

Sapphire Through-Hole Machining

Challenges

- Poor hole wall surface quality
- Long polishing time for mass production

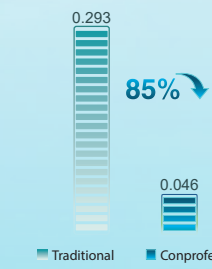
Conprofe Solution

- Ultrasonic Engraving and Milling Center** ULM-400
- + **Ultrasonic** Machining System
- + **Solid PCD Micro-Edge** Cutting Tool

Conprofe Benefits

- Hole wall roughness Ra down by **85%**, from 0.293 μ m to 0.046 μ m
- No need for polishing

Hole Sidewall Roughness Ra (μ m)



Material: Sapphire
Hole: D2.5x0.8mm



Carbon-Ceramic Brake Disc for New Energy Vehicle

Challenges

- Severe tool wear
- Low machining efficiency (C/T 120 min)
- Chipping, delamination and fiber pull-out and hole edge cracking

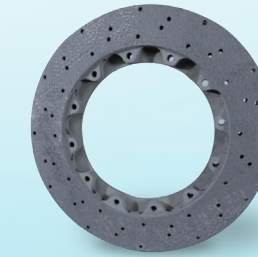
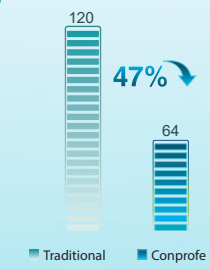
Conprofe Solution

- Ultrasonic Precision Engraving and Milling Center** ULM-600
- + **Ultrasonic** Machining System
- + **Solid PCD Drill**

Conprofe Benefits

- Improved surface quality without obvious chipping, cracking, delamination or fiber pull-out
- Cycle time down by **47%**, from 120 min to 64 min

Cycle Time (min)



Material: Carbon-Ceramic Composite
Dimension: D380x20.5mm
Features: LD, Contouring, Step Milling and Hole Drilling



Forged Titanium Alloy Deep Blind Cross-Hole Drilling

Challenges

- Long cycle time
- Poor hole wall quality: heat discoloration, high roughness and severe burring

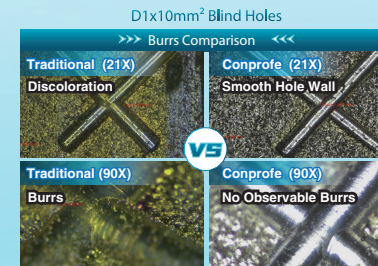
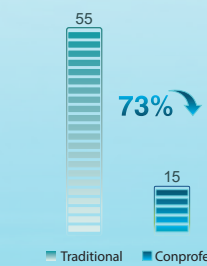
Conprofe Solution

- Ultrasonic Drilling and Milling Center** UGT-500
- + **Ultrasonic** Machining System
- + **Through-Spindle Cooling** System
- + **Smartguy 5-Axis** Rotary Table

Conprofe Benefits

- Cycle time down by **73%**, from 55 seconds to 15 seconds
- Smooth hole wall without discoloration
- No observable burrs and no need for manual deburring

Cycle Time (s)



General Precision Manufacturing

Deep Hole Drilling in Quartz Glass Optical Fiber Preform

Challenges

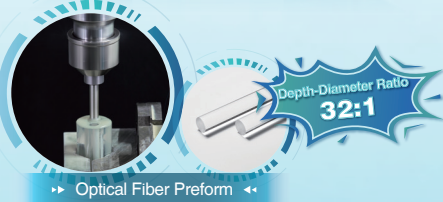
- Poor hole side-wall surface quality
- Poor hole parallelism
- Hole edge chipping
- Machining failure due to tool breakage

Conprofe Solution

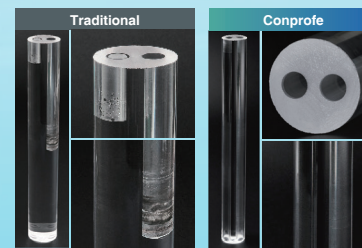
- Ultrasonic Drilling and Milling Center** UGT-500
- + **Ultrasonic** Machining System
- + **Through-Spindle Cooling** System

Conprofe Benefits

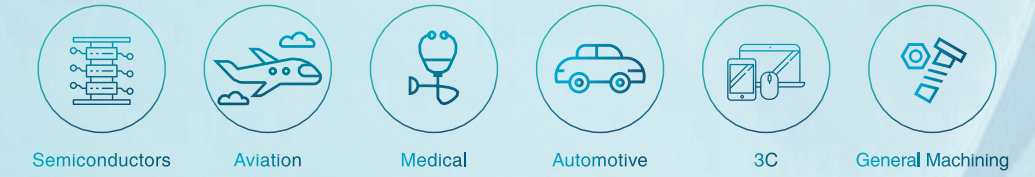
- Hole wall roughness **Sa < 0.122 μ m**
- Hole parallelism **< 0.0385mm**, meeting customers' requirements



