameter(D)	Clearance Diameter (d2)	Effective Blade Length (h1)	Clearance Length (h2)	Total Length (L)	Tool Holder Diameter (d)
0.5	0.45	0.8	3	45	4
1	0.95	1.2	6	45	4
1.5	1.45	1.2	6	45	4
2	1.95	1.2	6	45	4
3	2.95	2.5	6	45	4
4	3.95	2.5	6	45	4
6	5.95	2.5	10	50	6
8	7.95	2.5	10	50	8
10	9.95	2.5	10	50	10
12	11.95	2.5	10	50	12
16	15.95	2.5	10	60	16
20	19.95	2.5	10	60	20

Not Customized

➤ Solid PCD Micro-Edge Spherical Cap Ball End Nose Mill



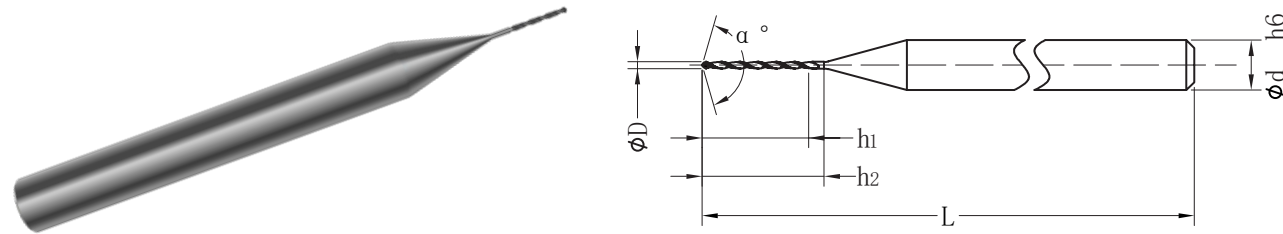
Specification Chart

Unit:mm

Blade Diameter(D)	R Angle (R <sub>1</sub> )	R Angle (R <sub>2</sub> )	Effective Blade Length (h1)	Clearance Length (h2)	Total Length (L)	Tool Holder Diameter (d)
2	4	0.3	1.2	6	40	4
4	10	0.3	2.5	6	40	4
4	10	0.5	2.5	6	40	4
6	20	0.5	2.5	6	40	6
8	20	1	2.5	6	40	8
10	40	2	2.5	6	40	10

Not Customized

➤ Solid PCD Drill



Specification Chart

Unit:mm

Blade Diameter(D)	Drill Point Angle( $\alpha$ )	Blade Length (h1)	Clearance Length (h2)	Total Length (L)	Tool Holder Diameter (d)
0.2	148°	4	4.5	38	3.175
0.3	148°	4	4.5	38	3.175
0.4	148°	4	4.5	38	3.175
0.5	148°	6.5	7.5	38	3.175
0.6	148°	6.5	7.5	38	3.175
0.8	148°	6.5	7.5	38	3.175
1.0	140°	6.5	7.5	45	4
1.2	140°	11	12	45	4
1.5	140°	11	12	45	4
2	140°	11	12	45	4
4	140°	20	22	60	4
6	140°	20	22	60	6
8	140°	20	22	60	8
10	140°	20	22	60	10
12	140°	20	22	75	12

Not Customized

## Gyroscope Machining

Machining Case of Solid PCD Micro-Edge Cutting Tool

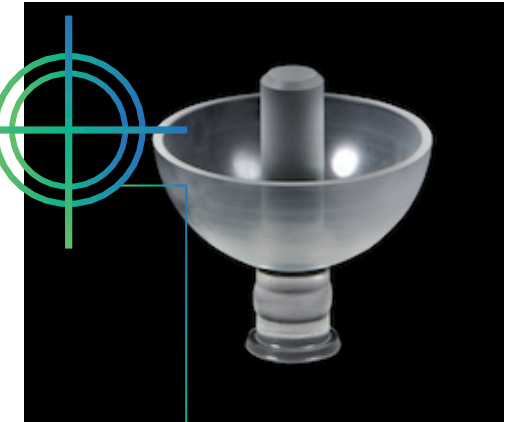
➤ UHB200-5Axis

Material: Quartz Glass

Dimension: 20\*20\*15.5mm

Wall Thickness: **0.7mm**

Advantages: No chippings, cracks and the shorter depth of subsurface damage layer



Cutting Tool

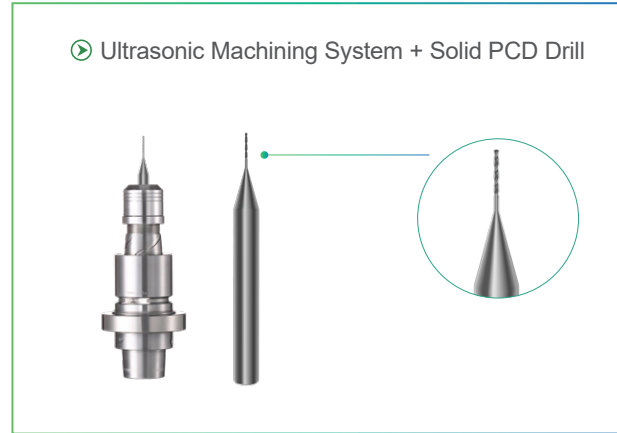
➤ Ultrasonic Machining System+Solid PCD Micro-Edge Cutting Tools





