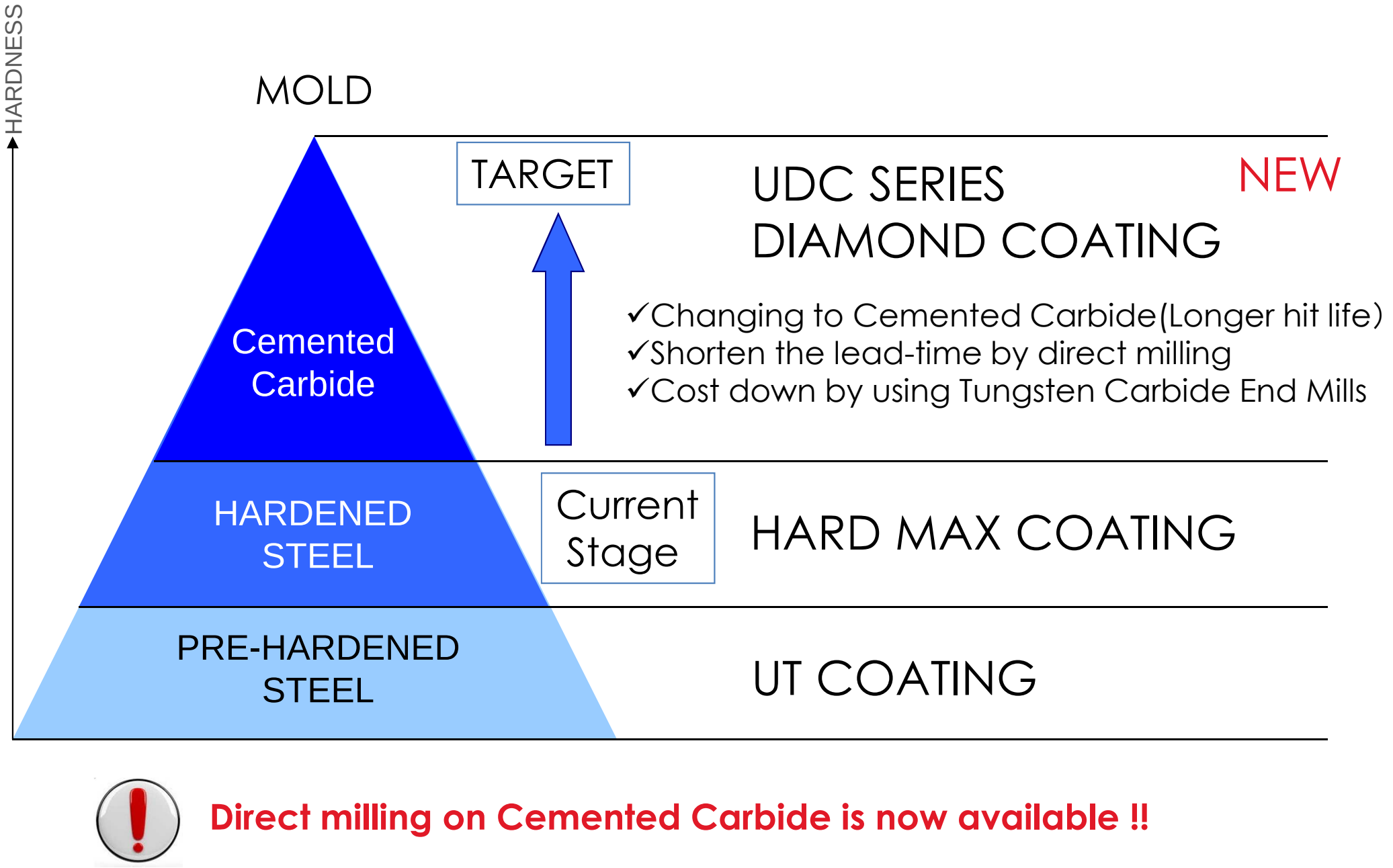
UNION TOOL UDC SERIES

UDC
ULTRA DIAMOND COAT

UNION TOOL

CONTENTS

UDC SERIES TARGET



Direct milling on Cemented Carbide is now available !!

UDC SERIES UDC Diamond Coating

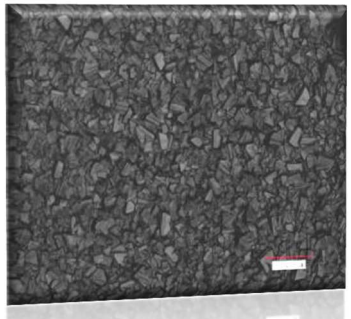
Hardness: 9000Hv

High adhesion & Wear resistance

Special Diamond Coating

- Diamond coating made by Thermal CVD method
- Super high Adhesion and Wear resistance
- Controlled micro structure
- Improves both Hardness and Durability

[Standard]
Grain size: Normal
Hardness: Normal

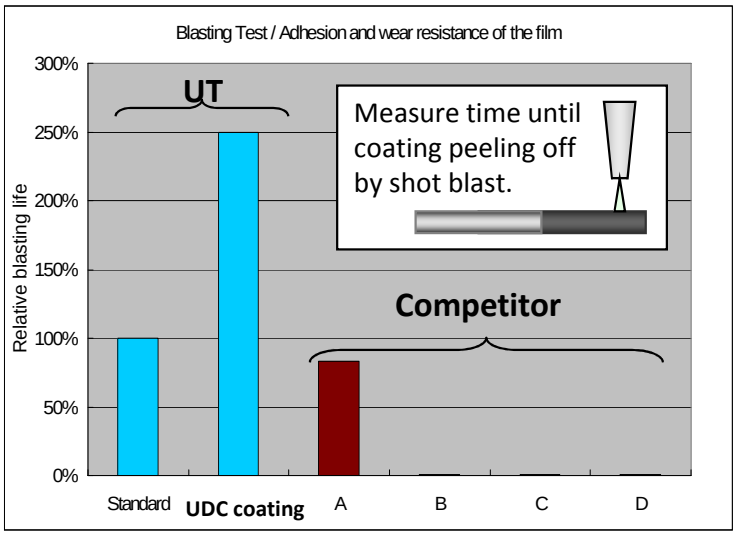


[High Wear Resistance]
Grain size: Large
Hardness: High

[Smooth surface]
Grain size: Small
Hardness: Low

Controlled Diamond coating micro structure → Improves Hardness & Durability

Comparison of Adhesion / Wear resistance using shot-blast test



UDC SERIES UDC Diamond Coating

Required Characteristics

Toughness

Original coating process with excellent controlled micro-structure offers outstanding toughness.

Hardness

Our original SP3 structure has similar hardness to diamond.

Adherence

UNION TOOL original pre-treatment process and coating process offers extreme adherence.

UDC
ULTRA DIAMOND COAT

UDC SERIES Variety

Standard Ball

Long Neck Ball

Long Neck Corner Radius

UDC Drill

Thread Mill

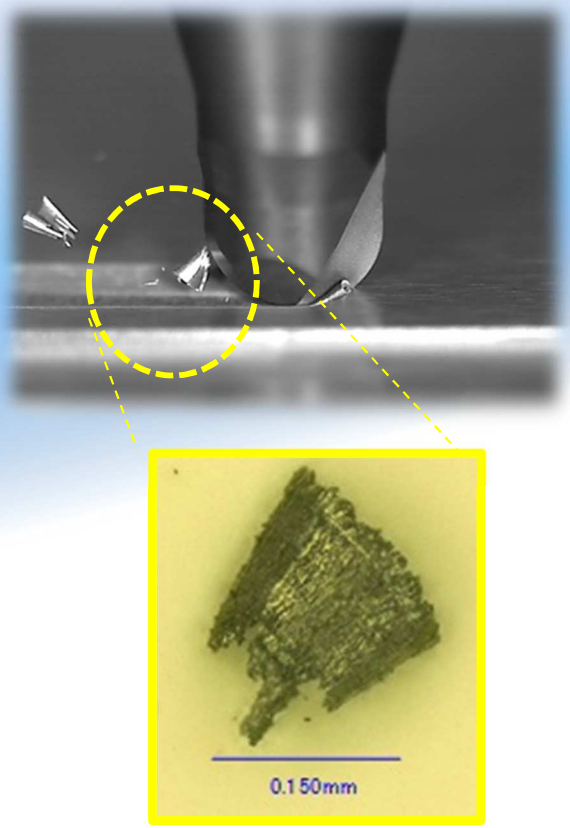
Total: 7 series [167 models]

