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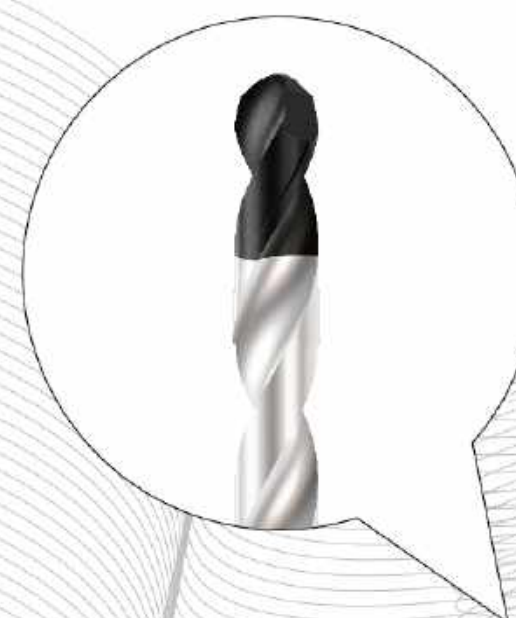
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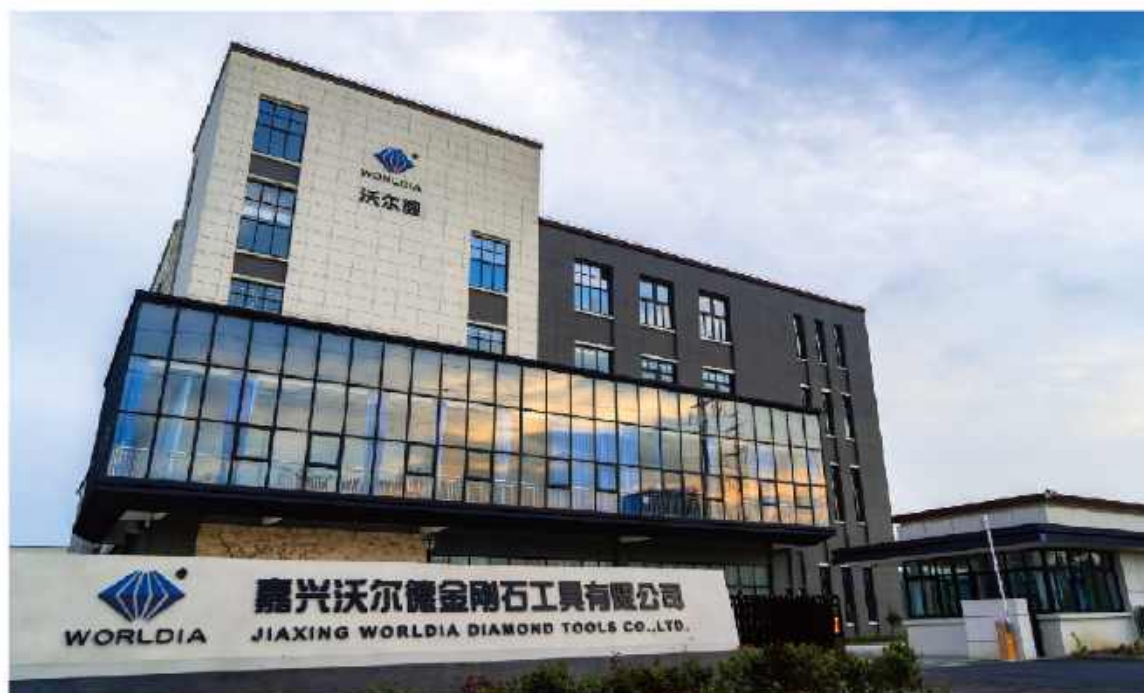
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PCD Micro Drills

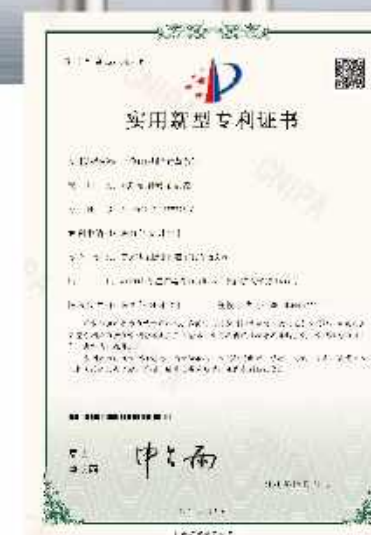
Super-Precision Maching D0.1-D3.0mm





- Beijing Worldia Diamond Tools Co., Ltd. was founded in 2006 in Beijing Zhongguancun Science and Technology Park;
- The Worldia Group currently has one branch and several wholly-owned subsidiaries. Among them, the two largest subsidiaries are Jiaxing Worldia Diamond Tools Co., Ltd. and Langfang Supower Diamond Technology Co., Ltd.;
- The company is a high-tech enterprise mainly engaged in the research and development, production and sales of superhard cutting tools and superhard material products;
- Our products are involved in many well-known enterprises in the fields of optoelectronic display industry, aerospace, nuclear industry, photovoltaic, wind power, semiconductor and equipment, and we have formed long-term and stable cooperative relations with customers in these fields;
- On July 22, 2019, worldia was officially listed on the STAR Market in Shanghai Stock Exchange. (Stock Code: 688028)