# Carbon Fiber Hole Machining

Application Case of Solid PCD Drill



**Traditional Machining**

Entry of the hole

Exit of the hole

- Severe tool wear and short tool life
- Low machining efficiency
- Severe burring with high scrap rate

**Ultrasonic System + Solid PCD Drill**

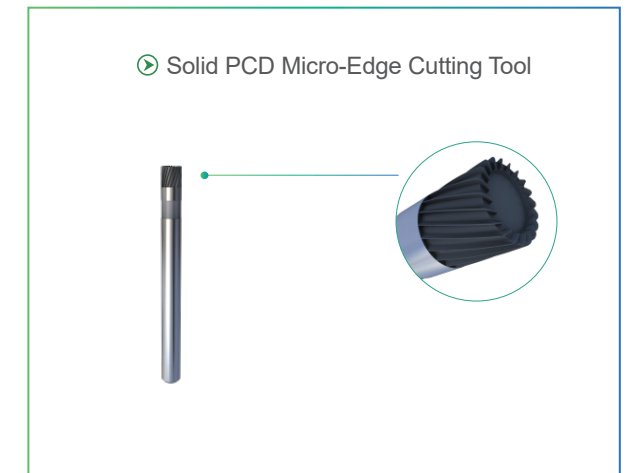
Entry of the hole

Exit of the hole

- Smooth and neat holes; no tearing, delamination, burring and softening
- Significantly reduce burrs around holes
- Hole quality improved by 3 times

# Carbon Fiber Milling

Application Case of Solid PCD Micro-Edge Cutting Tool



**Blind Grooving**

Solid PCD Micro-Edge Cutting Tool

- Slight burrs in groove
- No cracks around groove wall

Tungsten Steel Milling Cutter

- Severe burrs around groove
- Cracks around groove wall

Ra (μm)

Tool	Ra (μm)
Solid PCD Micro-Edge Cutting Tool	0.512
Tungsten Steel Milling Cutter	2.011

**Cavity Machining**

Solid PCD Micro-Edge Cutting Tool

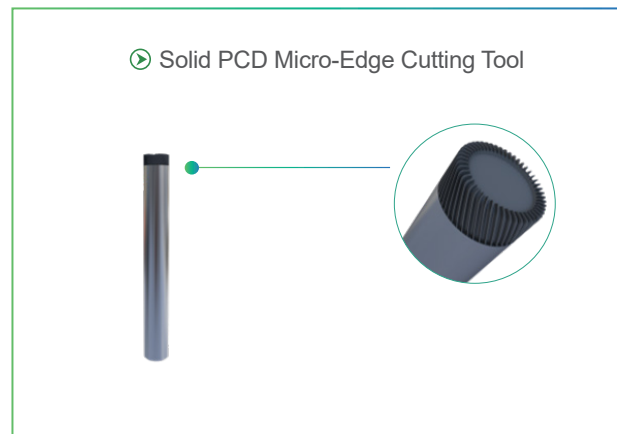
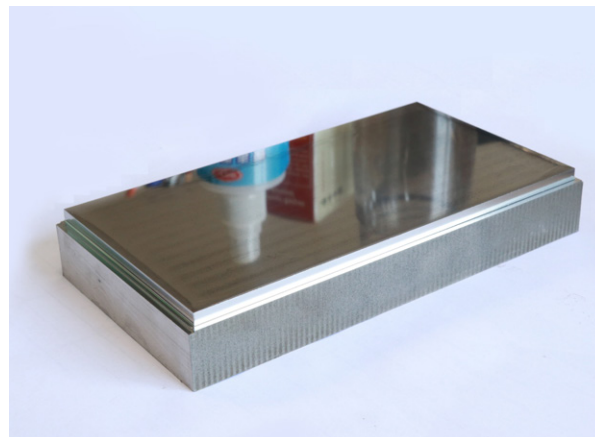
**Ra 0.493μm**