CONTENTS

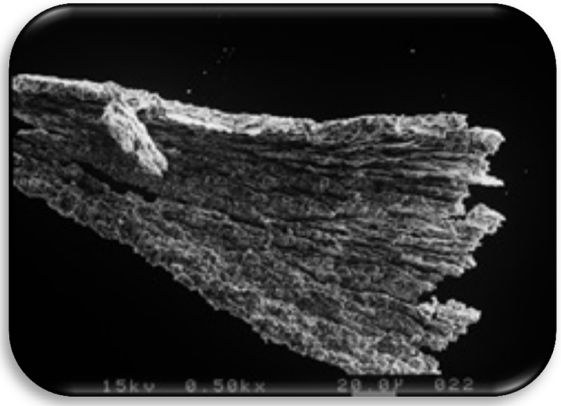
- Features of UDC series, patented Diamond Coating.
- **Close study of milling “Cemented Carbide”.**
- NEW “F series”
- BONUS data

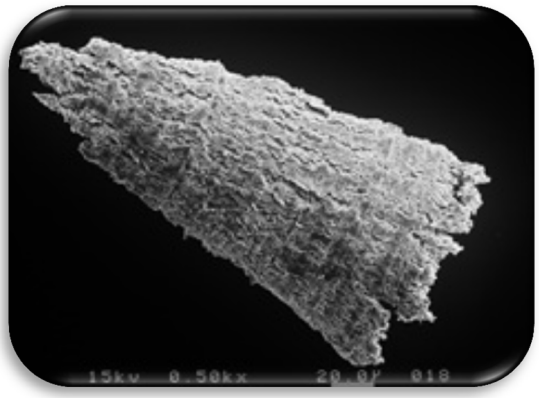
CARBIDE MILLING Cutting Chips

Material: 90HRA (CIS VM-40) Cemented Carbide



UDCB Series





Process	Tool	Spindle speed [min^{-1}]	XY Feed [mm/min]	ap [mm]	Coolant
Roughing	UDCB2010-0070 (R0.5)	30,000	300	0.1	Air blow

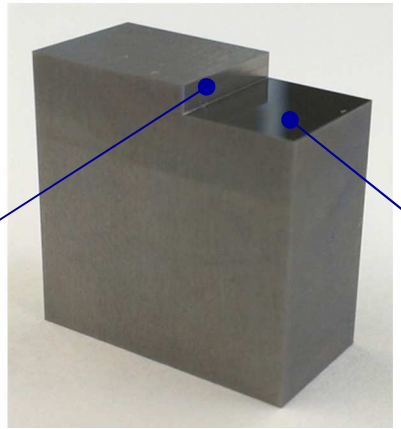
CARBIDE MILLING Mirror Surface

Material: 90HRA (CIS VM-40) Cemented Carbide

Coolant: Air Blow (Roughing)
Oil Mist (Finishing)

Work Size: 10mm x 8mm x 18mm

SIDE
Ra: 0.069µm
Rz: 0.535µm



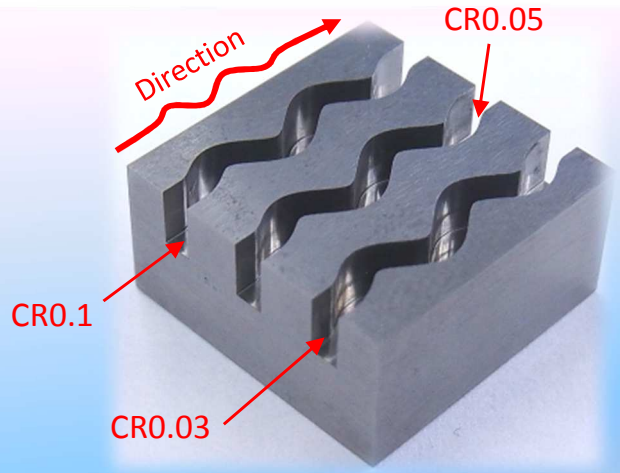
BOTTOM
Ra: 0.010µm
Rz: 0.078µm

UDCLRS Series

Material Removal Rate = 144mm³

Process	Tool	Spindle speed [min^{-1}]	XY Feed [mm/min]	ap [mm]	ae [mm]
Roughing	UDCLRS 2020-005-020 (ϕ2 CR0.05 x 2mm)	20,000	750	0.05	0.9
Finishing	UDCLRS 2020-005-020 (ϕ2 CR0.05 x 2mm)	20,000	100	0.05	0.01 (Bottom) 0.9 (Side)

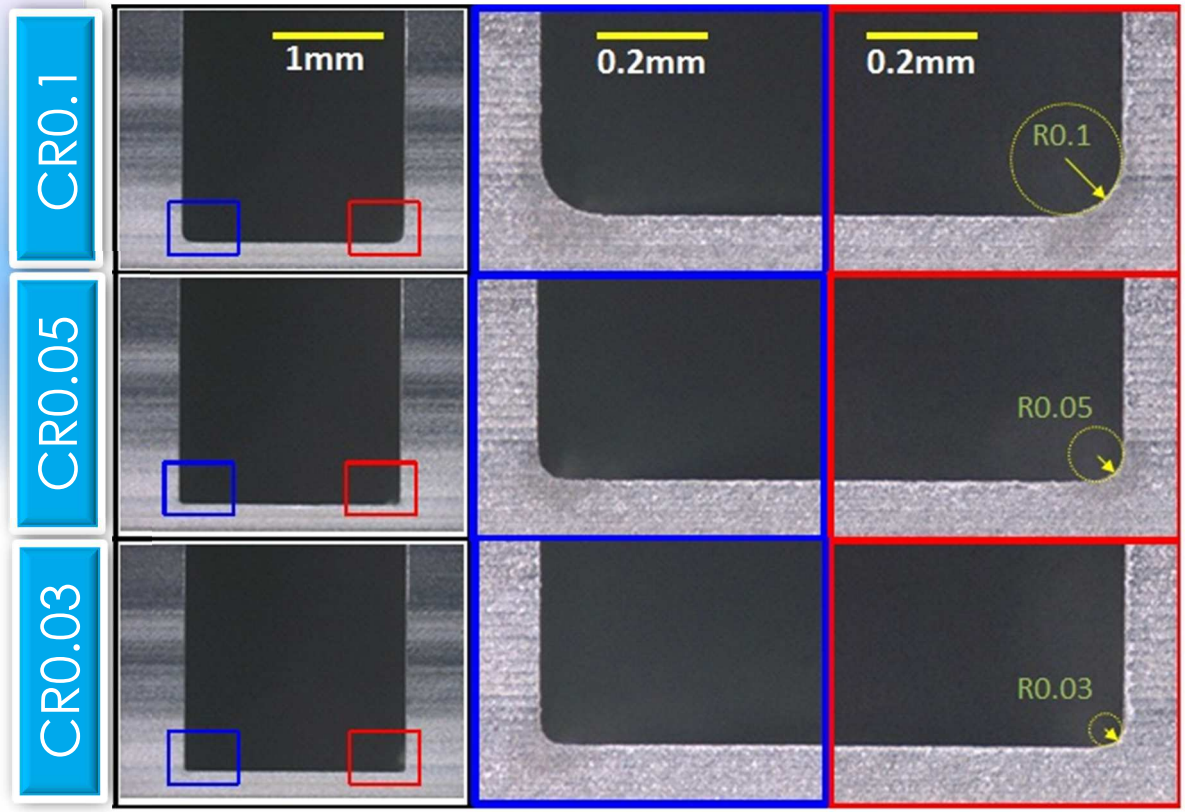
CARBIDE MILLING Transcription



Material: 90HRA (CIS VM-40) Cemented Carbide

Slotting Depth: 4mm
Work Size: 20mm x 20mm x 10mm

Work Bottom Corner Radius transcription



Material Removal Rate = 176mm³

Tool	Spindle speed [min^{-1}]	XY Feed [mm/min]	ap [mm]	Coolant	Milling Time [min]
UDCLRS	20,000	185	0.02	Air blow	30