PCD MICRO DRILL

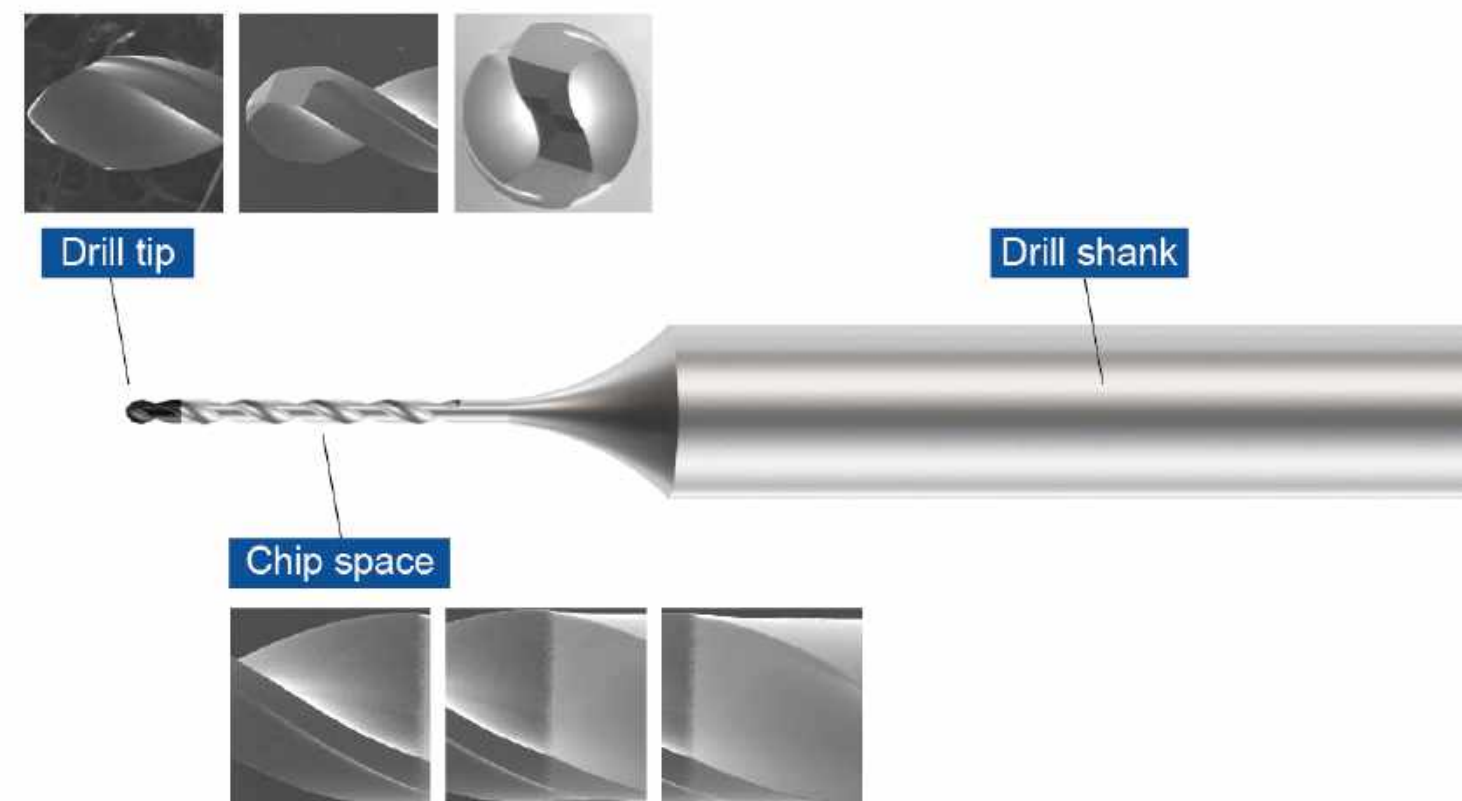


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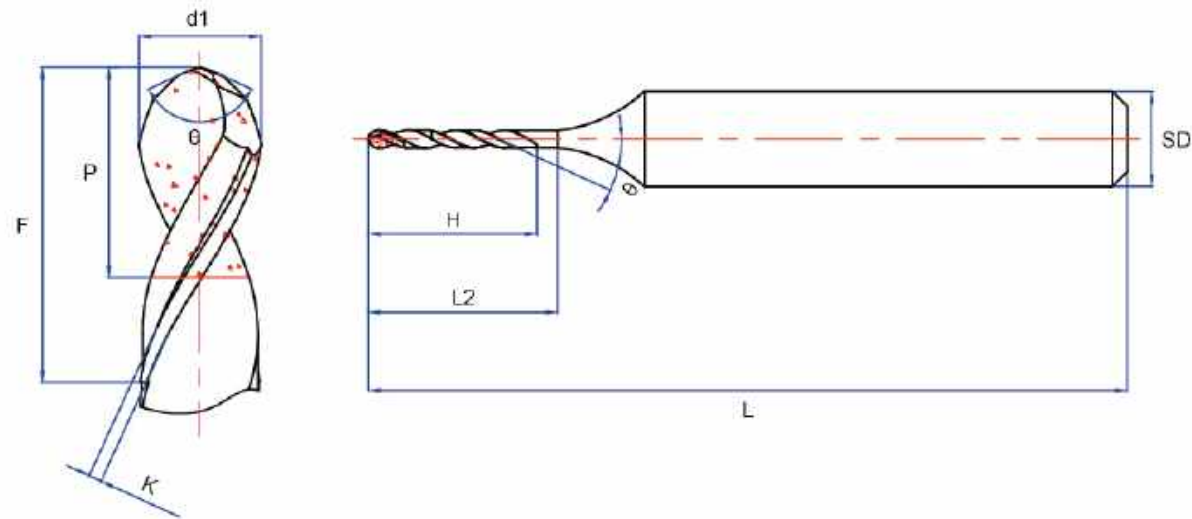
PCD MICRO DRILL SLOT STRUCTURE AND DRILL TIP