Tungsten Milling Cutter

**Ra 1.211μm**

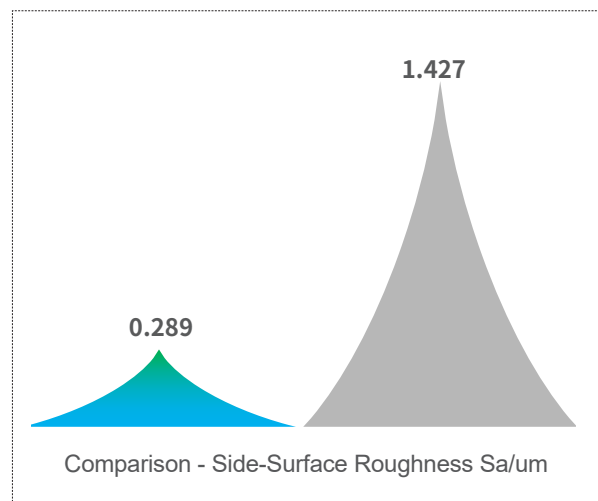
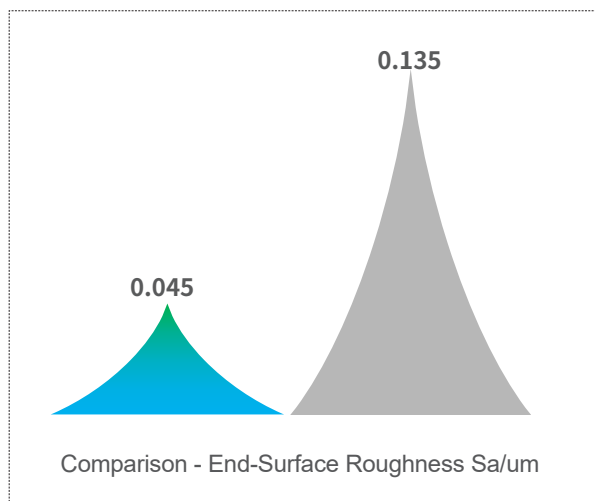
# Superalloy

Application Case of PCD Micro-Edge Cutting Tool



Solid PCD Micro-Edge Cutting Tool | Diamond Coated Cutting Tool

Solid PCD Micro-Edge Cutting Tool | Diamond Coated Cutting Tool

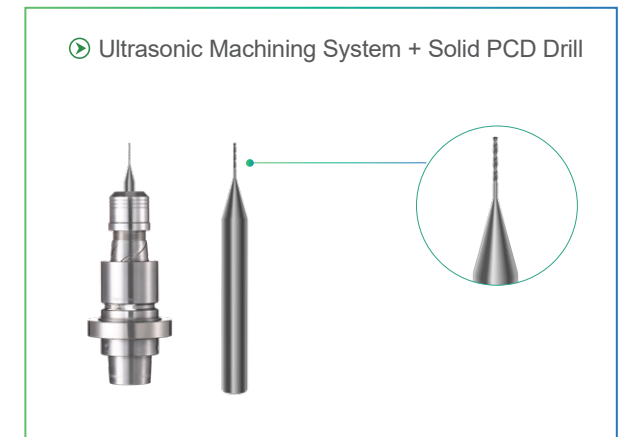
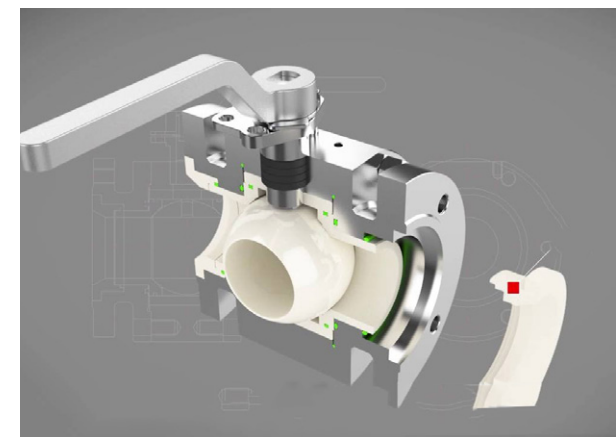


Test conditions: S=5,000rpm F=2,000mm/min Ap=0.05mm Ae=0.3mm

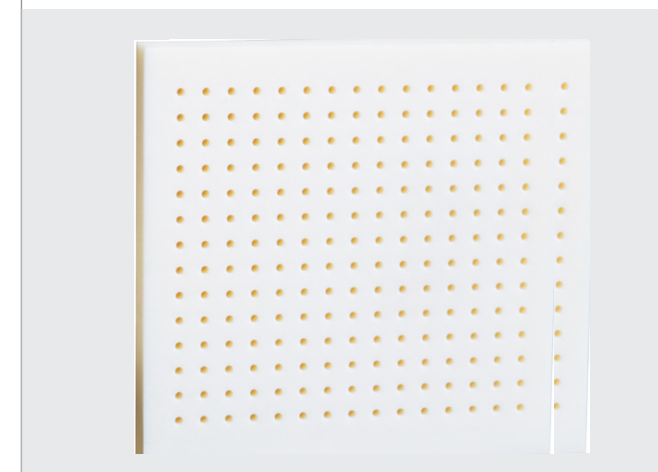
**Solid PCD Micro-Edge Cutting Tool  
Superalloy with Mirror-Finish Effect**