Material: Quartz Glass
Hole: D30x250mm
Feature: Two D7.8x250mm Through-Holes
Hole Wall Roughness: Sa < 0.8 μ m



Conprofe **Ultrasonic-Green** Machine Tools
Innovative Application Cases



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Semiconductor Industry

Curved Electrode of Single Crystal Silicon

Challenges

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

Conprofe Solution

- **Ultrasonic Precision Engraving and Milling Center** ULM-600
- + **Ultrasonic** Machining System
- + **Solid PCD Drill**

Conprofe Benefits

- Continuous machining of over **2,000** $\varnothing 0.45 \times 24.75mm$ 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 $Ra\ 6.54\mu m$ to $Ra\ 0.013\mu m$



Aviation and Aerospace Industry

Nomex Honeycomb Contouring

Challenges

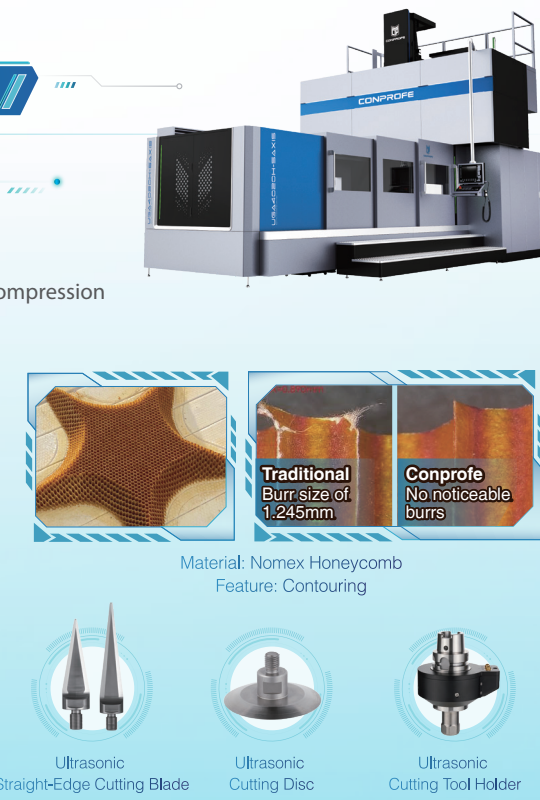
- Uneven machined surface, severe burrs and excessive dust
- Vulnerable to workpiece deformation, tearing and buckling due to compression

Conprofe Solution

- **Ultrasonic Gantry 5-Axis Machining Center** UGA4020H-5AXIS
- + **Ultrasonic** Machining System

Conprofe Benefits

- Efficient 3D contouring of complicated shapes
- Mitigated dusting and no observable burrs
- Effectively lower cutting force with even stress on the workpiece
- Flat and smooth cutting surface without buckling



Medical Industry

Tibial Plateau Machining

Challenges

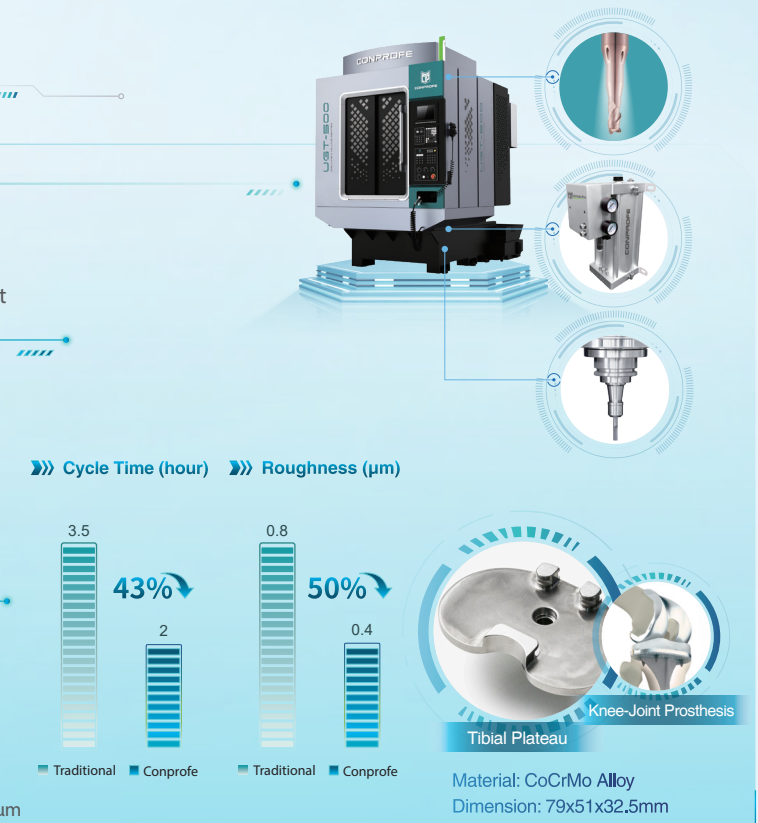
- Long cycle time
- Short tool life
- Low polishing efficiency and high manual labor cost