Features	Advantages
1.The edge surface is polished and the main edge is sharp; 2.The grinding groove is smooth and the chip removal is excellent; 3.The tip rotates stably and the hole position is accurate.	1.PCD micro drill has characteristics of high hardness, wear resistance, and relatively long service life compared with traditional alloy microdrill; 2.PCD micro drill is widely used in addition to processing metal materials, can also be used for inorganic non-metallic material processing, with high processing precision; 3.PCD micro drill, compared with traditional alloy microdrill, can process hole wall with better quality. 4.PCD micro drills exhibits low affinity with both non-ferrous metals and non-metallic materials, thereby preventing chip adhesion to the cutting edge during processing, minimizing the formation of built-up edge (BUE).

SPECIFICATION SELECTION

Note:  Integral PCD



Series	Specification	d1	L2	L2/D	SD	L	θ	Application
WZ1	d1*L2*SD3.175*L*θ	φ0.1≤φ0.3	2-6	38	3.0/3.175/4.0	38.1/45	80°-160°	Graphite, ceramics, aluminum alloys, titanium alloys and other non-ferrous metals; PCB circuit boards
		φ0.3≤φ0.8	2-7					
		φ0.8≤φ1.5	2-19					
WZ2	d1*L2*SD3.175*L*θ	φ0.4≤φ0.8	4-19	38	3.0/3.175/4.0	38.1/45	80°-160°	Alumina ceramics, zirconia ceramics and other composite ceramic wear-resistant materials; Quartz, microcrystalline glass, sapphire and other non-metallic materials
PZ		φ0.8≤φ2.0						
		φ2.0≤φ4.0	10-17.5					
WZ3	d1*L2*SD3.175*L*θ	φ0.3≤φ0.4	2-7	51	3.0/3.175/4.0	38.1/45	80°-160°	Monocrystalline silicon, polysilicon
		φ0.4≤φ1.0	2-24					
WZ-X	d1*L2*SD3.175*L*θ	φ0.4≤φ1.0	2-7	17	3.0/3.175/4.0	38.1/45	80°-160°	Silicon Carbide, aluminum-based silicon carbide, silicon nitride
Remark	1. Each increment of d1 corresponds to 0.05mm. 2. Provide customization services							

APPLICATION

Semi-conductor industry Aerospace National defense
 Automotive electronics High-end medical equipments
 3C electronics



WZ3

SERIES MICRO DRILLS

The main application is in the high-precision micro drilling of semiconductor materials such as monocrystalline silicon, polycrystalline silicon, and silicon carbide.

Advantages

- 1.Minimal chipping at hole edges;
- 2.Machined hole diameters has excellent roundness, ensuring high consistency in diameter processing;
- 3.Exceptional surface finish on hole walls with Ra<0.1um;
- 4.The tool demonstrates outstanding wear resistance, a long service life and excellent stability;
- 5.The tool enables micro machining with a maximum depth-to-diameter ratio of 51:1.