# Deep Micro-Hole Machining of Sintered Ceramics

Application Case of Solid PCD Drill



Ultrasonic Machining System + D1\*6 Solid PCD Drill



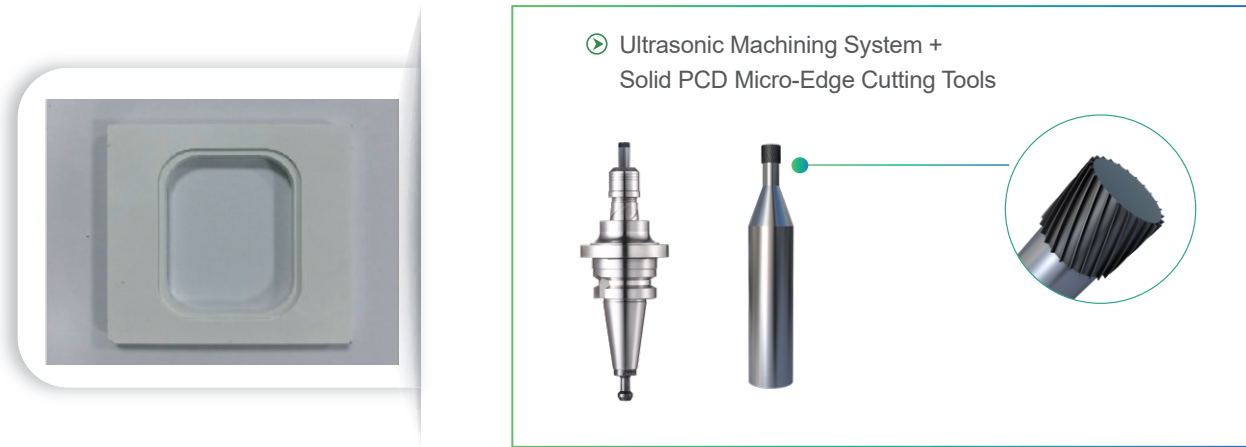
Machining Requirement:  
S=25,000rpm | F=30mm/min | Ap=0.06mm

- Depth diameter ratio of deep micro hole is **6:1**
- The hardness of sintered ceramics is as high as **1400Hv**

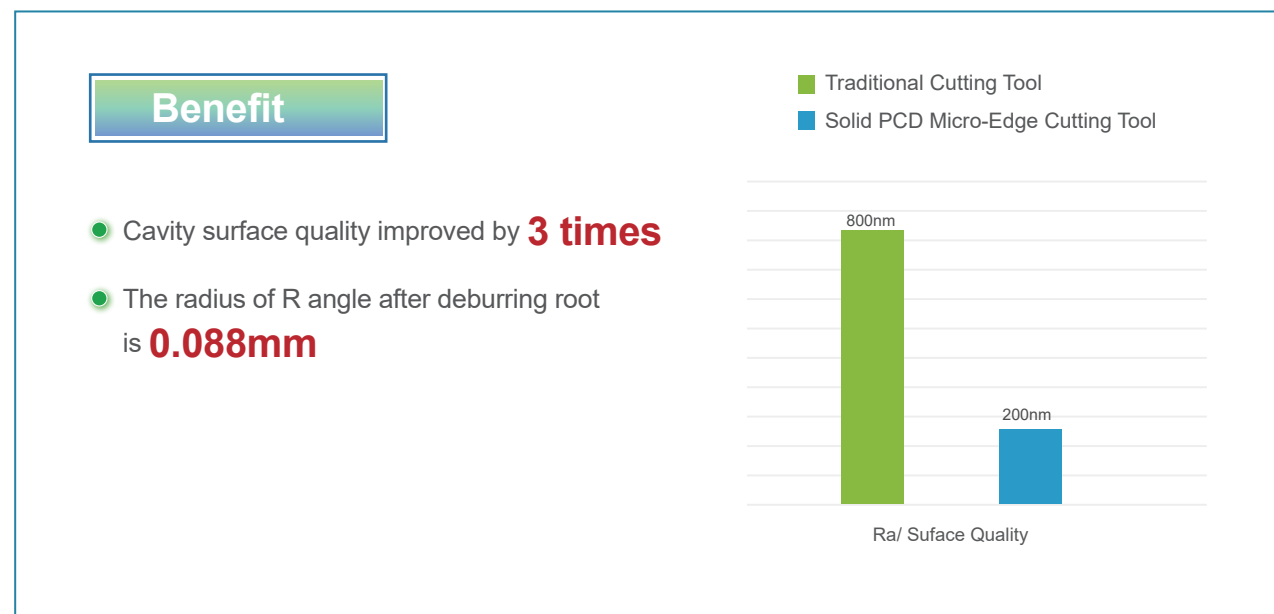
With ultrasonic machining, the cycle time of the D1\*6 Solid PCD reached **750 holes/pcs**