*Bottom surface ap = 0.01mm

CARBIDE MILLING Accuracy

Measuring data on each label

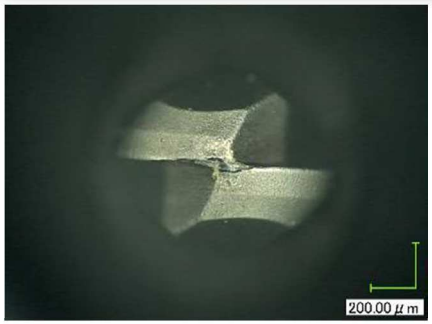
- Actual Outer Diameter
- Max/Min rate of Ball Radius tolerance
- Max/Min rate of Corner Radius tolerance

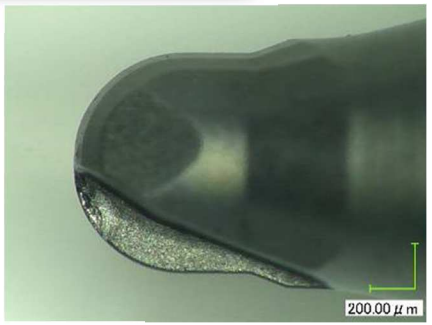
CARBIDE MILLING Coolant

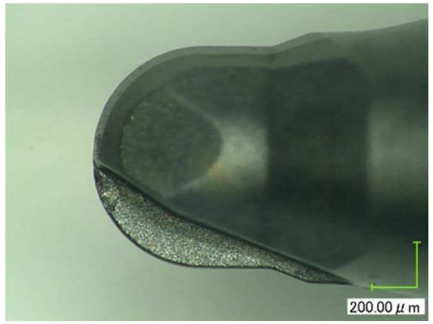
Material: 90HRA (CIS VM-40)
Cemented Carbide

Tools after milling 10hr 30min

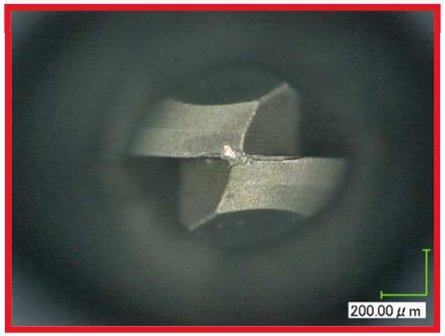
Water Soluble coolant

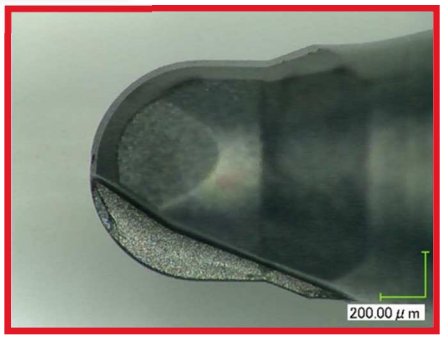


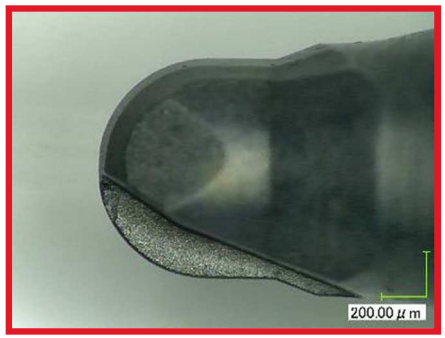




Air Blow (Nozzle)







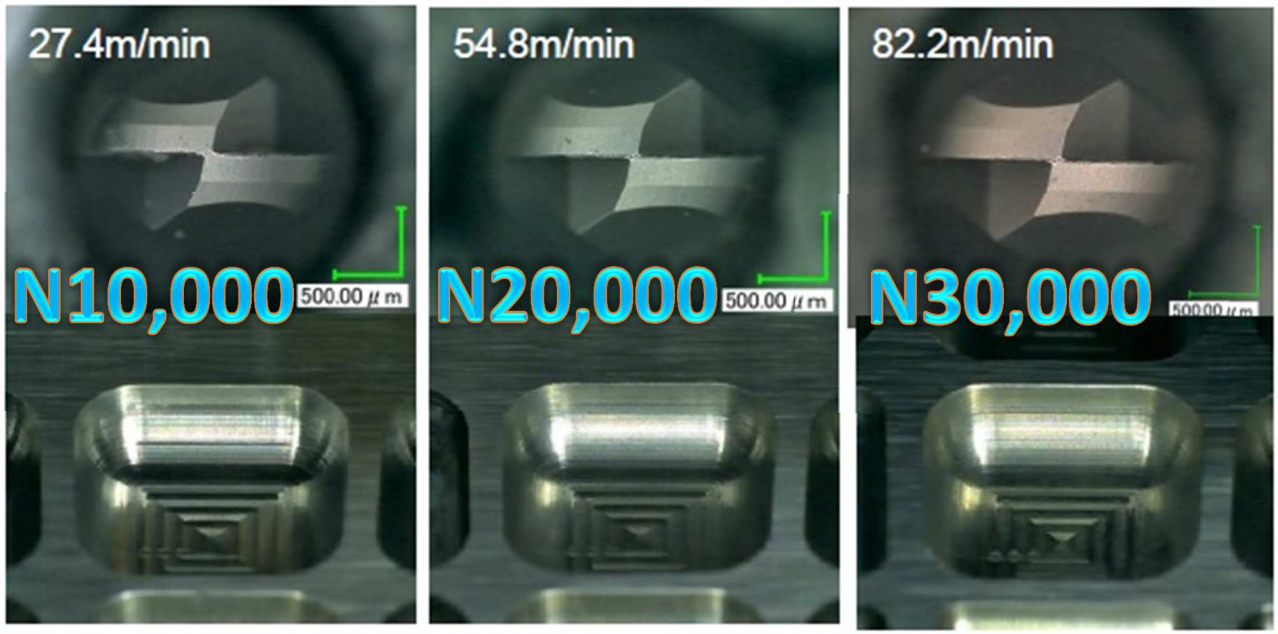
Use Air Blow for best result !

Tool	Spindle speed [min^{-1}]	XY Feed [mm/min]	ap [mm]	ae [mm]	Coolant	Milling Time [h: m]
UDCB 2010-0070 (R0.5 x 0.7)	20,000	100	0.05	0.02	Air blow / Water Soluble	10:30

*Bottom surface ae amount = 0.03mm

UDC SERIES Spindle Speed

Vf100 **Vf200** **Vf300**



[Milling condition]

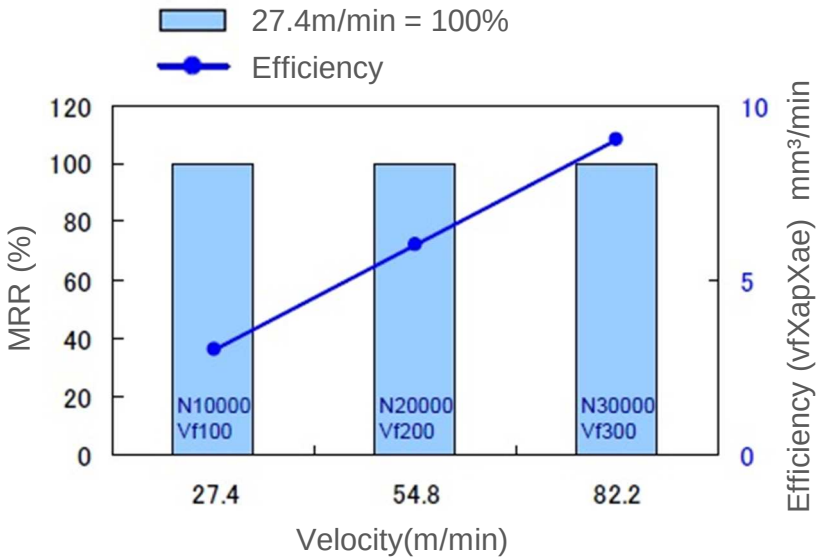
Tool: R1.0 Ball type (UDCB2020-0140)

