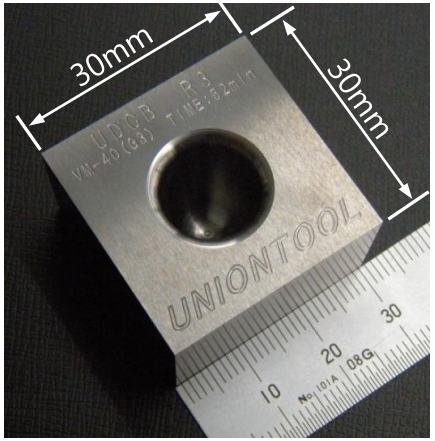
UNION TOOL CO.

UDCB Cemented Carbide Deep Pocket

UDC ULTRA DIAMOND COAT

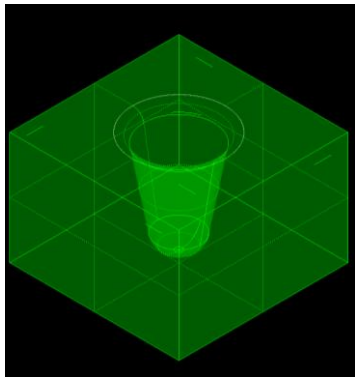
Model

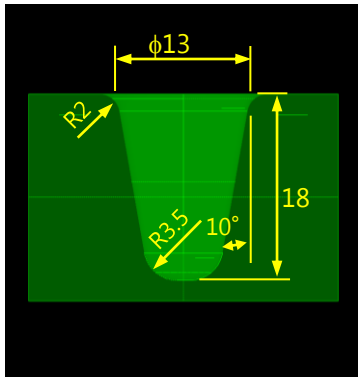
Tapered circular pocket
Size: ϕ13 x Depth 18 mm Draft: 10°
Upper surface: R2 Bottom surface: R3.5



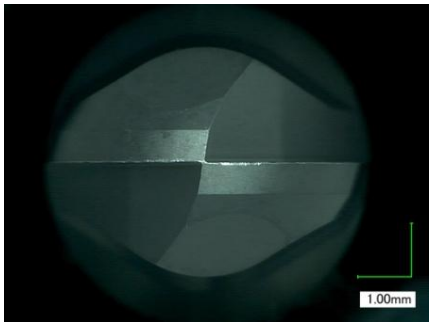
Milling Condition

Tool	2-Flute ball UDCB 2060-0420 (R3 x 4.2)
Work material	Cemented carbide VM-40 (90HRA)
Spindle Speed	20,000 min^{-1}
Feed Rate	200 mm/min
a_p	0.2 mm
a_e	0.4 mm
Coolant	Air blow
Cycle time	**52 min**
MRV	**1,400 mm^3 (1.4cc)** 26.9 mm^3/min





Tool after milling



Removed 1.4cc with one tool!

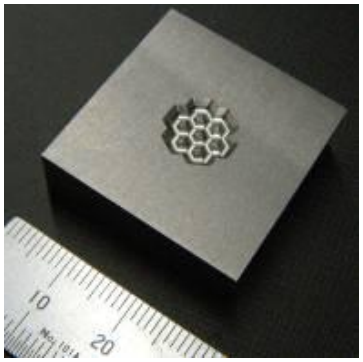
UNION TOOL CO.

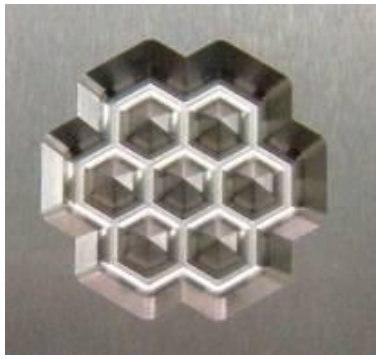
UDCB Cemented Carbide Hexagonal Pyramid Shape