## Sintering Ceramic Cavity Deburring

Application Case of Solid PCD Micro-Edge Cutting Tool

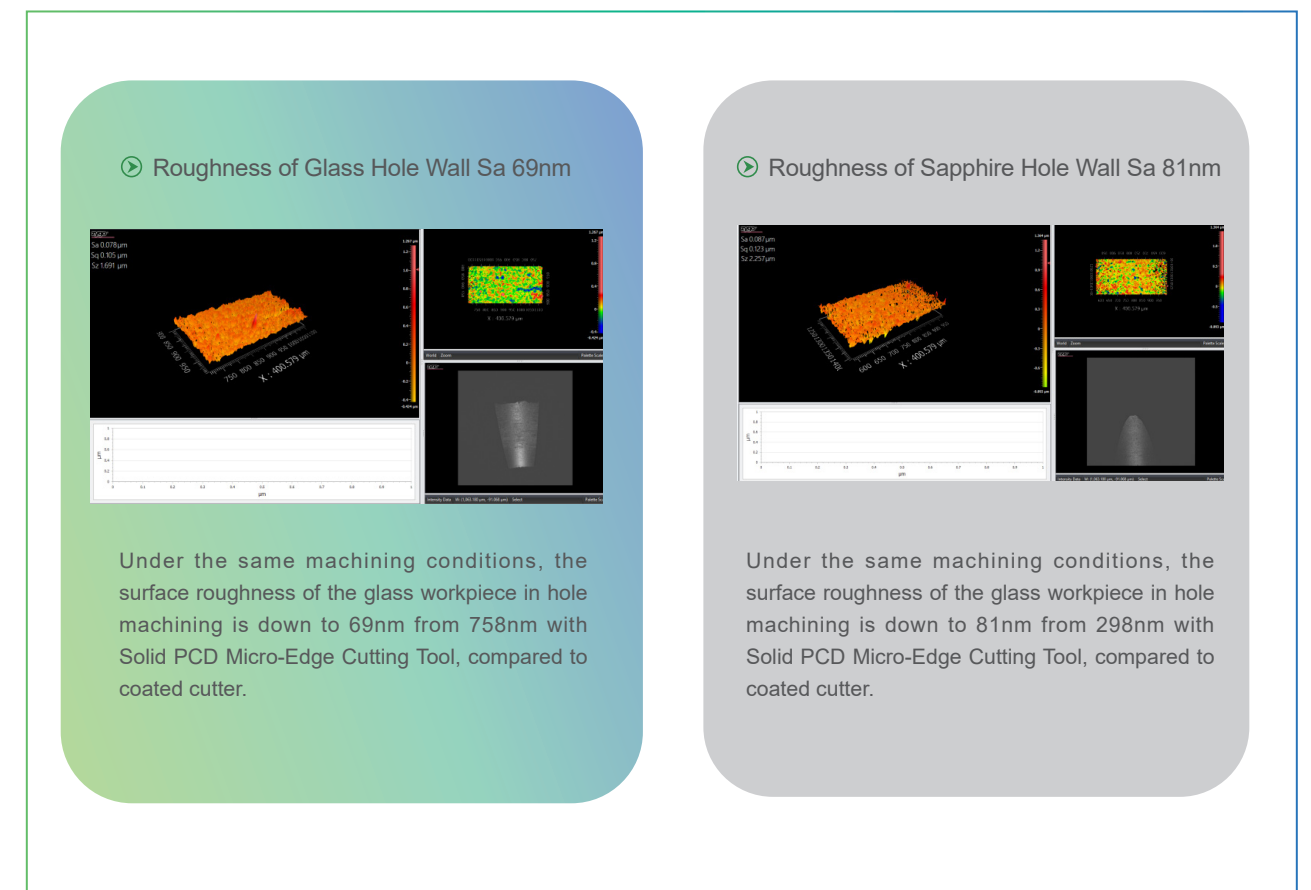


- Machining Requirement - Ceramic Internal Cavity Finishing & Deburring
- Challenges in Traditional Machining - Low surface quality and efficiency with extra time on re-machining



## Glass/Sapphire Hole Machining

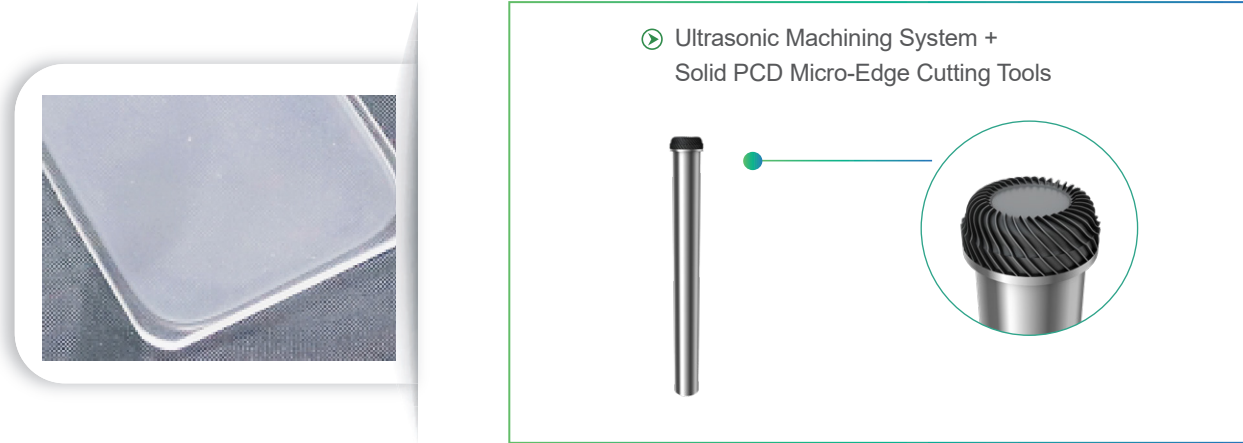
Application Case of Solid PCD Micro-Edge Cutting Tool