Work Material:	G3(VM-40) 90HRA
ap:	0.1mm
ae:	0.3mm
Coolant:	Oil Mist
Milling time:	6.53min/pc
MRA:	20mm³

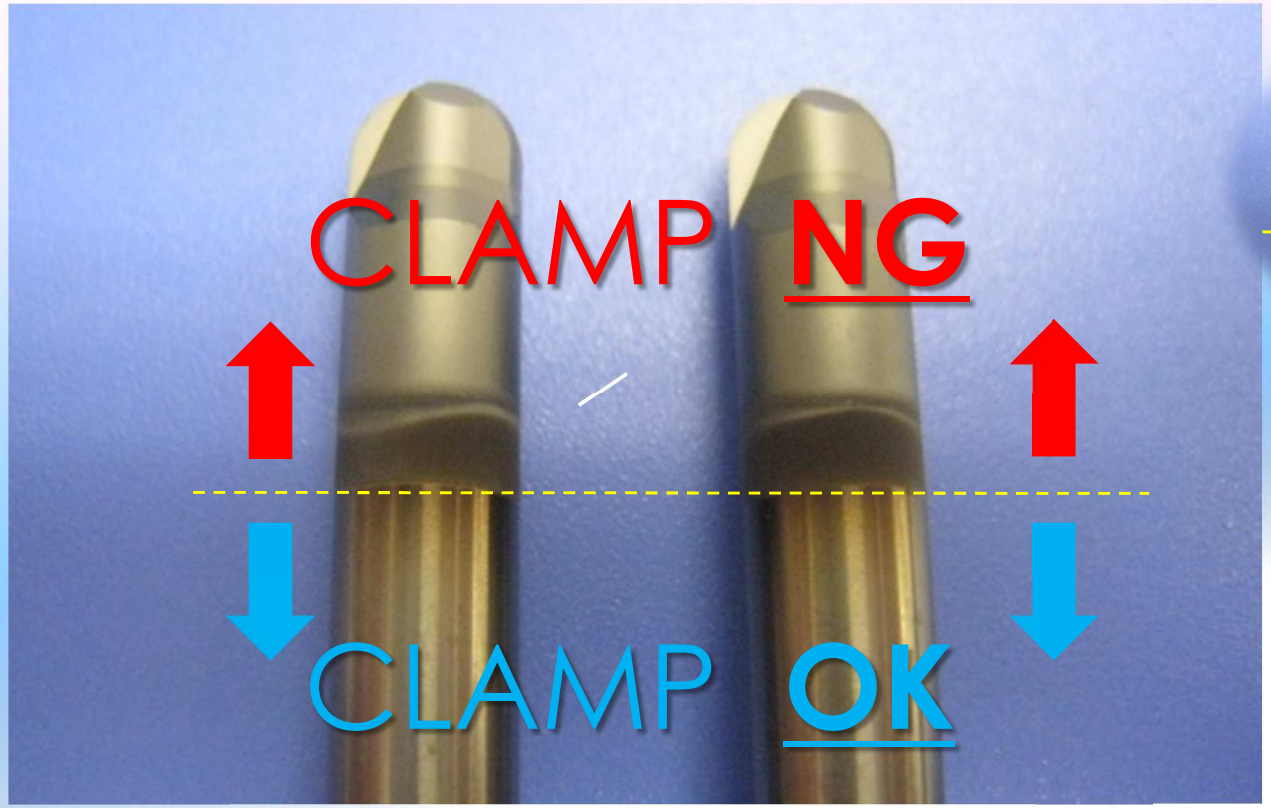
Testing Result (R1 tool with Vc = 27 ~ 82m/min)

- No difference on "Tool Life" or "Tool Damage" between each spindle speed.
- Higher spindle speed improves the efficiency.

MRR & Efficiency



UDC SERIES CAUTION



Do NOT clamp the coated area on shank part into the tool holder. Tool might stuck inside.

CONTENTS

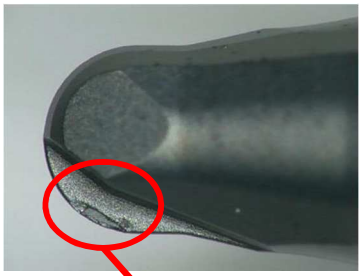
UDCBF & UDCLBF What's new?

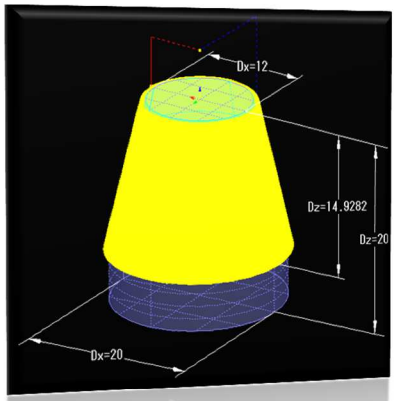
- Newly developed Coating
- New Tip Design
- Special Treatment on cutting edge

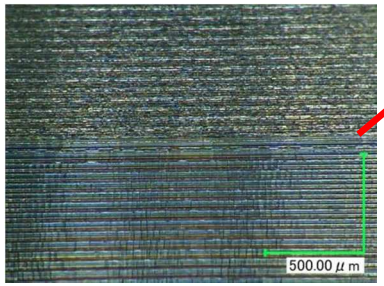
CHARACTERISTIC Surface Finishing

Tool: R0.5 Ball type UDCB & UDCBF

Spindle speed	30,000 min^{-1}
Feed rate	300 mm/min
ap:	0.05mm
ae:	0.02mm
Coolant:	Air Blow
Tool Overhang:	20mm
Work material :	Cemented Carbide
Milling time:	55 min 5 sec