Application

Micro drilling of monocrystalline silicon shower head

PROCESSING CASE of MONOCRYSTALLINE SILICON ①—— $\phi 0.39$

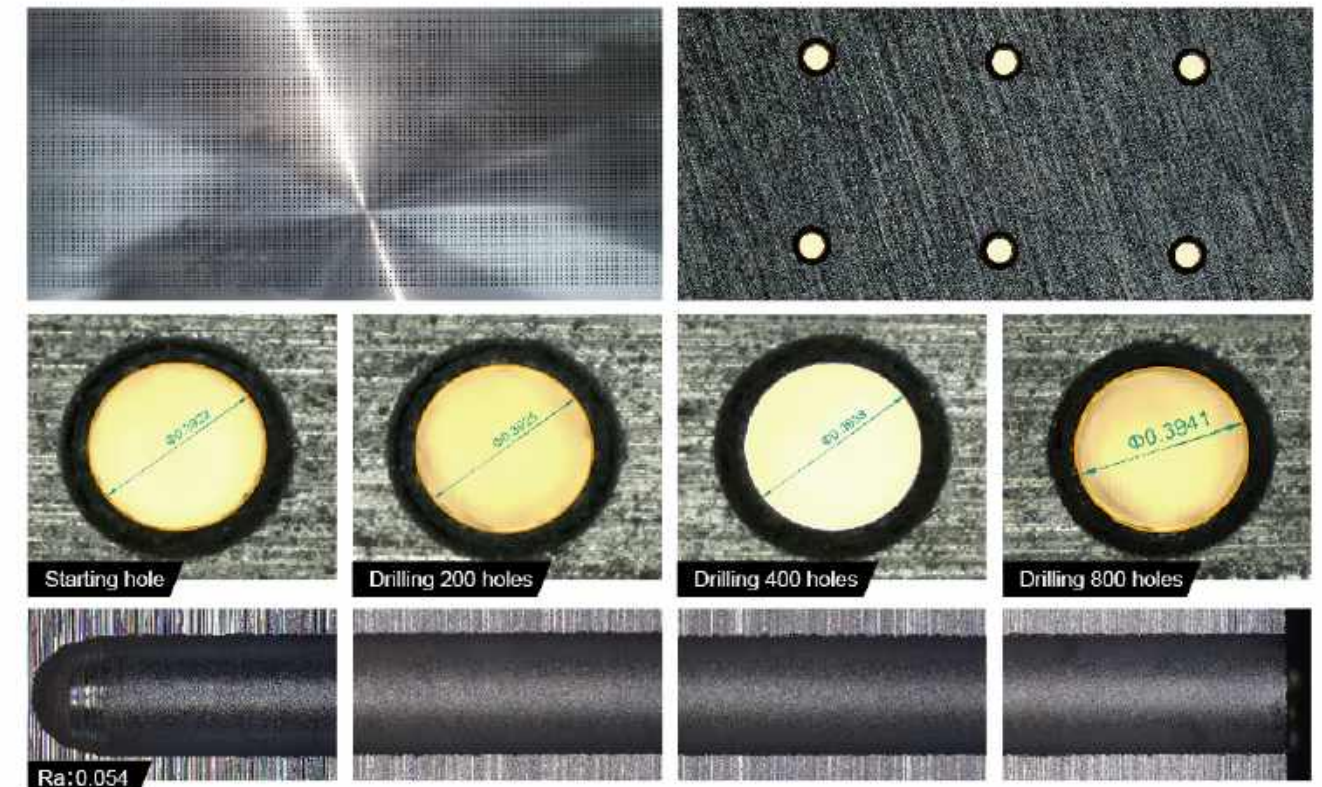
Parameter

Series	Specification
WZ3	$\phi 0.39 \times 11.5 \times \text{SD}3.175 \times \text{L}45 \times 130^\circ$

Monocrystalline silicon(0.39*10.5)-drilling parameter and quality						
Index	Spindle speed(S)	Feeding speed(F)	Each processing depth(Q)	Effective machining depth(Z)	Single hole drilling time	Drilling way
Data	20000r/min	10mm/min	0.1mm	10.5mm	167S	G83

Index	Borehole diameter	Starting diameter	Ending diameter	Stability in 800 holes	Hole roundness	Chipping
Data	0.391mm	0.392mm	0.394mm	<0.01mm	<0.005mm	<0.03

Drilling result



PROCESSING CASE of MONOCRYSTALLINE SILICON ②—— $\phi 0.5$

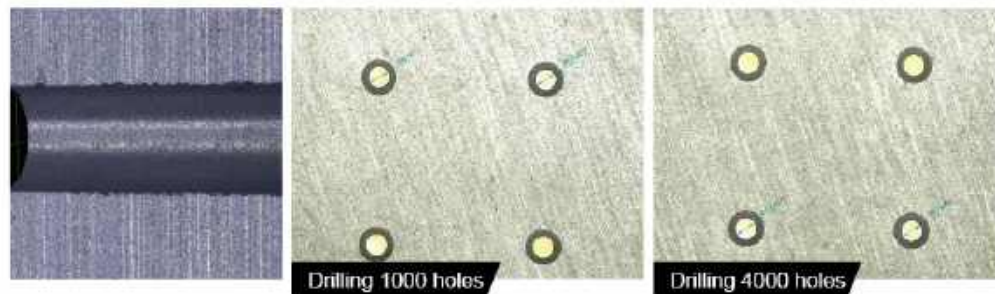
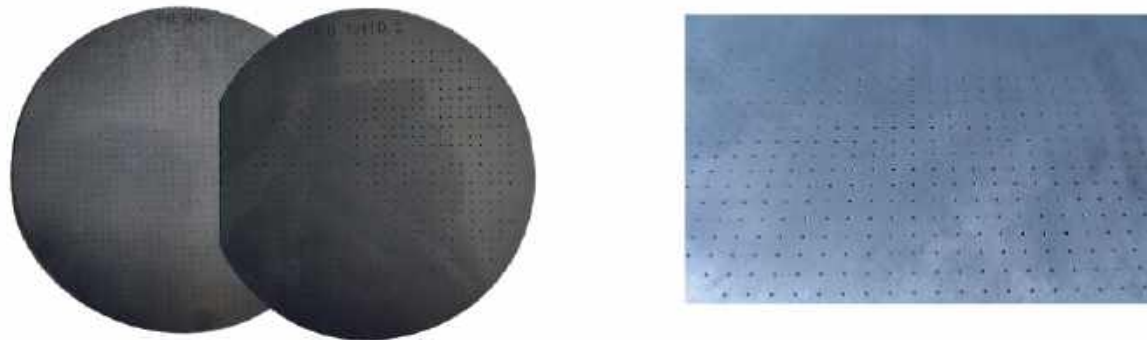
Parameter

Series	Specification
WZ3	0.5*7*SD3.175*L38.1*130°

Monocrystalline silicon(0.5*6.5)-drilling parameter and quality						
Index	Spindle speed(S)	Feeding speed(F)	Each processing depth(Q)	Effective machining depth(Z)	Single hole drilling time	Drilling way
Data	20000r/min	15mm/min	0.05mm	6.5mm	107S	G83

Index	Borehole diameter	Starting diameter	Ending diameter	Stability in 2000 holes	Hole roundness	Chipping
Data	0.497mm	0.501mm	0.503mm	<0.01mm	<0.005mm	<0.035

