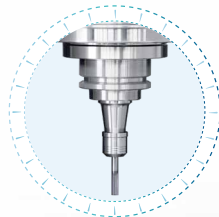


# Semiconductor Industry

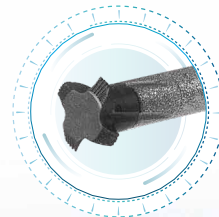
## Conprofe Ultrasonic Machining Solutions



Solid PCD Micro Drill



Ultrasonic Machining System



Solid PCD Thread Mill



Ultrasonic Engraving and Milling Center

Ultrasonic Vertical 5-Axis Machining Center

Vertical DDR Rotary Table

Ultrasonic Graphite Machining Center

## Quartz Glass Showerhead Drilling



### Challenges

- Low machining efficiency
- Vulnerable to hole edge chipping

### Conprofe Solution

- **Ultrasonic Precision Engraving and Milling Center ULM-600**

+ **Ultrasonic** Machining System

+ **Solid PCD** Drill

### Conprofe Benefits

- Continuous drilling of **1,200** D0.5x5mm holes
- Cycle time reduced by **72%**, from 270s to 75s per hole
- Hole edge chipping decreased by **68%**, from 0.4mm to 0.13mm

»» Cycle Time (s/hole)



## Carbon Silicon Showerhead Drilling



### Challenges

- High hardness
- Demanding depth-diameter ratio

### Conprofe Solution

- **Ultrasonic Precision Engraving and Milling Center ULM-500**

+ **Ultrasonic** Machining System

+ **Solid PCD** Drill

### Conprofe Benefits

- Continuously machining over 100 D0.5×6.5mm holes (Depth-Diameter Ratio 13:1)
- Smooth hole wall and good hole quality (Hole chipping size < 0.02mm)



»» Showerhead <<<

Material: Silicon Carbide (HV2,700)

## Single Crystal Silicon Curved Electrode Hole Drilling



### Challenges

- Immature machining solution
- Hard to control hole perpendicularity
- Hole wall roughness  $\geq Sa\ 6.54\mu m$
- Hole roundness  $\geq 0.025mm$

### Conprofe Solution

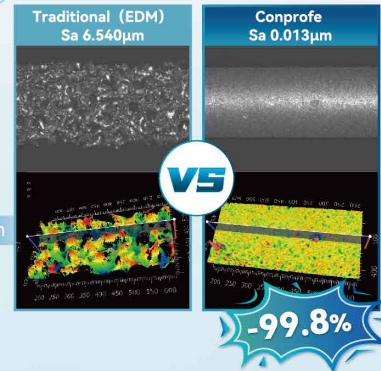
- **Ultrasonic Precision Engraving and Milling Center**

ULM-600

- + **Ultrasonic** Machining System
- + **Solid PCD** Micro Drill



Material: Single-Crystal Silicon



### Conprofe Benefits

- Continuous machining of over **2,000** D0.45x24.75mm ultra-deep holes
- With ultra-deep micro-hole drilling, no obvious chipping around hole edges
- Hole roundness **0.003mm**
- Hole wall roughness down by **99.8%**, from Ra 6.540µm to Ra **0.013µm**

## AlSiC Threaded Hole Machining



### Challenges

- Cycle time >180s/hole
- Unstable workpiece quality
- Vulnerable to hole edge chipping
- Low precision
- High cost (Tool life <1 hole)

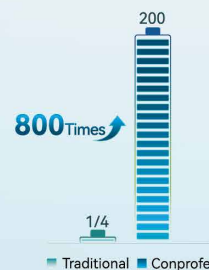
### Conprofe Solution

- **Ultrasonic Precision Engraving and Milling Center**

ULM-400

- + **Ultrasonic** Machining System
- + **Solid PCD** Drill     + **Solid PCD** Thread Mill

### »» Tool Life (Hole)



Material: AlSiC

### Conprofe Benefits

- Tool life improved by **800 times**, from 1/4 hole to 200 holes
- Wall thickness of 0.5mm, without any cracks or chippings



## Polysilicon Slotted Confinement Ring



### Challenges

- Low efficiency
- Recurring cracking issues leading to high scrap rate

### Conprofe Solution

- **Ultrasonic Precision Engraving and Milling Center**

ULM-600

+ **Ultrasonic** Machining System

+ Smartguy Vertical DDR High-Speed Rotary Table

### Conprofe Benefits

- Reduced cutting force and improved efficiency with ultrasonic machining
- Lower surface roughness
- Reduced chipping or crack
- Improved hole roundness



>>> Confinement Ring <<<

Material: Polysilicon

## Alumina Ceramic Disc Grinding



### Challenges

- Low efficiency
- Poor tool life
- Micro grinding cracks giving rise to scrap of the workpiece

### Conprofe Solution

- **Ultrasonic Precision Engraving and Milling Center**

ULM-600

+ **Ultrasonic** Machining System

### Conprofe Benefits

- Better chip evacuation
- Improved machining efficiency
- Reduced micro cracks on the surface of hard-brittle material
- **40%** workpiece surface roughness reduction

>>> Workpiece Surface Roughness ( $\mu\text{m}$ )