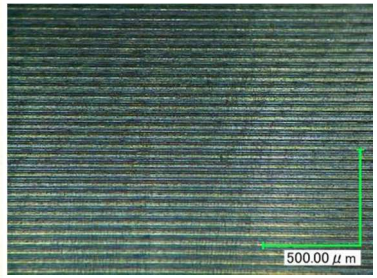


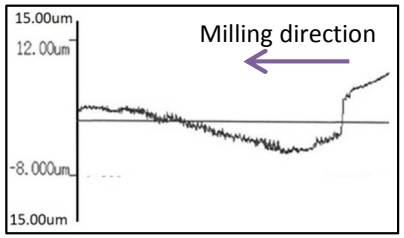


Ra 0.20um
Rz 1.21um

Milling Direction

Ra 0.19um
Rz 1.44um

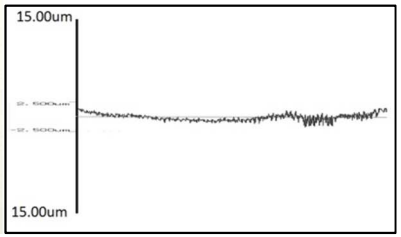




Form Accuracy

UDCB

UDCBF



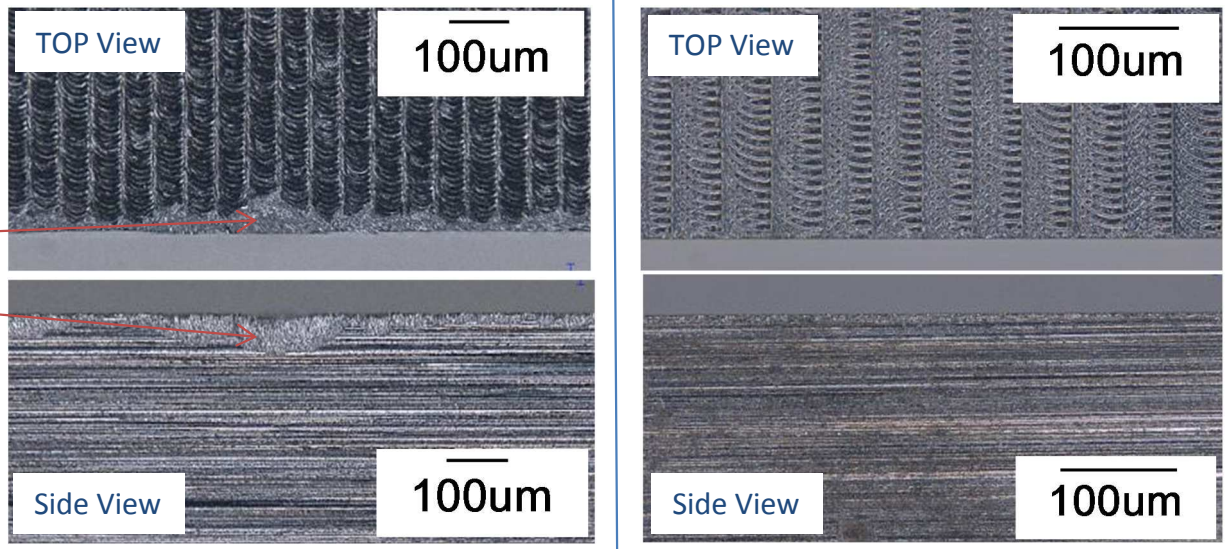
Form Accuracy

CHARACTERISTIC Surface Finishing

Tool: R0.5 Ball type UDCB & UDCBF

Spindle speed	30,000 min^{-1}
Feed rate	300 mm/min
ap:	0.02mm
ae:	0.05mm
Coolant:	Air Blow
Work material :	Cemented Carbide 90HRA(VM-40)

Micro edge chipping



UDCB UDCBF

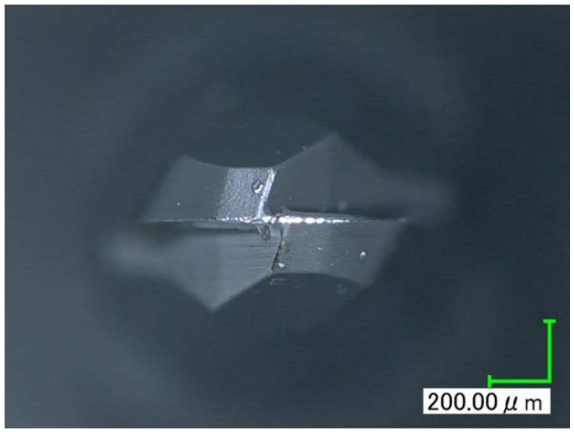
Comparison of Micro Edge chipping on material surface

CARBIDE MILLING CARBIDE INSERT

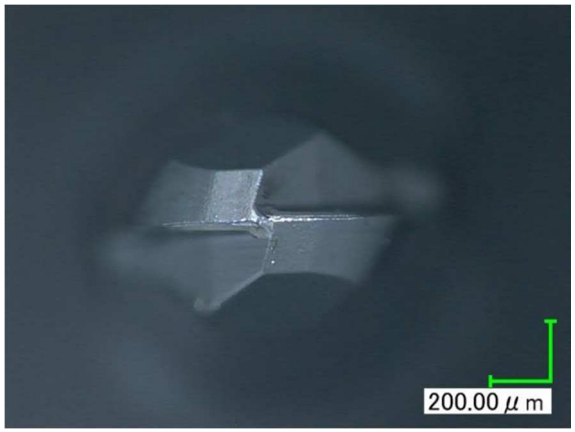
TOOL : UDCBF 2010-0070 (R0.5 x 0.7mm)
Material : Cemented Carbide VM-40 (90HRA)

	Roughing	Finishing	
Item	UDCBF 2010-0070	UDCBF 2010-0070	
Spindle Speed [min-1]	30,000		
XY Feed [mm/min]	300		
Ap[mm]	0.05	0.028	
Ae[mm]	0.25	0.02	
Coolant	Airblow (Nozzle)		
MRR[mm^3]	86.3	12.0	ttl: 98.3mm^3
Milling time	43 min	2 hrs 17min	ttl: 3 hrs

※Used 1 tool each for Roughing and Finishing process.

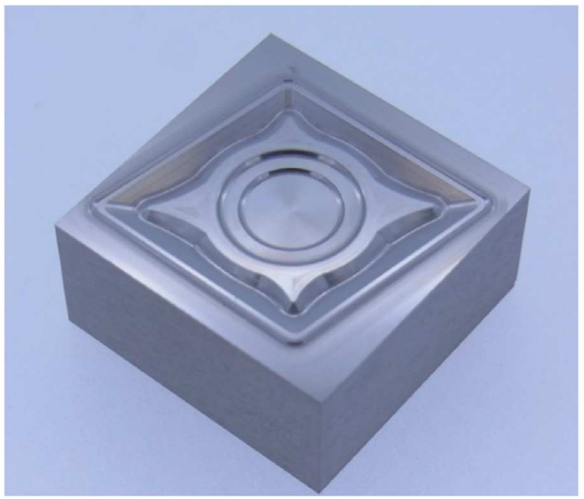


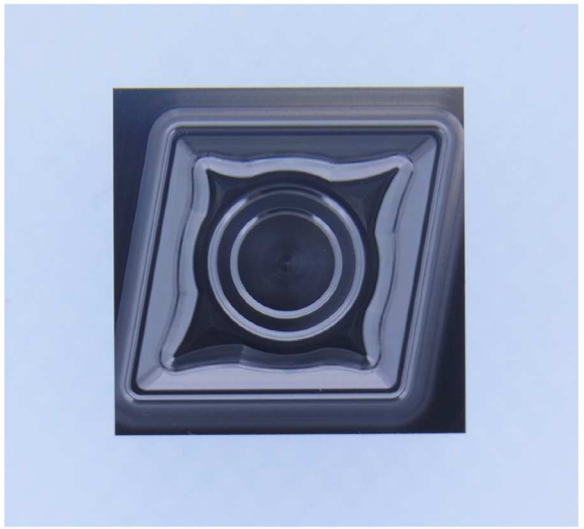
After Roughing



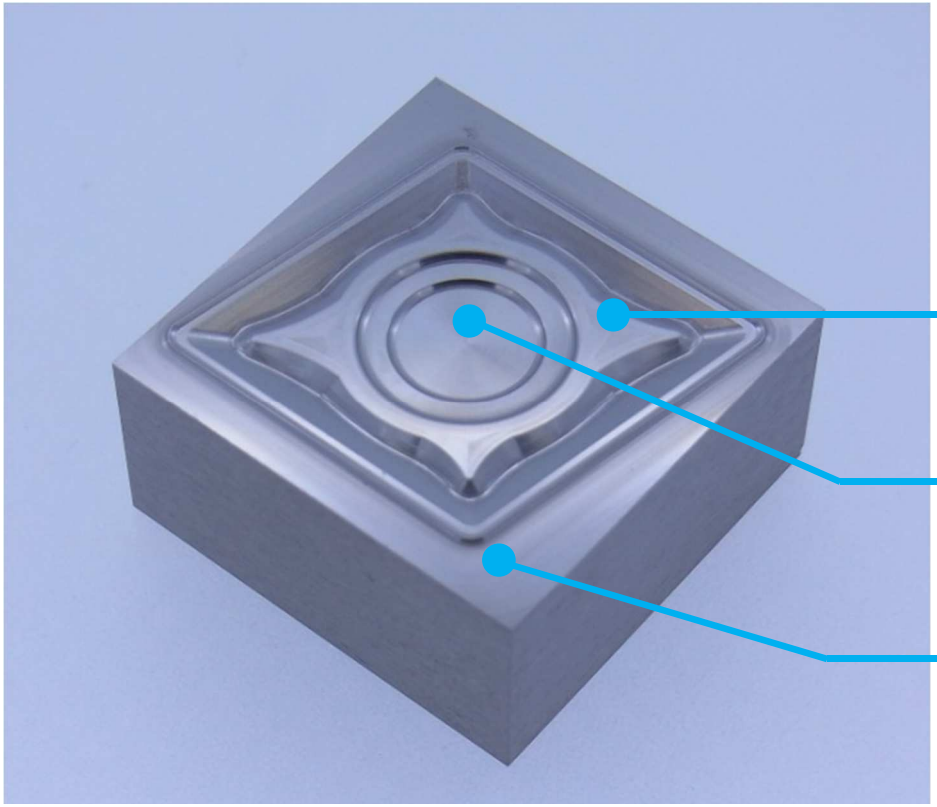
After Finishing

Work size : 20×20×t10[mm]