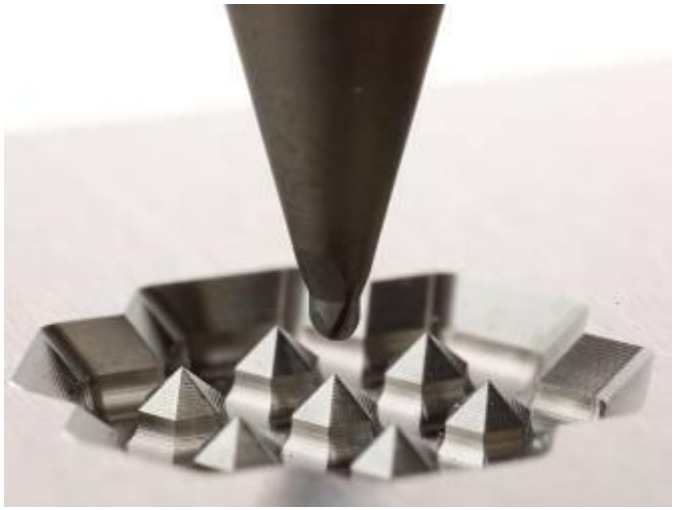
UDC ULTRA DIAMOND COAT

Model

Hexagonal pyramid shape
Size: 10.2 x 10.2 x Depth 1.39 mm



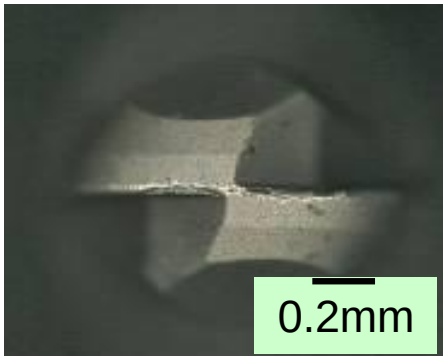




Milling Condition

Tool	2-Flute ball UDCB 2010-0070 (R0.5 x 0.7)
Work material	Super micro grain cemented carbide VF-20 (92.5HRA)
Spindle Speed	30,000 min^{-1}
Feed Rate	300 mm/min
a_p	0.05 mm
a_e	0.25 mm (Near a bottom surface 0.03 mm)
Coolant	Air blow
Cycle time	36 min
MRV	72.6 mm^3 (2.02 mm^3/min)

Tool after milling



UNION TOOL CO.

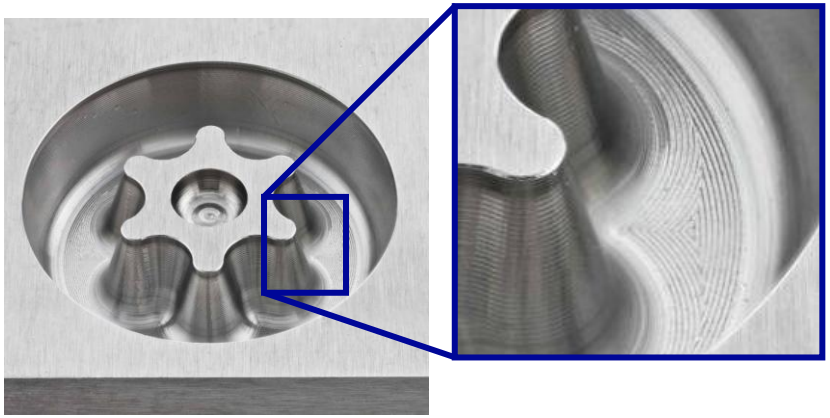
UDCB Cemented Carbide Hexalobular Shape

UDC ULTRA DIAMOND COAT

Model

Hexalobular shape

Size: ϕ9 x Depth 2.2 mm

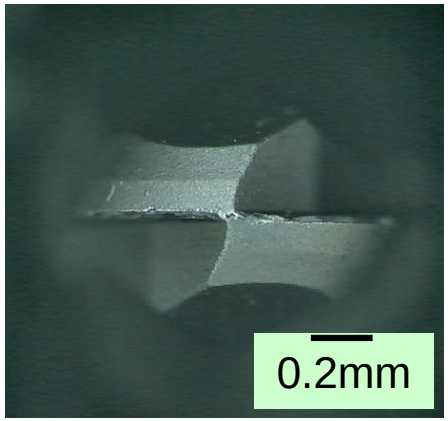


Milling Condition

Tool	2-flute ball UDCB 2010-0070 (R0.5 x 0.7)
Work material	Super micro grain cemented carbide VF-20 (92.5HRA)
Spindle Speed	30,000 min^{-1}
Feed Rate	300 mm/min
a_p	0.05 mm
a_e	0.30 mm (Bottom surface 0.05 mm)
Coolant	Oil mist
Cycle time	39 min
MRV	91.7 mm^3 (2.35 mm^3/min)

MRV 0.091cc with R0.5 tool!