Drilling result



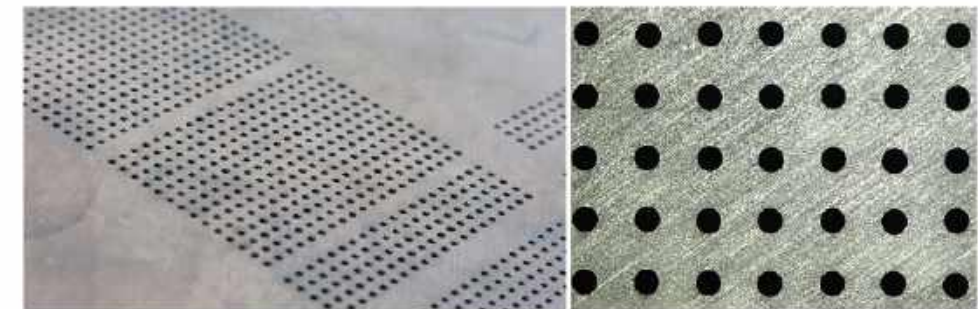
PROCESSING CASE of MONOCRYSTALLINE SILICON ③—— $\phi 0.48$

Parameter

Series	Specification
WZ3	$\phi 0.48$ *22*SD3.175*L55*130°

Monocrystalline silicon(0.48*21 ratio of hole diameter to depth 43.75:1)-drilling parameter and quality						
Index	Spindle speed(S)	Feeding speed(F)	Each processing depth(Q)	Effective machining depth(Z)	Cooling type	Drilling way
Data	18000r/min	10mm/min	0.05mm	21mm	External cooling	G83

Drilling result



Challenges

- 1.High-hardness and brittle materials are prone to chipping.
- 2.Large depth-to-diameter ratio of the holes makes it challenging to control machining accuracy and surface quality.
- 3.Short tool life with a tendency to break during hole machining.
- 4.Stringent requirements for hole diameter consistency.

Advantages

- 1.Hole entrance chipping is less than 0.03mm and dimensional accuracy is within 0.01mm.
- 2.Outstanding quality of hole walls with Ra values below 0.1um.
- 3.Long tooling life with the capability for continuous and stable processing.

SPECIFICATION SELECTION of WZ3 SERIES

Specification	d1	L2	SD	L	θ
φ0.35*9*SD3.175*L45*130°	0.35	9	3.175	45	130°
φ0.39*11.5*SD3.175*L45*130°	0.39	11.5	3.175	45	130°
φ0.4*11.5*SD3.175*L45*130°	0.4	11.5	3.175	45	130°
φ0.45*11.5*SD3.175*L45*130°	0.4	11.5	3.175	45	130°
φ0.45*7*SD3.175*L38.1*130°	0.45	7	3.175	38.1	130°
φ0.48*17*SD3.175*L55*130°	0.48	17	3.175	55	130°
φ0.5*7*SD3.175*L38.1*130°	0.5	7	3.175	38.1	130°
φ0.5*12*SD3.175*L45*130°	0.5	12	3.175	45	130°
φ0.5*13.5*SD3.175*L45*130°	0.5	13.5	3.175	45	130°
φ0.55*11.5*SD3.175*L45*130°	0.55	11.5	3.175	45	130°
φ0.6*7*SD3.175*L38.1*130°	0.6	7	3.175	38.1	130°
φ0.6*18*SD3.175*L64*130°-7	0.6	18	3.175	45	130°
φ0.7*12.5*SD3.175*L45*130°	0.7	12.5	3.175	45	130°
φ0.75*11.5*SD3.175*L45*130°	0.75	11.5	3.175	45	130°
φ0.8*11*SD3.175*L45*130°	0.8	11	3.175	45	130°
φ0.85*7*SD3.175*L38.1*130°	0.85	7	3.175	38.1	130°
φ1.0*8*SD3.175*L38.1*130°	1.0	8	3.175	38.1	130°
φ1.0*20*SD3.175*L66*130°-7	1.0	20	3.175	66	130°

Remark: Provide customization service

WZ-X SERIES MICRO DRILLS

The main application is in the high-precision micro drilling of semiconductor materials such as silicon carbide, aluminum-based silicon carbide and silicon nitride.

Characteristics of the material to be machined

Extremely hard and brittle material, second only to diamond in hardness.

Advantages

1. There is no chipping of the hole wall, and the hole wall finish is less than 0.1 Ra.
2. Tool life can achieve stable processing of more than 200 holes.

Drilling diameter
D0.4~D1.0



PROCESSING CASE of QUARTZ GLASS— $\phi 0.455$

Parameter of quartz glass

Mohs hardness	Purity	Softening temperature	Volume density	MOE	Bending strength	Fracture toughness	Application
7 Level	99.98%	1730°C	>2.23g/cm ³	80.9Gpa	785-1150Mpa	33.4Mpa.m ^{1/2}	Wear-resistant equipment, semiconductor, photovoltaic, metallurgy

