CONPROFE

Conprofe Ultrasonic-Green Machine Tools

Innovative Application Cases

Semiconductors | Aviation | Medical | Automotive | 3C | General Machining

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Semiconductor Industry

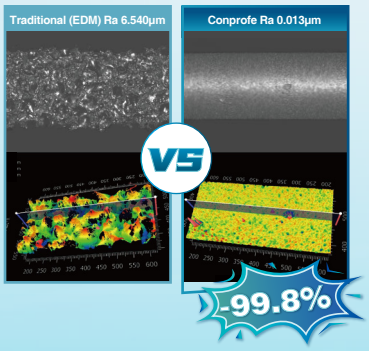
Curved Electrode of Single Crystal Silicon

Challenges

- Immature machining solution
- Hole wall roughness ≥Ra 6.54μm
- Hole roundness ≥0.025mm
- Hard to control hole perpendicularity

Showerhead

Material: Single-Cystal Silicon



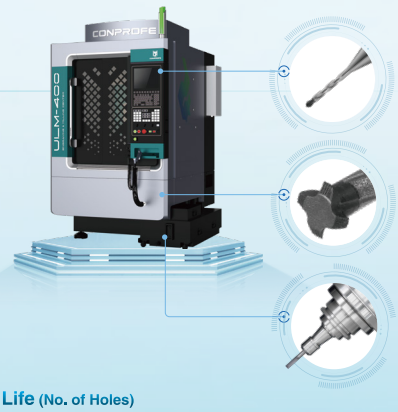
Conprofe Solution

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

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 6.54μm to Ra **0.013μm**

AlSiC Threaded Hole Machining



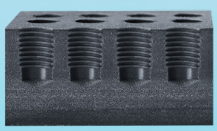
Challenges

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

Conprofe Solution

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

Tool Life (No. of Holes)



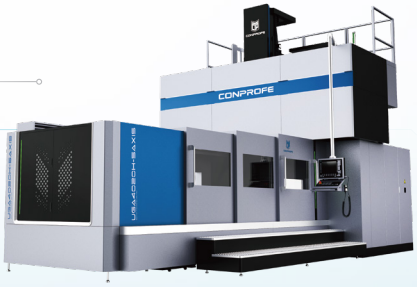
Material: AlSiC

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

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

Material: Nomex Honeycomb
Feature: Contouring

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

Ultrasonic
Straight-Edge Cutting Blade

Ultrasonic
Cutting Disc

Ultrasonic
Cutting Tool Holder

Superalloy Blade Cooling Holes Machining

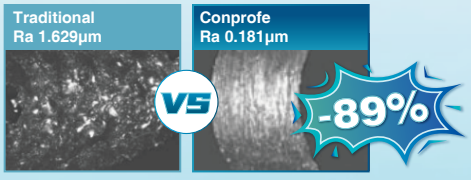
Material: Superalloy
Feature:
φ0.5/0.6/0.7mm Oblique Holes

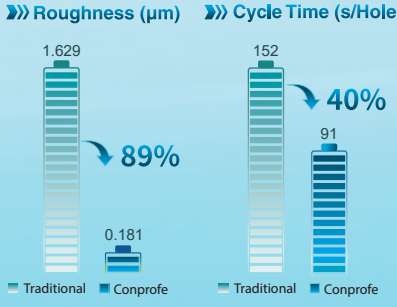
Challenges

- 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 CO_2 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 1.629μm to **Ra 0.181**μm
- Cycle time shortened by **40%**, from 152s to 91s

Medical Industry

Tibial Plateau Machining

Challenges

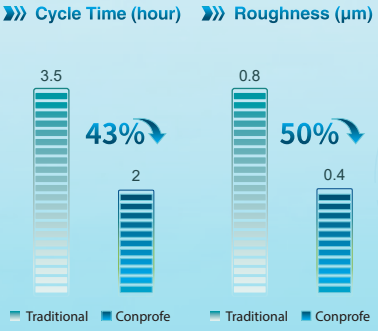
- Long cycle time
- Short tool life
- Low polishing efficiency and high manual labor cost