Tool after milling

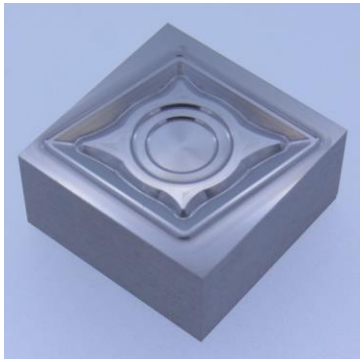


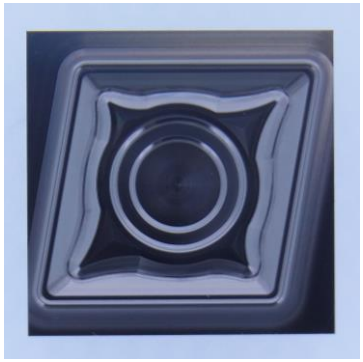
UDCBF Cemented carbide Indexable insert mold milling

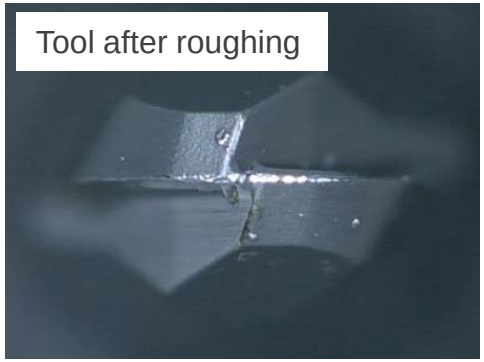
Tool : UDCBF 2010-0070 (R0.5 x 0.7)
Material : VM-40 (90HRA)
Work size : 20 x 20 x 10 mm
Coolant : Air blow

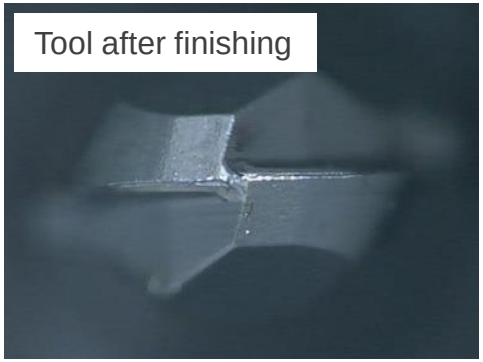
Process	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p (mm)	a_e (mm)	Cycle time (h:m)	MRV (mm^3)
Roughing	30,000	300	0.05	0.25	0:43	86.3
Finishing	30,000	300	0.028	0.02	2:17	12.0