Parameter

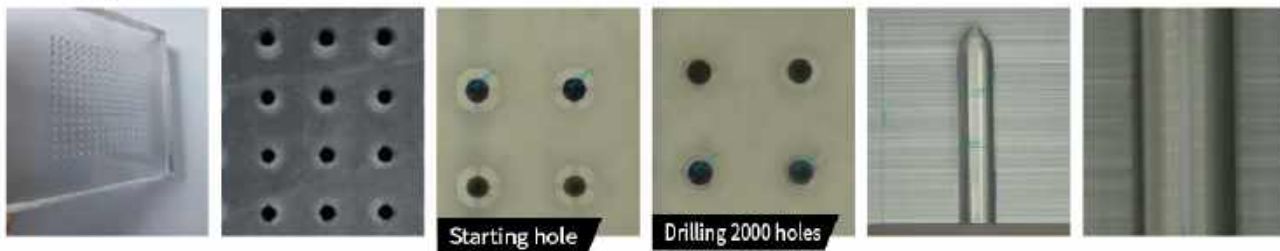
Series	Specification
WZ2	$\phi 0.45^{\circ} 7^{\circ} \text{SD} 3.175^{\circ} \text{L} 38.1^{\circ} 130^{\circ}$

Quartz glass(0.45*6.0)-drilling parameter and quality

Index	Spindle speed(S)	Feeding speed(F)	Each processing depth(Q)	Effective machining depth(Z)	Cooling type	Drilling way
Data	18000r/min	15mm/min	0.05mm	6.0mm	External cooling	G83

Index	Borehole diameter	Starting diameter	Ending diameter	Stability in 2000 holes	Hole roundness	Chipping
Data	0.455mm	0.463mm	0.48mm	<0.02mm	<0.005mm	<0.05mm

Drilling result



Advantages

- 1.Minimal hole chipping and the chipping size less than 50um;
- 2.The processing efficiency is high, and it takes only 88 seconds to process a single hole.
- 3.Tooling life enables continuous stable processing of more than 2000 holes.

PROCESSING CASE of ALUMINA CERAMIC— $\phi 0.8$

Parameter of Alumina Ceramic

Density	HRC	Bending strength	Compressive strength	Fracture toughness	MOE	Fracture toughness	Thermal shock	Maximum operating temperature
3.94g/cm ³	HRA≥86	310Mpa	2558Mpa	3-4Mpa.M-1/2	359Gpa	7-810-6K-1	225ΔT°C	1770°C

Parameter

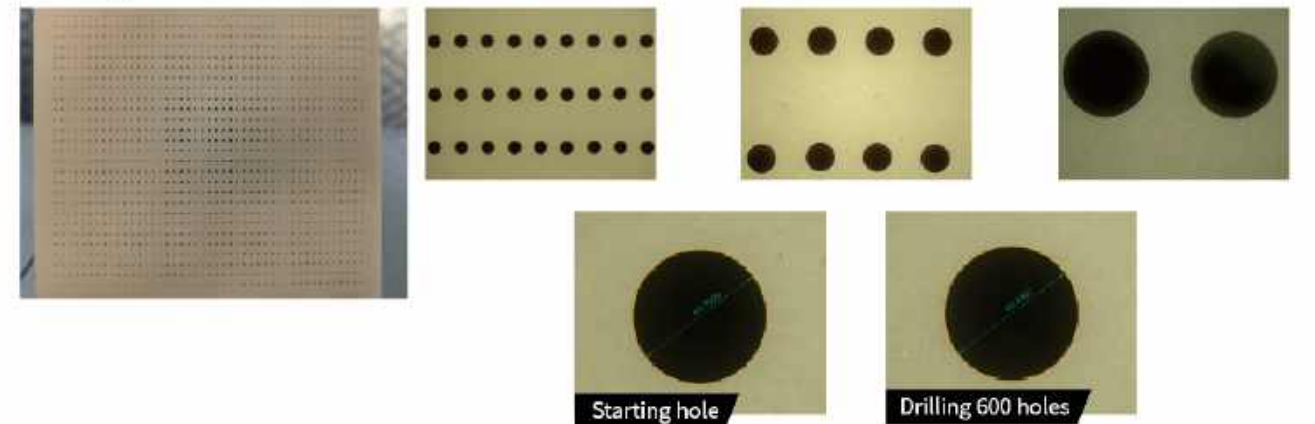
Series	Specification
WZ2	$\phi 0.8^{\circ} 13.5^{\circ} \text{SD} 3.175^{\circ} \text{L} 45^{\circ} 130^{\circ}$

Alumina ceramic (0.8*9.5)-drilling parameter and quality

Index	Spindle speed(S)	Feeding speed(F)	Each processing depth(Q)	Effective machining depth(Z)	Cooling type	Drilling way
Data	20000r/min	10mm/min	0.1mm	9.5mm	External cooling	G83

Index	Borehole diameter	Starting diameter	Ending diameter	Stability in 600 holes	Hole roundness	Chipping
Data	0.801mm	0.799mm	0.796mm	<0.01mm	<0.005mm	<0.02mm

Drilling result



Advantages

- 1.The material remains free of cracks after drilling with minimal chipping.
- 2.Achieves size precise and consistent hole diameter (<10 um).
- 3.Capable of achieving a tooling life of 800 holes or more with continuous and stable processing.