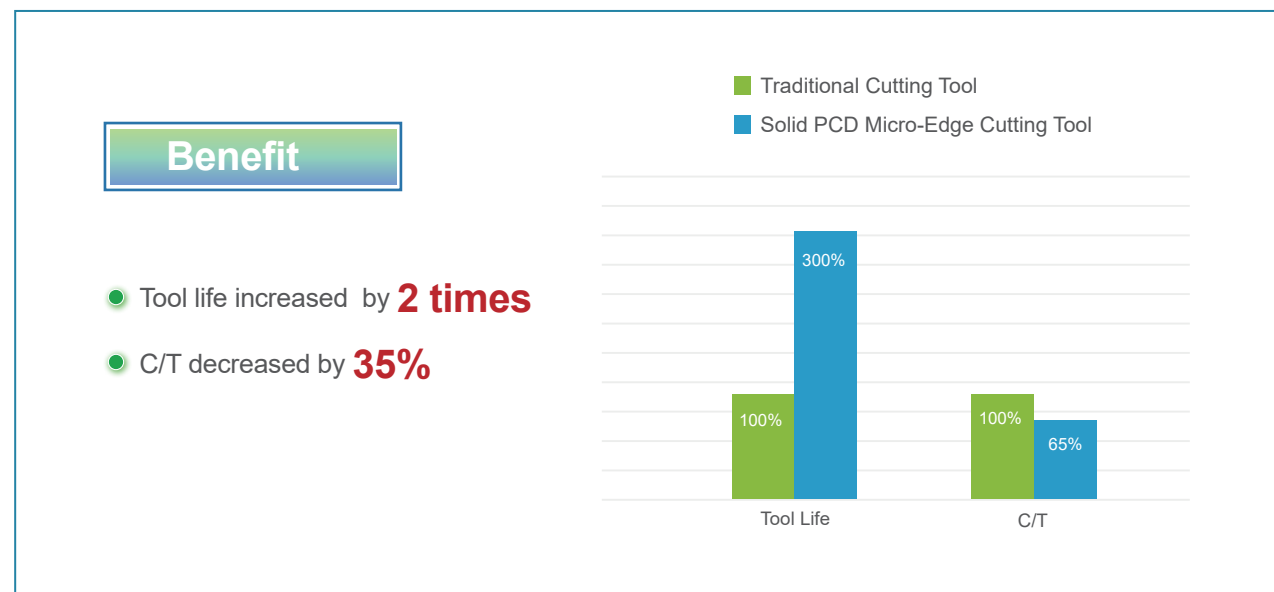


## Sapphire Curve Surface Finishing

Application Case of Solid PCD Micro-Edge Cutting Tool

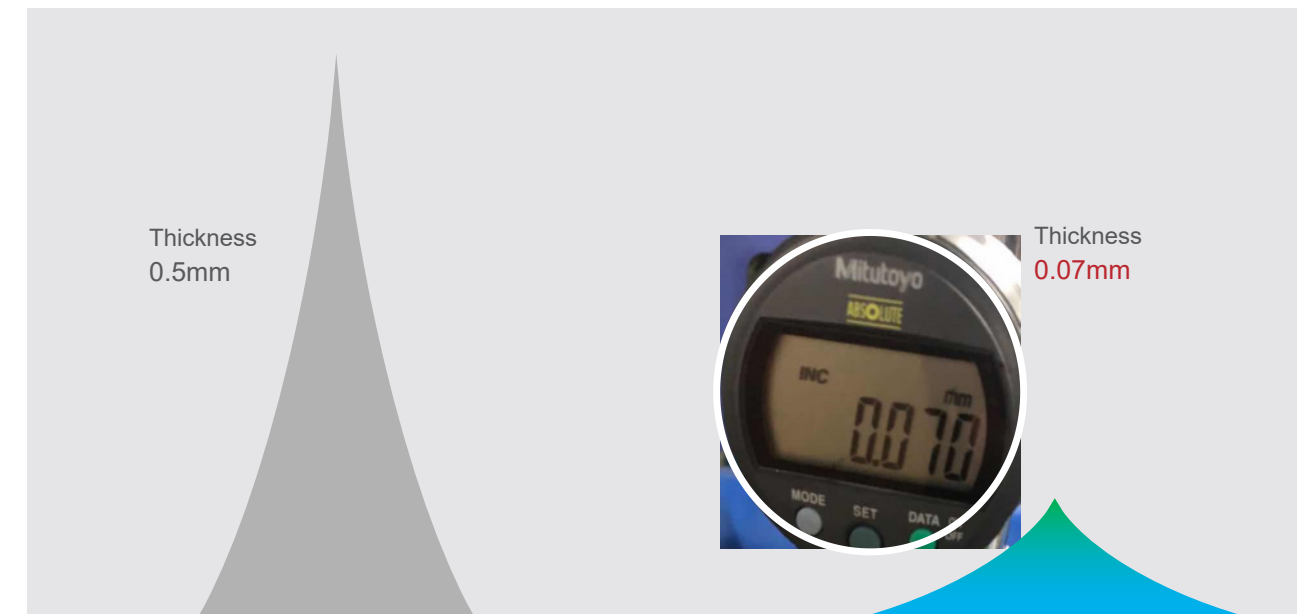


- Machining requirement - Contour and surface finishing on sapphire curve surface
- Challenges in Traditional Machining - Low surface quality and efficiency with extra time on re-machining