※One End Mill for both roughing and finishing processes Total 3:00



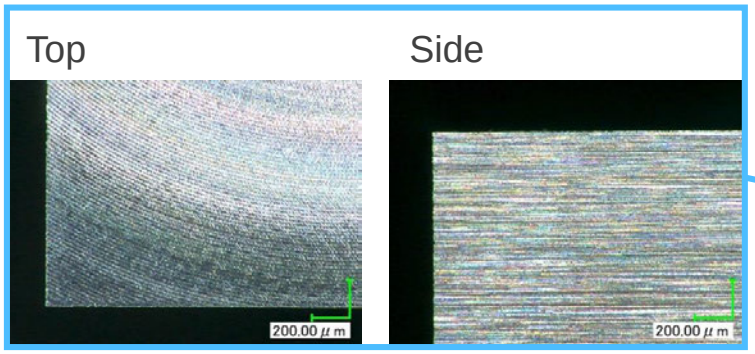


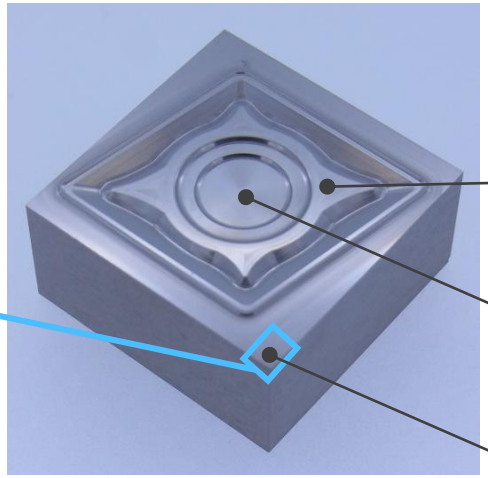




～ Work sample after finishing ～

Minimized edge chipping





″Excellent surface quality″

Ra: 0.051 μm
Rz: 0.399 μm

Ra: 0.068 μm
Rz: 0.520 μm

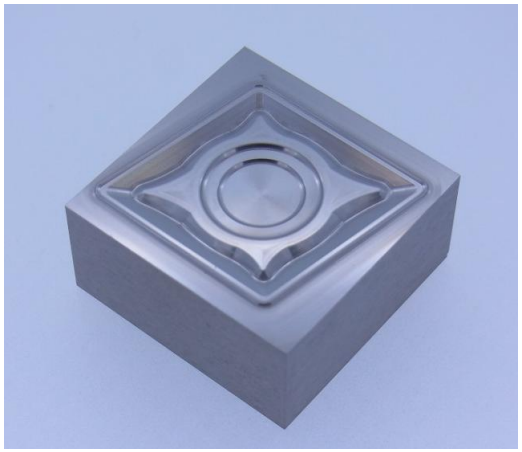
Ra: 0.054 μm
Rz: 0.408 μm

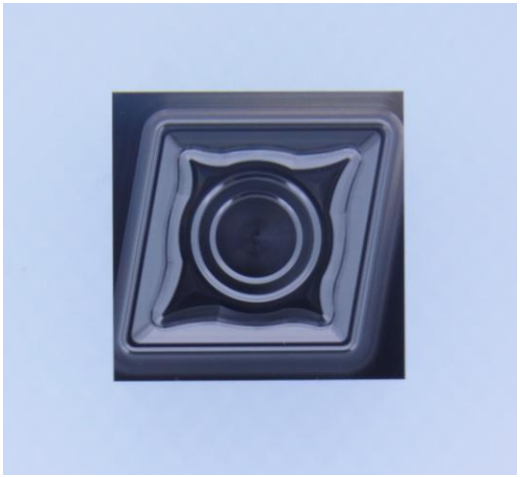
UNION TOOL CO.

UDCBF Cemented Carbide Carbide Insert

UDC ULTRA DIAMOND COAT

Tool : 2-flute high-grade ball UDCBF 2010-0070 (R0.5 x 0.7)
Work material : Cemented carbide VM-40 (90HRA)

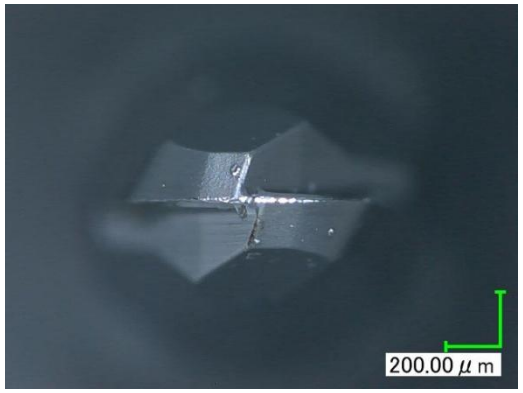




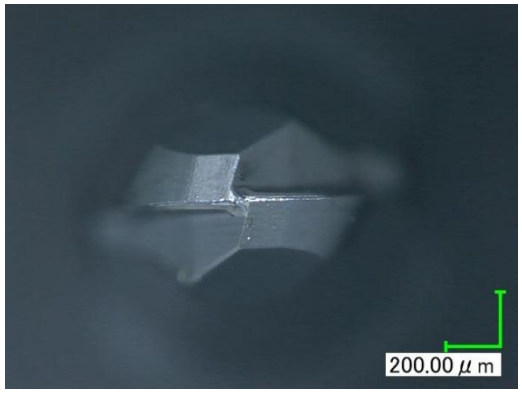
Work size: 20 x 20 x t 10 mm

Process	Roughing	Finishing	
Tool	UDCBF R0.5 x 0.7		
Spindle Speed	30,000 min^{-1}		
Feed Rate	300 mm/min		
Axial Depth	0.05 mm	0.028 mm	
Radial Depth	0.25 mm	0.02 mm	
Coolant	Air blow (Nozzle)		
MRV	86.3 mm^3	12.0 mm^3	Total: 98.3 mm^3
Cycle time	43 min	2 hr 17 min	Total: 3 hr