CARBIDE MILLING CARBIDE INSERT



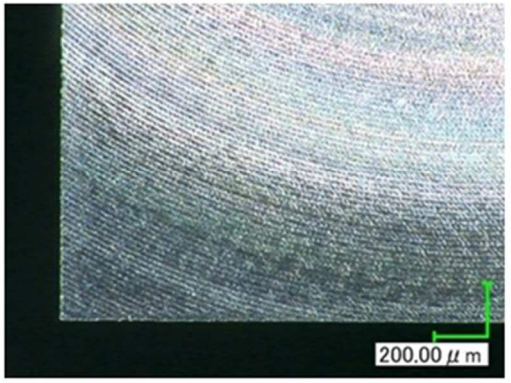
UDCBF excellent surface roughness

Ra: 0.051 μm
Rz: 0.399 μm

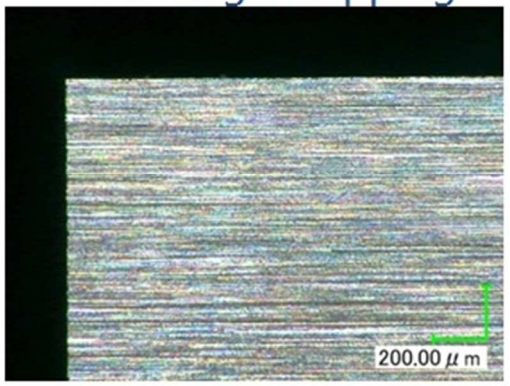
Ra: 0.068 μm
Rz: 0.520 μm

Ra: 0.054 μm
Rz: 0.408 μm

Excellent Surface



No Edge chipping



CONTENTS

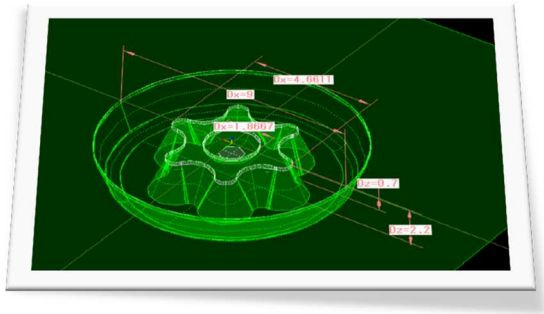
CARBIDE MILLING Zirconia

Coolant: Water Soluble
Milling Time: 98min
Work Size: φ9 mm x Depth 2.2mm

Milling Ceramic !

Material: Zirconia

UDCB Series



Material Removal Rate = 91.7mm³

Process	Tool	Spindle speed [min^{-1}]	XY Feed [mm/min]	Approach Feed [mm/min]	ap [mm]	ae [mm]	Milling time [min]
Roughing	UDCB2010-0070 (R0.5)	30,000	300	40	0.05	0.05	98

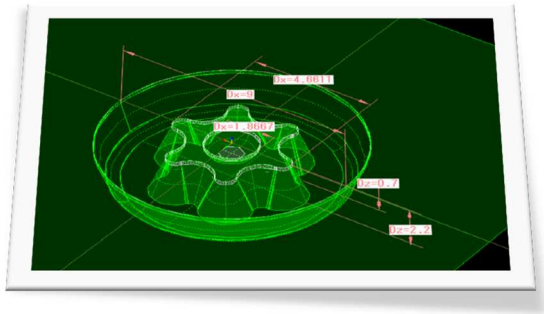
CARBIDE MILLING Alumina

Coolant: Water Soluble
Milling Time: 196min
Work Size: φ9 mm x Depth 2.2mm

Milling Ceramic !

Material: Alumina

UDCB Series



Material Removal Rate = 91.7mm³

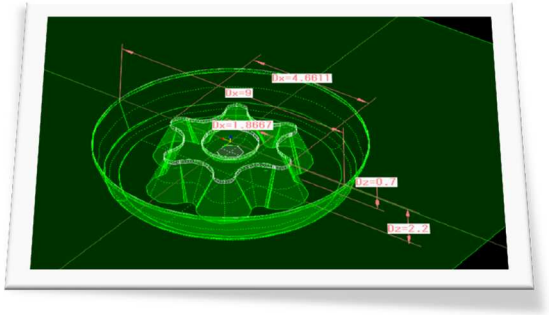
Process	Tool	Spindle speed [min^{-1}]	XY Feed [mm/min]	Approach Feed [mm/min]	ap [mm]	ae [mm]	Milling time [min]
Roughing	UDCB2010-0070 (R0.5)	30,000	300	40	0.05	0.05	196

*Used 2 tools. First tool could not finish and milled twice with same program/condition.

CARBIDE MILLING Hexalobular

Material: 92.5HRA (CIS VF20)
Cemented Carbide

Coolant: Air Blow
Milling Time: 39min
Work Size: φ9 mm x Depth 2.2mm



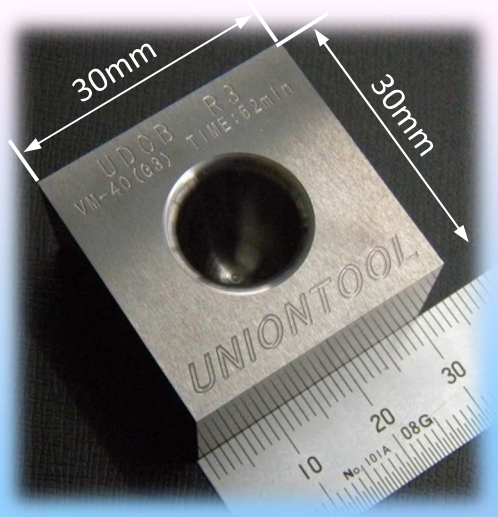
UDCB Series

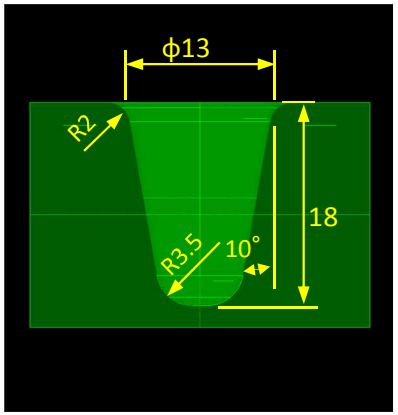
Material Removal Rate = 91.7mm³

Process	Tool	Spindle speed [min^{-1}]	XY Feed [mm/min]	Approach Feed [mm/min]	ap [mm]	ae [mm]	Milling time [min]
Roughing	UDCB2010-0070 (R0.5)	30,000	300	100	0.05	*0.30	39