## Corning Glass

Application Case of Solid PCD Micro-Edge Cutting Tool



### Ultra Thin Glass - Material (Corning Glass)

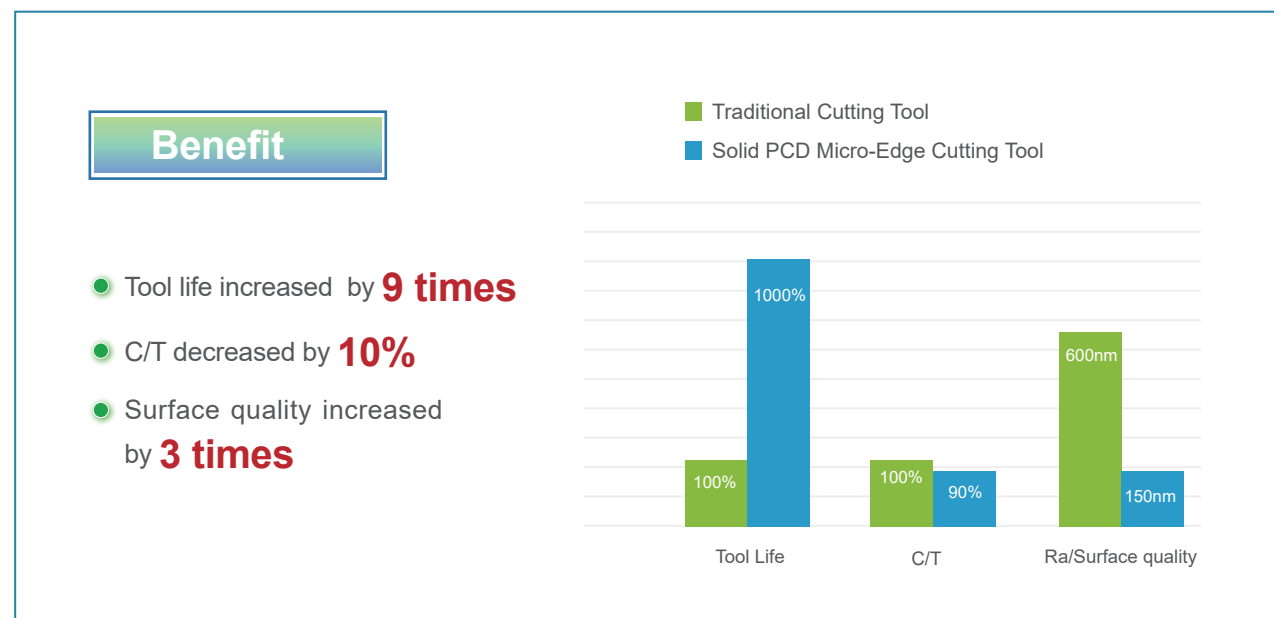
- As thin as **0.07mm**
- No tool mark and crack on workpiece surface
- Roughness down to **Ra 0.254µm**, from **Ra 0.531µm**