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 0.8μm to Ra 0.4μm



Material: CoCrMo Alloy
Dimension: 79x51x32.5mm

3D-Printed Titanium Alloy Spinal Cage Milling

Challenges

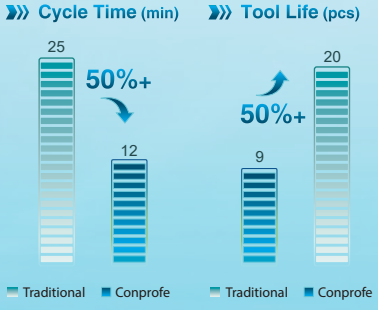
- Long cycle time
- Short tool life
- No cutting fluids allowed
- Severe burring and poor surface quality with dry cutting

Conprofe Solution

- **Ultrasonic Vertical 5-Axis Machining Center**
  UGV200-5AXIS
  + **Ultrasonic** Machining System
  + Supercritical CO_2 Cryogenic Spindle-Through Cooling System (**$ScCO_2$**)

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



Spinal Cage Milling
Material:
3D-Printed Titanium Alloy TC4

3C Industry

Sapphire Through-Hole Machining

Challenges

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

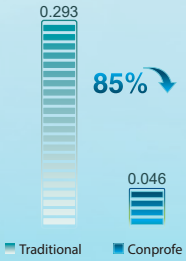
Conprofe Solution

- **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 0.293μm to 0.046μm
- No need for polishing

Hole Sidewall Roughness Ra (μm)



Material: Sapphire
Hole:：D2.5x0.8mm

Forged Titanium Alloy Deep Blind Cross-Hole Drilling

Challenges

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

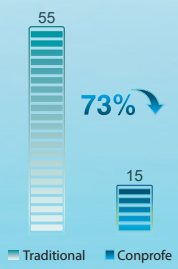
Conprofe Solution

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

Conprofe Benefits

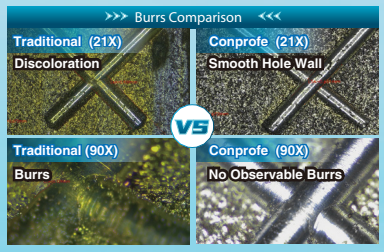
- Cycle time down by **73%**, from 55 seconds to 15 seconds
- Smooth hole wall without discoloration
- No observable burrs and no need for manual deburring

Cycle Time (s)



Material: Titanium Alloy

D1x10mm² Blind Holes



Automotive Industry

Carbon-Ceramic Brake Disc for New Energy Vehicle

Challenges

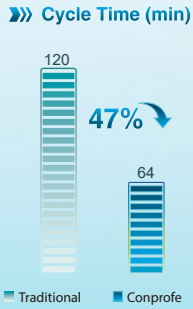
- Severe tool wear
- Low machining efficiency (C/T 120 min)
- Chipping, delamination and fiber pull-out and hole edge cracking

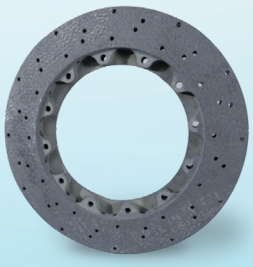
Conprofe Solution

- **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





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

General Precision Manufacturing

Deep Hole Drilling in Quartz Glass Optical Fiber Preform

Challenges

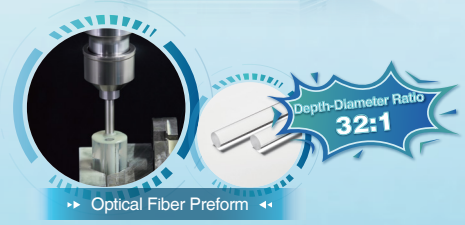
- Poor hole side-wall surface quality
- Poor hole parallelism
- Hole edge chipping
- Machining failture due to tool breakage

Conprofe Solution

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

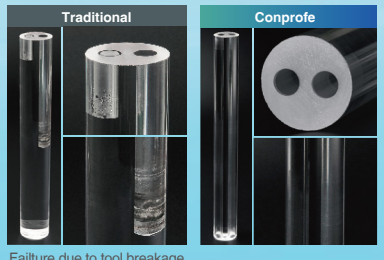
Conprofe Benefits

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



Optical Fiber Preform

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



Failture due to tool breakage