*Bottom surface ae amount = 0.05mm

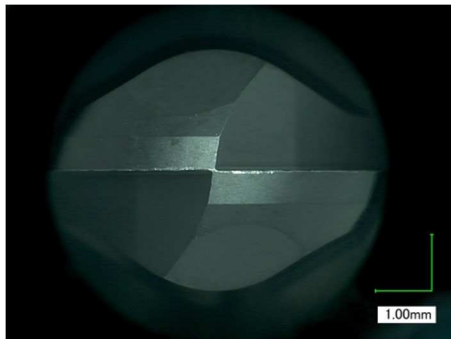
CARBIDE MILLING Deep Milling





Material: 90HRA (CIS VM-40)
Cemented Carbide

Tool after used

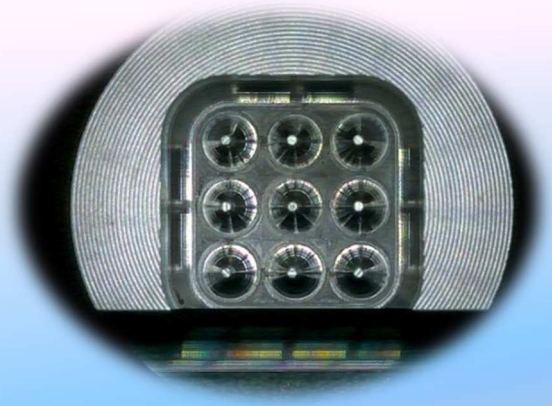


UDCB Series

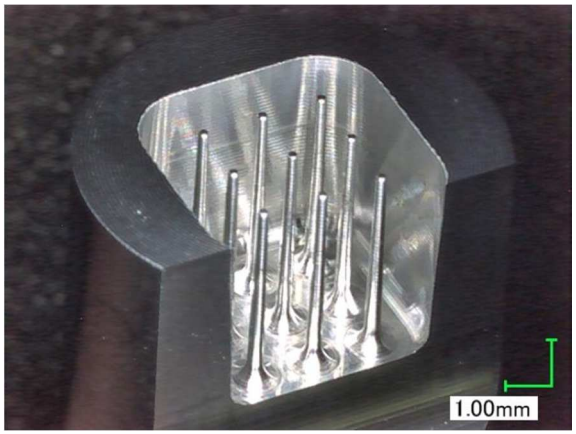
Material Removal Rate = 1,400mm³

Tool	Spindle speed [min^{-1}]	XY Feed [mm/min]	ap [mm]	ae [mm]	Coolant	Milling Time [min]
UDCB 2060-0420 (R3 x 4.2)	20,000	200	0.2	0.4	Air blow	52

CARBIDE MILLING Pin Holder



Material: 92.5HRA (CIS VF-20)
Cemented Carbide

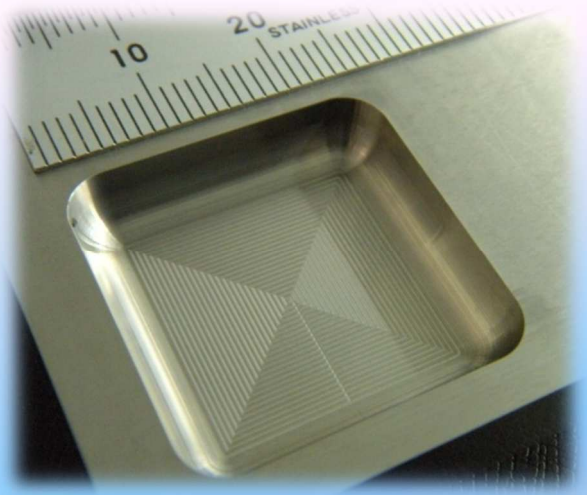


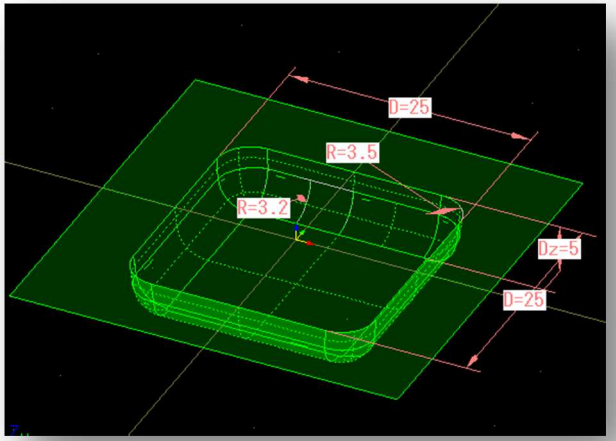
*Used UDCLB 2030 -080 (R1.5 x8mm) to open the wall.

UDCLB Series

Process	Tool	Spindle speed [min^{-1}]	XY Feed [mm/min]	ap [mm]	ae [mm]	Milling time [min]
First step	UDCLB2010-0500 (R0.5 x 5mm)	30,000	300	0.1	0.05	52
Second step	UDCLB2010-0500 (R0.5 x 5mm)				0.05 (Bottom surface 0.02mm)	39
Wall opening	UDCLB2030-080 (R1.5 x 8mm)	27,500	275	0.125	0.33	29

CARBIDE MILLING Pocket Milling

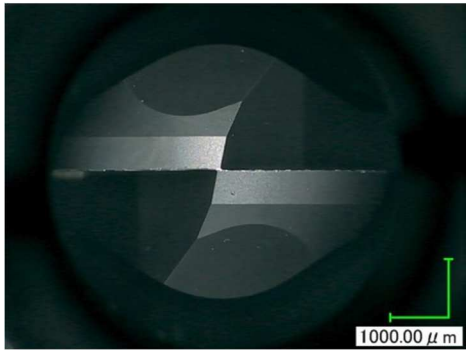




Material: 92.5HRA (CIS VF-20)
Cemented Carbide

UDCB Series

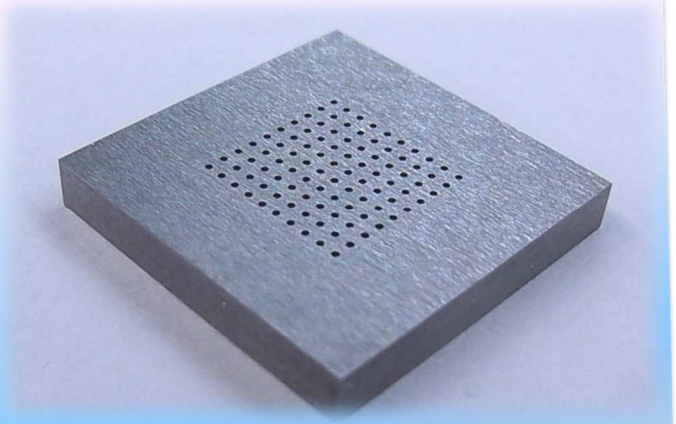
Tool after used



Material Removal Rate = 2,800mm³

Tool	Spindle speed [min^{-1}]	XY Feed [mm/min]	ap [mm]	ae [mm]	Coolant	Milling Time [min]
UDCB 2060-0420 (R3 x 4.2)	20,000	200	0.2	0.4	Air blow	137

CARBIDE DRILLING φ0.4 Blind hole

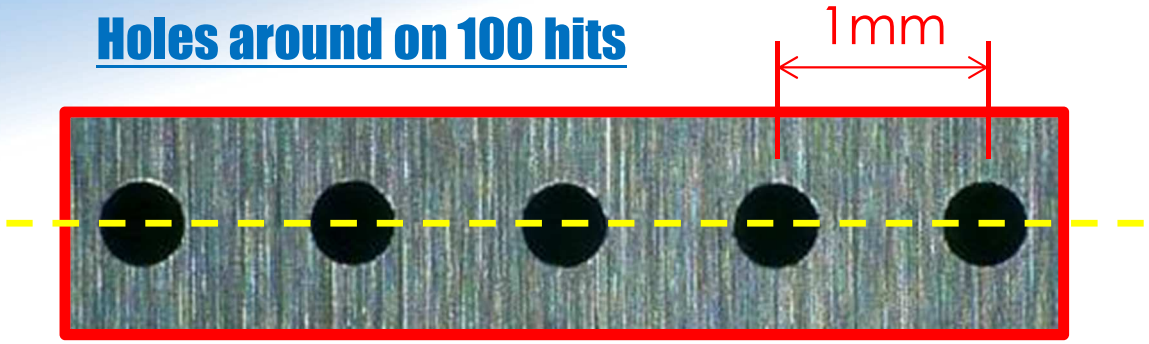


Material: 90HRA (CIS VM40)
Cemented Carbide

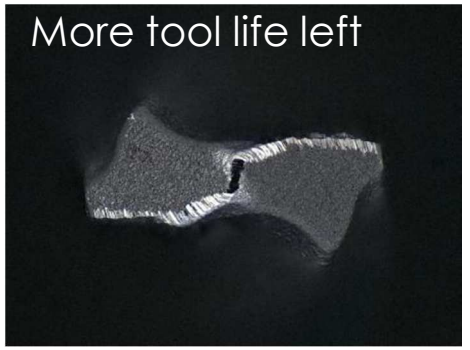
Coolant:	Air Blow [nozzle]
Hole depth:	2.8mm x 100 holes
Work size:	20mm x 20mm x 3mm
Drilling Time:	36 sec/hole

100 holes drilling in 60 min !