## Glass front cover cavity finishing

Application Case of Solid PCD Micro-Edge Cutting Tool

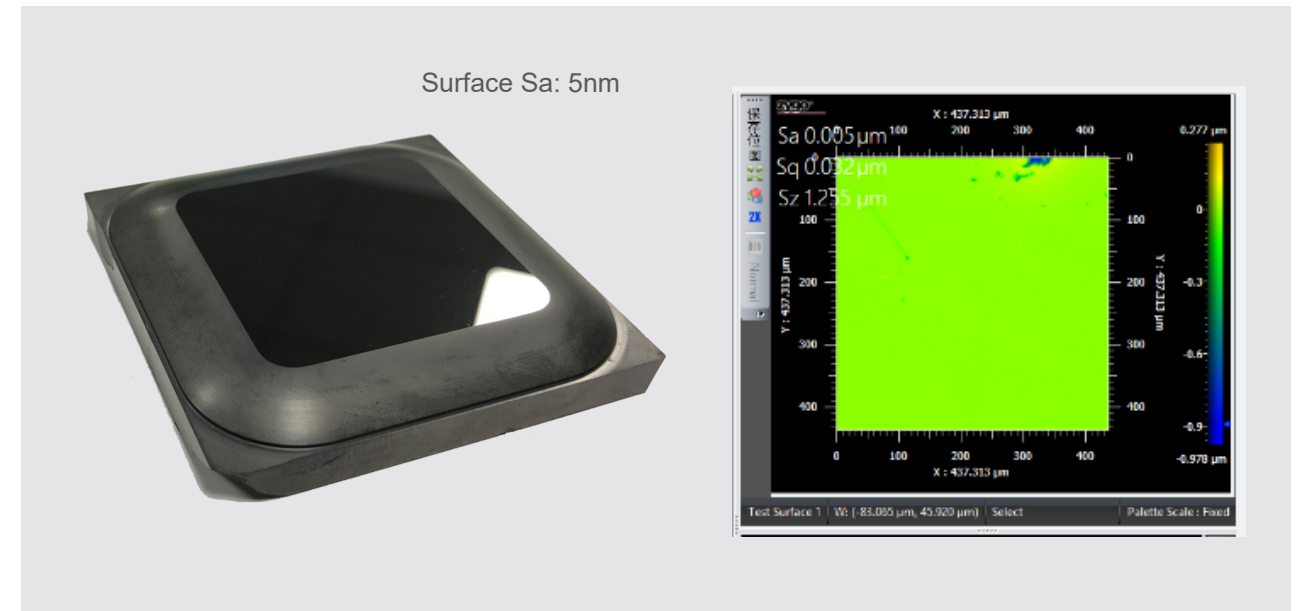


- Machining requirement - Contour and surface finish machining on Glass front cover inner cavity
- Challenges in Traditional Machining - Low surface quality and efficiency with extra time on re-machining



## Silicon Carbide Ceramic

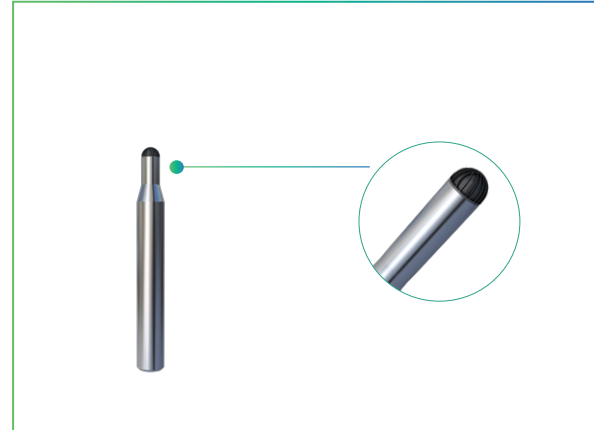
Application Case of Solid PCD Micro-Edge Cutting Tool



The unprecedented **5nm** mirror-finish effect of the super-hard silicon carbide material is derived from the unique Solid PCD Micro-Edge Cutting Tool Technology

## Graphite Mirror Finishing

Application Case of Solid PCD Micro-Edge Cutting Tool



## International Patented Product — Solid PCD Micro-Edge Cutting Tool

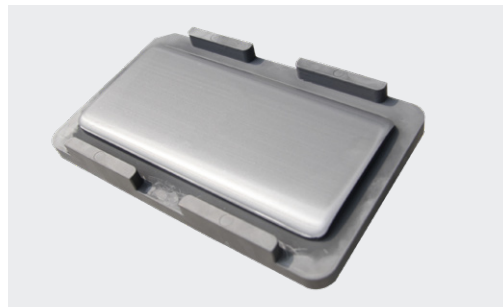
### ➤ Better Surface Quality

- Achieve mirror finish effect
- Min. **0.01mm** of cutting-edge width
- Contour accuracy can be controlled within **3μm**

### ➤ Longer Tool Life

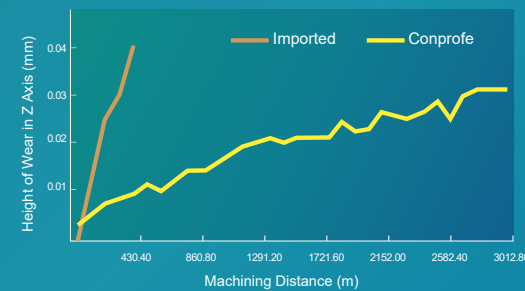
- Improved tool rigidity and sharpness by unique tool edge structure
- Tool life increased by **3-8 times**, compared to imported coated diamond cutter.

### ➤ Brand-New Innovation Graphite Precision Machining Solution



### Comparison of Graphite Parameters

Comparison between Conprofe Solid PCD Micro-Edge Cutting Tool and Imported Diamond-Coated Cutting Tool  
(S=24,000, F=3,000, A<sub>p</sub>=0.1, A<sub>φ</sub>=0.2)



**8 times** Tool life of Conprofe Solid PCD Cutting Tool increased by 8 times under the same machining conditions, compared to imported cutting tools

- The surface roughness of the graphite mold is significantly reduced by **70%**
- Tool life increased by **8 times (max)**
- Machining efficiency improved by **3 times**