PROCESSING CASE of ZIRCONIA CERAMIC— $\phi 0.5$

Parameter of Zirconia Ceramic								
Density	Mohs hardness	Bending strength	Compressive strength	Fracture toughness	Elastic modulus	Thermal expansion	Thermal shock	Operating temperature
6.02g/cm ³	9.0 Level	1100Mpa	2500Mpa	11Mpa.M-1/2	200Gpa	10.5X10-6/°C	300ΔT°C	500-1000°C

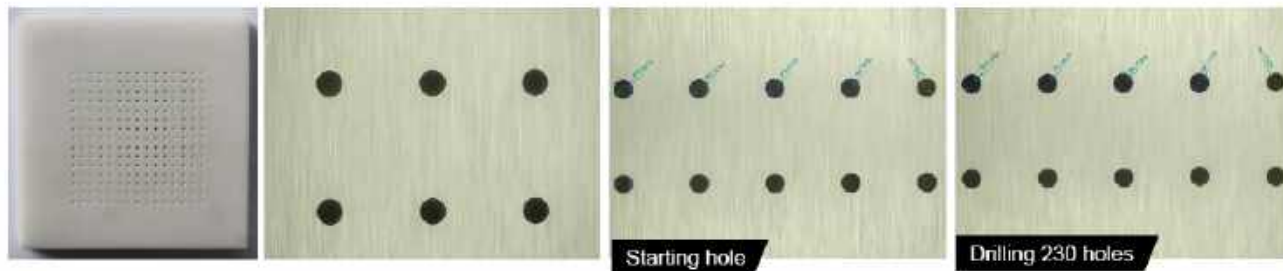
Application: Radiators, communication hardware, IC electronic devices, new energy electronic equipment

Parameter

Series	Specification
WZ2	$\phi 0.5^*6^*SD3.175^*L38.1^*130^{\circ}$

Zirconia Ceramic(0.5*6.0)-drilling parameter and quality						
Index	Spindle speed(S)	Feeding speed(F)	Each processing depth(Q)	Effective machining depth(Z)	Cooling type	Drilling way
Data	20000r/min	5mm/min	0.03mm	5.0mm	External cooling	G83
Index	Borehole diameter	Starting diameter	Ending diameter	Stability in 230 holes	Hole roundness	Chipping
Data	0.501mm	0.503mm	0.506mm	<0.01mm	<0.005mm	<0.02

Drilling result



Advantages

- 1.The material remains free of cracks after drilling with minimal chipping.
- 2.Achieves size precise and consistent hole diameter (<10 um).
- 3.Capable of achieving a tooling life of 200 holes or more with continuous and stable processing.

SPECIFICATION SELECTION of WZ2 SERIES

Specification	d1	L2	SD	L	θ
$\phi 0.3^*3^*SD3.175^*L38.1^*130^{\circ}$	0.3	3	3.175	38.1	130°
$\phi 0.3^*5^*SD3.175^*L38.1^*130^{\circ}$	0.3	5	3.175	38.1	130°
$\phi 0.35^*7^*SD3.175^*L38.1^*130^{\circ}$	0.3	7	3.175	38.1	130°
$\phi 0.45^*7^*SD3.175^*L38.1^*130^{\circ}$	0.45	7	3.175	38.1	130°
$\phi 0.5^*7^*SD3.175^*L38.1^*130^{\circ}$	0.5	7	3.175	38.1	130°
$\phi 0.6^*9^*SD3.175^*L45^*130^{\circ}-6.5$	0.6	9	3.175	45	130°
$\phi 0.8^*7^*SD3.175^*L38.1^*130^{\circ}$	0.8	7	3.175	38.1	130°
$\phi 0.89^*7^*SD3.175^*L38.1^*130^{\circ}$	0.89	7	3.175	38.1	130°
$\phi 0.95^*8.5^*SD3.175^*L38.1^*130^{\circ}$	0.95	8.5	3.175	38.1	130°
$\phi 1.1^*8^*SD3.175^*L45^*130^{\circ}$	1.1	8	3.175	38.1	130°
$\phi 1.2^*14^*SD3.175^*L45^*130^{\circ}$	1.2	14	3.175	45	130°
$\phi 1.25^*11.5^*SD3.175^*L45^*120^{\circ}$	1.25	11.5	3.175	45	120°
$\phi 1.3^*8^*SD3.175^*L45^*130^{\circ}$	1.3	8	3.175	45	130°
$\phi 1.4^*14^*SD3.175^*L45^*130^{\circ}$	1.4	14	3.175	45	130°
$\phi 1.5^*8^*SD3.175^*L45^*130^{\circ}$	1.5	8	3.175	45	130°

Remark: Provide customization service

WZ1

SERIES MICRO DRILLS

The main application is in the high-precision machining of graphite, polymer wear-resistant materials, aluminum alloys and other non-ferrous metal materials.

Advantages

- 1.PCD micro drills have a longer tooling life than alloy micro drills by more than 10 times while maintaining stable performance.
- 2.The dimensional accuracy of drilled apertures can be precisely controlled within 5 μ m.
- 3.High-speed machining is possible, allowing for cutting speeds 2-3 times faster than those of alloy micro drilling tools.This feature meets the high-volume, high-efficiency, and high-precision machining requirements of machining centers.
- 4.The high wear resistance of diamond micro-drilling tools reduces the frequency of tool changes and minimizes tool breakage, ultimately improving efficiency.