Holes around on 100 hits



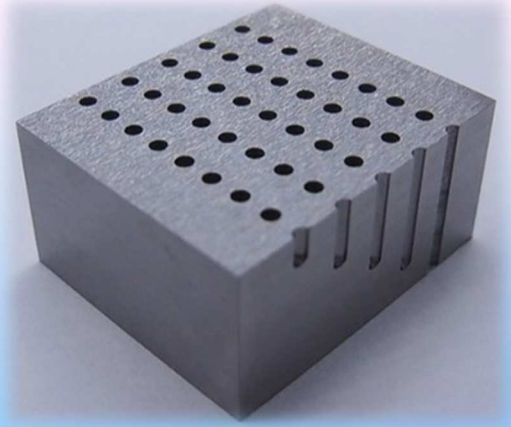
Tool after 100 hits



Process	Tool	Spindle speed [min^{-1}]	Feed [mm/min]	Peck Amount [mm]	Hole Depth [mm]	Drilling time [sec]
Drilling	UDCMX 2040-040 (0.4mm x 4mm)	20,000	5	Non-Step	2.8mm	36/hole

*Bottom surface ae amount = 0.05mm

CARBIDE DRILLING φ1.0 x 10mm



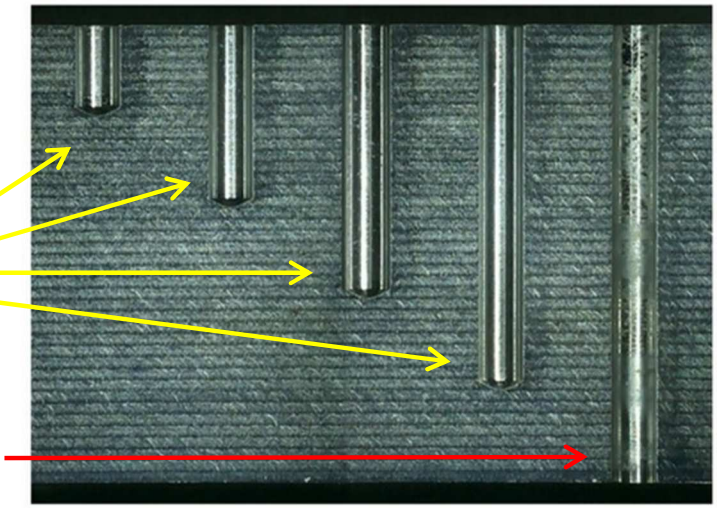
Material: 90HRA (CIS VM40)
Cemented Carbide

Total 50 holes drilling in 86 min !

Coolant: Air Blow [nozzle]
Work size: 20mm x 20mm x 10mm
Drilling Time: total 86 min

Cross Section

Depth : 2mm 4mm 6mm 8mm 10mm



Process	Tool	Spindle speed [min^{-1}]	Feed [mm/min]	Peck Amount [mm]	Hole Depth [mm]
Drilling	UDCMX 2100-100 (1.0mm x 10mm)	20,000	7.5	0.1	2, 4, 6, 8, 10

CARBIDE MILLING Drilling + Thread milling

Drilling UDCLB 2060-1500 (R3x15mm)
Thread Milling UDCT M8-1.25-16 (M8)
Material Cemented Carbide VM-40 (90HRA)

※Used 2 drills for Roughing and 1 tool each for Chamfering & Finishing.

Work Size : 50x50xt10[mm]

Note	Drilling（Spiral drilling）	Thread milling
Spindle Speed	8,000[min^{-1}]	5,300[min^{-1}]
Feed	50[mm/min]	30[mm/min]
Z Feed	Roughing ：0.1[mm/rev] Finishing（Zero-cut）：0.3[mm/rev]	1.25[mm/rev]
Coolant	Air blow (Nozzle)	Air blow (Nozzle)
Hole	Through Hole ϕ6.8 Depth10[mm] x 16 holes	Depth 10[mm] x 16 holes
Milling Time	16 holes ➔ 152 min （9min30sec/hole）	16 holes ➔ 48 min （3 min/ hole）

Drilling

Threading

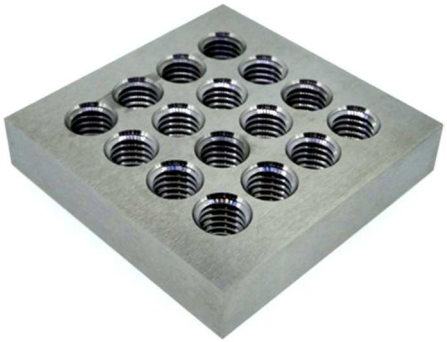
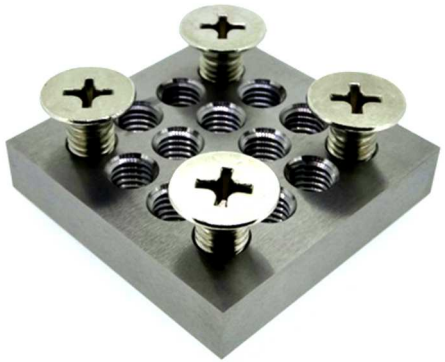


Image with screw



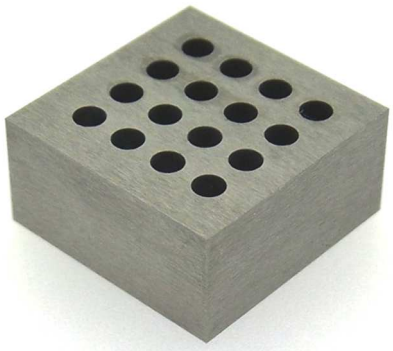
CARBIDE MILLING Drilling + Thread milling

Drilling UDCMX 2250-100 (2.5mm x10mm)
Thread Milling UDCT M3-0.5-6 (M3)
Material Cemented Carbide VM-40 (90HRA)

Work Size : 20x20xt10[mm]

Note	Drilling	Thread milling
Spindle Speed	2,000[min^{-1}]	20,000[min^{-1}]
Feed	5[mm/min]	3[mm/min]
Peck Amount	0.5mm	-
Coolant	Air blow (Nozzle)	Air blow (Nozzle)
Hole	Blind Hole ϕ2.5 Depth 8[mm] x 16 holes	Blind Hole Depth 6[mm] x 16 holes
Milling Time	2min 2sec / hole	9 min 15sec / hole

Drilling



Threading

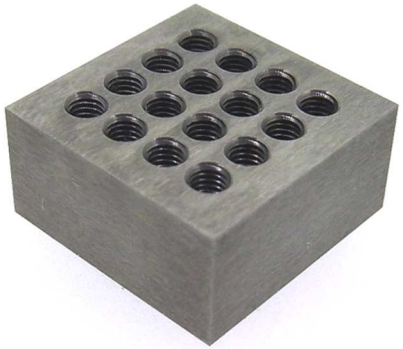


Image with screw