>>> Ceramic Disc <<<

Material: Alumina Ceramic

## Ultrasonic Engraving and Milling Center

- Intelligent **Ultrasonic Machining System** developed by Conprofe to tackle the challenges in machining hard-to-cut materials
- Various kinds of screw guide protection available to meet machining needs of hard-brittle materials and metals
- Single tool magazine / extended tool magazine available
- Optional spindle speed with max. speed of 40,000rpm
- Full closed loop control with high-precision linear encoders, positioning accuracy of **5 $\mu$ m**, repeatability of **3 $\mu$ m**
- High precision probe for on-machine measurement function
- With centrifugal filtration, bag and other multi-stage filtration system



## Ultrasonic Vertical 5-Axis Machining Center

- Intelligent **Ultrasonic Machining System** developed by Conprofe to tackle the challenges in machining hard-to-cut materials
- Bridge gantry structure, low center of gravity, short overhang and super high rigidity for lower thermal strain
- Full closed loop control with linear encoders
- Equipped with high power, torque and speed ultrasonic spindle
- Various chain-type tool magazine capacity options: 24~120 tools
- Automatic fire suppression system configured to reduce the risk of machining flammable and explosive materials
- Siemens 840D sl and SINUMERIK ONE 5-axis simultaneous control systems available



## Ultrasonic Graphite Machining Center

- Intelligent **Ultrasonic Machining System** developed by Conprofe to tackle the challenges in machining hard-to-cut materials
- Multi-layered protection with labyrinth design, positive pressure sealing and special dust collector design
- Superior performance in vibration damping, accuracy retention, dynamic characteristics and thermal stability due to its high-rigidity bed casting and symmetrical gantry structure
- Full closed loop control with high-precision linear encoders to ensure repeatability accuracy of **2 $\mu$ m**
- Equipped with high-volume, high-power stand-alone filter cartridge dust collector
- Optional handheld vacuum cleaner with mobile operation for more thorough vacuuming



## Solid PCD Micro Drill

- Suitable for drilling hard-brittle materials, effectively reducing chipping
- Hole quality **up by 3 times** vs. conventional cutters in machining **CFRP**
- Successful breakthrough in machining ultra-deep micro-hole with Depth-Diameter **Ratio of 55:1** in single crystal silicon workpiece



## Solid PCD Thread Mill

- Conprofe Solid PCD Drill - best fit for hard-brittle materials threading
- Thread milling efficiency **up by 100%** vs. traditional thread mills, with machining cost per hole reduced by more than **2 times**
- Tool life **up by 50~100 times** vs. traditional thread mills
- Customized specifications of micro-diameter thread mills available

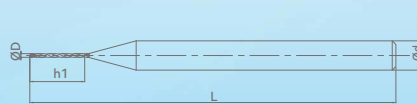


### Solid PCD Micro Drill

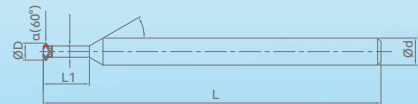
Cutting Edge Diameter (D)	Cutting Edge Length (h1)	Overall Length (L)	Shank Diameter (d)
0.45	7.5	40	4
0.5	7.5	40	4
0.6	9	40	4
0.8	12	40	4
1.0	15	45	4
1.1	16.5	45	4
1.2	18	45	4
1.3	19.5	45	4
1.4	21	50	4
1.5	22.5	50	4
1.8	27	60	4
2.0	30	60	4

### Solid PCD Thread Mill

Spec.	Cutting Edge Diameter (D)	Thread Angle (α)	Reference Pitch	Neck Diameter (d2)	Neck Length (L1)	Neck Angle (r)	No. of Cutting Edges	Overall Length (L)	Shank Diameter (d)
M2.5	1.95	60°	0.45	1.28	6.5	15°	4	45	4
M3.0	2.36	60°	0.5	1.63	7.5	15°	4	45	4
M4.0	3.19	60°	0.7	2.15	9.5	15°	4	50	4
M5.0	3.97	60°	0.8	2.86	10	15°	4	50	6
M6.0	4.9	60°	1.0	3.38	15	15°	3	60	6
M8.0	6.0	60°	1.75	4	15	15°	4	50	8
M10	7.95	60°	1.75	5.63	15	15°	4	60	10
M12	9.95	60°	1.75	7.3	15	15°	4	65	10



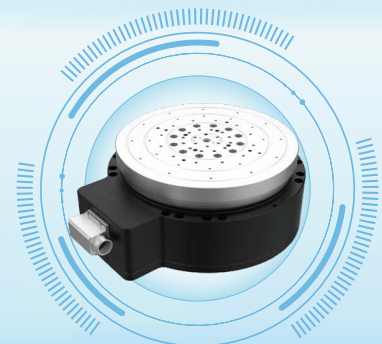
Solid PCD Micro Drill



Solid PCD Thread Mill

## Vertical DDR Rotary Table

- **High Speed: Max. 1,500rpm**
- High Precision: **No backlash**, standard 26-bit encoder
- Mill-Turn: for both **milling** and **high-speed turning**
- High Load Capacity: Max. load of **80KG**
- Built-in Air Path: **Built-in positive labyrinth, fixture positive pressure** and **vacuum air paths**, with aesthetic look that avoids tube folding or air holding during high-speed rotation
- Compatible with Fanuc, Siemens, Mitsubishi, Brother and other CNC controllers



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