PROCESSING CASE of GRAPHITE—— ϕ 0.12

Parameter of Graphite

Volume density	Electrical resistivity	Thermal conductivity	Thermal expansion	Shore hardness	Flexural strength	Compressive strength size	MOE	Air hole rate
1.9-1.93g/cm ³	11-13 μ Ωm	85(100°C)W/mk	5.8510-6/°C	70HSD	60Mpa	135Mpa	12Gpa	11%

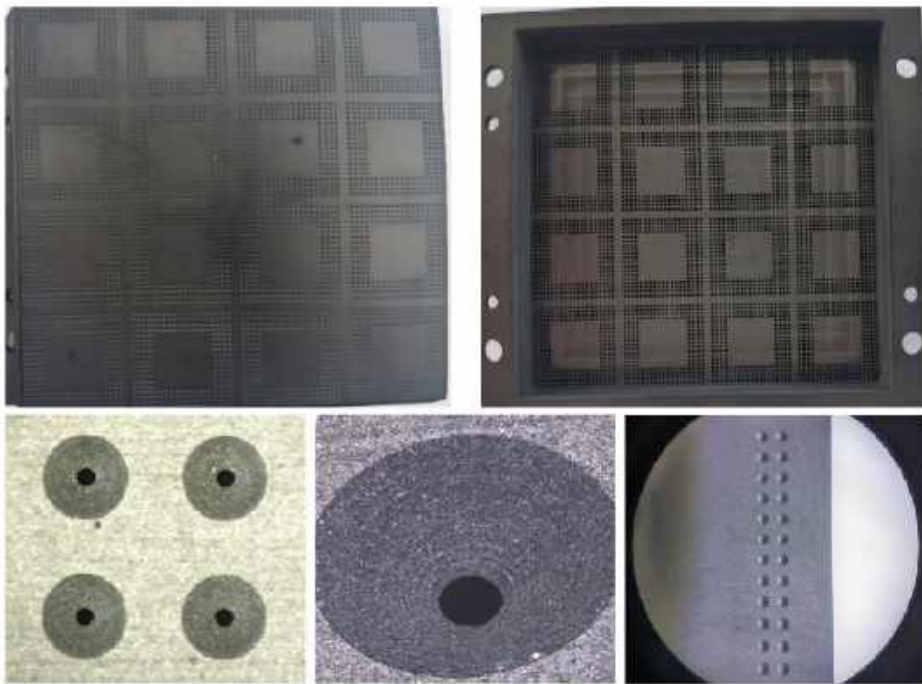
Application: Metallurgy, chemical industry, electric power,light industry, abrasive tools

Parameter

Series	Specification
WZ1	0.12*1.5*SD3.175*38.1*120°-1

Graphite(0.12*1.0)-drilling parameter and quality						
Index	Spindle speed(S)	Feeding speed(F)	Each processing depth(Q)	Effective machining depth(Z)	Cooling type	Drilling way
Data	22000r/min	40mm/min	0.05mm	1.0mm	Air cooling	G83
Index	Borehole diameter	Starting diameter	Stability in 3000 holes	Stability in 3000 holes	Hole roundness	Chipping
Data	0.120mm	0.121mm	0.198mm	<0.005mm	<0.005mm	<0.01mm

Drilling result



SPECIFICATION SELECTION of WZ1 SERIES

Specification	d1	L2	SD	L	θ
φ0.1*0.9*SD3.175*L38.1*120°	0.1	0.9	3.175	38.1	120°
φ0.11*1.5*SD3.175*L38.1*90°-1.3	0.11	1.5	3.175	38.1	90°
φ0.12*1*SD3.175*L38.1*120°-0.8	0.12	1	3	38.1	120°
φ0.15*2.3*SD3.175*L38.1*120°-2	0.15	2.3	3.175	38.1	120°
φ0.15*3*SD3.175*L38.1*120°	0.15	3	3.175	38.1	120°
φ0.18*2.5*SD3.175*L38.1*120°-2	0.18	2.5	3.175	38.1	120°
φ0.19*2*SD3.175*L38.1*120°-1.5	0.19	2	3.173	38.1	120°
φ0.2*1.2*SD3.175*L38.1*120°-1.0	0.2	1.2	3.175	38.1	120°
φ0.2*4*SD3.175*L38.1*120°-3.5	0.2	4	3.175	38.1	120°
φ0.25*3*SD3.175*L38.1*120°-2.5	0.25	3.0	3.0	38.1	120°
φ0.32*4*SD3.175*L38.1*120°-3.5	0.32	4.0	3.0	38.1	120°
φ0.35*0.8*SD3.175*L38.1*130°-0.5	0.35	0.8	3.175	38.1	130°
φ0.4*3.5*SD3.175*L38.1*120°	0.4	3.5	3.175	38.1	120°
φ0.4*7*SD3.175*L38.1*120°	0.4	7	3.175	38.1	120°
φ0.55*4.5*SD3.175*L38.1*130°	0.55	4.5	3.175	38.1	130°
φ0.6*2.5*SD3.175*L38.1*100°-1.5	0.6	2.5	3	38.1	100°
φ1.27*7*SD3.175*L38.1*90°-3	1.27	7	3.175	38.1	90°

NOTE

- 1.PCD micro drills tools are extremely delicate and have sharp edges. During usage or inspection, direct contact with the cutting edges should be avoided to prevent damage or breakage caused by external impact.
- 2.When removing or placing micro drills into their containers, handle them with care and avoid pointing the drill tips towards operators.
- 3.For measuring parameters such as diameter and flute length of micro drills, please use an automatic optical measuring device or non-contact optical measurement equipment.
- 4.When observing the machining conditions of products, always wear safety protection devices such as protective goggles.
- 5.Tool breakage may occur during trial use. Always ensure that appropriate safety protection devices are in place on equipment to prevent personal injury.