Conprofe Solution

- **Ultrasonic Drilling and Milling Center** UGT-500
- + **Ultrasonic** Machining System
- + **Minimum Quantity Lubrication (MQL)**
- + **Spindle-Through Cutting Tool**

Conprofe Benefits

- Only very slight observable cutter marks on the surface
- Grinding and polishing cost down by **45%** vs. traditional machining
- Cycle time shortened by **43%**, from 3.5h to 2h
- Surface roughness down by **50%**, from $Ra\ 0.8\mu m$ to $Ra\ 0.4\mu m$



AISI6 Threaded Hole Machining

Challenges

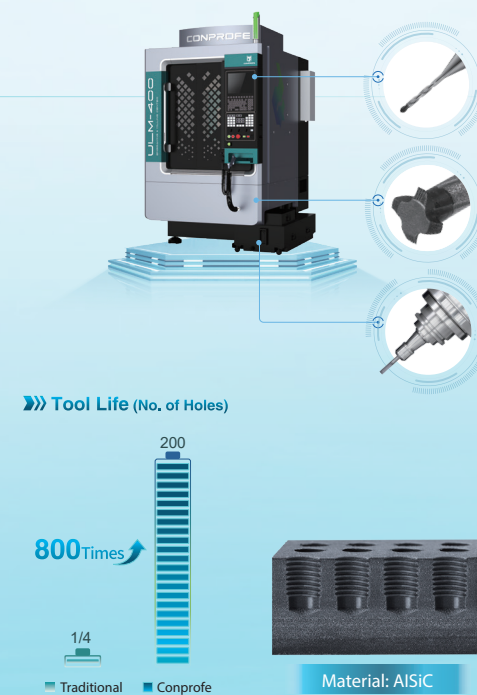
- Cycle time >180s/hole
- Unstable workpiece quality
- Vulnerable to hole edge chipping
- Low precision
- High cost (Tool life <1 hole)

Conprofe Solution

- **Ultrasonic Precision Engraving and Milling Center** ULM-400
- + **Ultrasonic** Machining System
- + **Solid PCD Drill**
- + **Solid PCD Thread Mill**

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



Superalloy Blade Cooling Holes Machining

Challenges

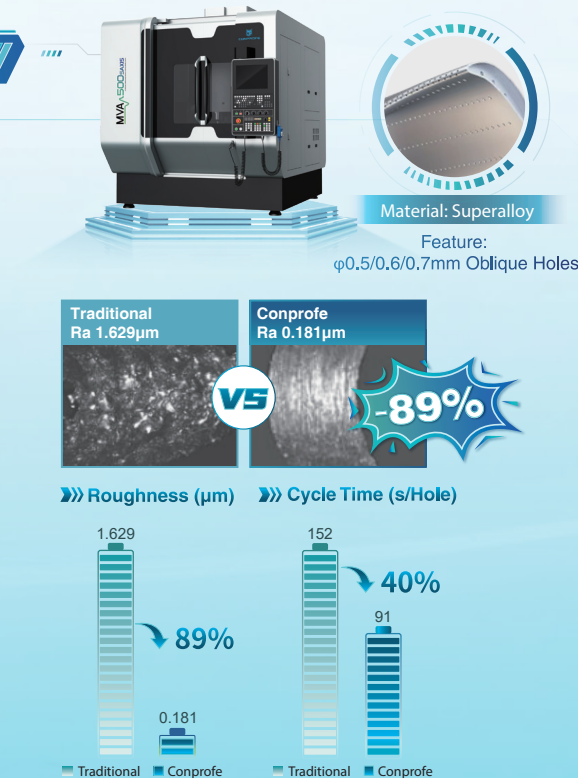
- Engine blade service life shortened by EDM recast layer
- Low machining efficiency (C/T with EDM: 150s)
- Hard to control the positioning accuracy

Conprofe Solution

- **Ultrasonic Vertical 5-Axis Machining Center** MVA500-5AXIS
- + **Ultrasonic** Machining System
- + **Supercritical CO₂ Cryogenic Cooling System (ScCO₂)**
- + **Minimum Quantity Lubrication (MQL)**

Conprofe Benefits

- Lower cutting force and significant burr reduction
- Hole wall roughness decreased by **89%**, from $Ra\ 1.629\mu m$ to $Ra\ 0.181\mu m$
- Cycle time shortened by **40%**, from 152s to 91s



3D-Printed Titanium Alloy Spinal Cage Milling

Challenges

- Long cycle time
- No cutting fluids allowed
- Short tool life
- Severe burring and poor surface quality with dry cutting

Conprofe Solution

- **Ultrasonic Vertical 5-Axis Machining Center** UGV200-5AXIS
- + **Ultrasonic** Machining System
- + **Supercritical CO₂ Cryogenic Spindle-Through Cooling System (ScCO₂)**

Conprofe Benefits

- Surface roughness **Ra < 0.6µm**
- Significant burr reduction, no need for manual deburring
- Achieve efficient, high-quality green processing and reduce workpiece scrap rate