Used single tool for each process



Tool after roughing



Tool after finishing

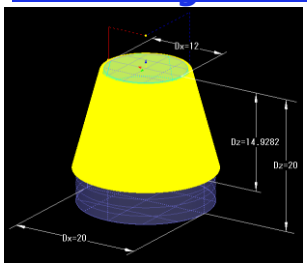
UDCBF Cemented Carbide Finished Surface Improvement

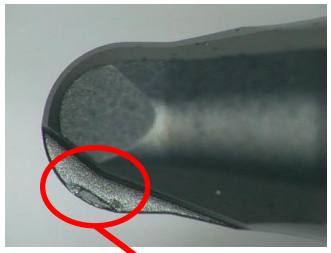
UDC ULTRA DIAMOND COAT

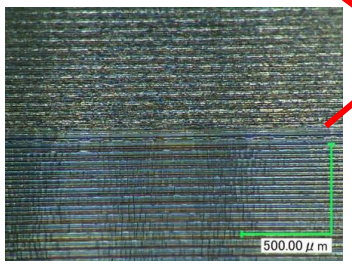
Condition

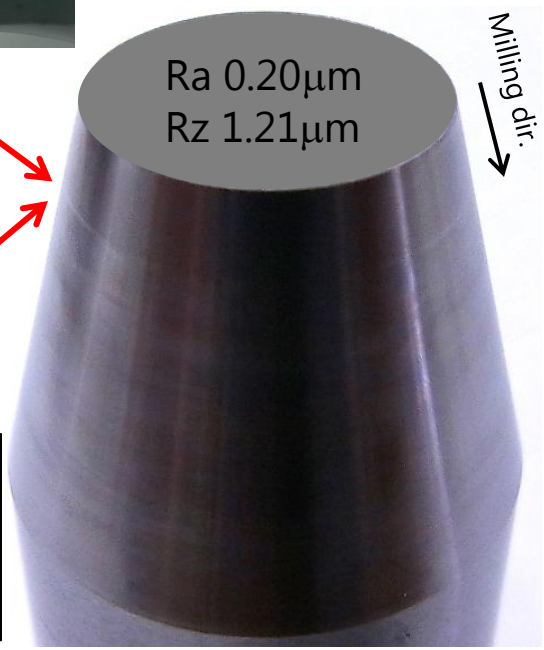
Work: Cemented carbide VF-10 (93HRA) Tool: 2-flute ball UDCB R0.5, 2-flute high-grade ball UDCBF R0.5
Coolant: Air blow (Nozzle) Overhang-length: 20mm
n=30,000min^{-1} Vf=300mm/min a_p=0.05mm a_e=0.02mm
Cycle time: 55 min 5 sec

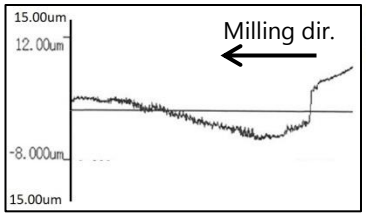
Processing model







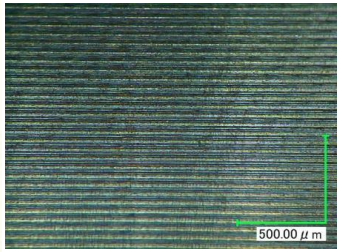


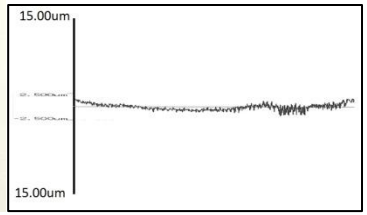


Profile precision

UDCB

UDCBF





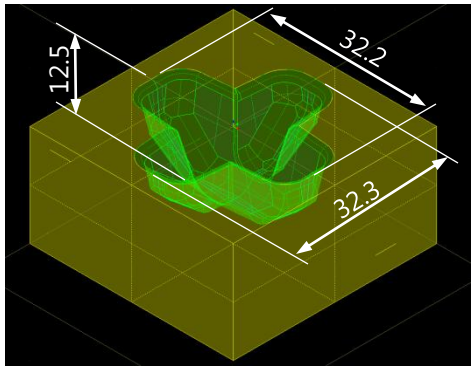
Profile precision

UNION TOOL CO.

Cemented Carbide (Low Hardness)
UDCBF Pocket Milling

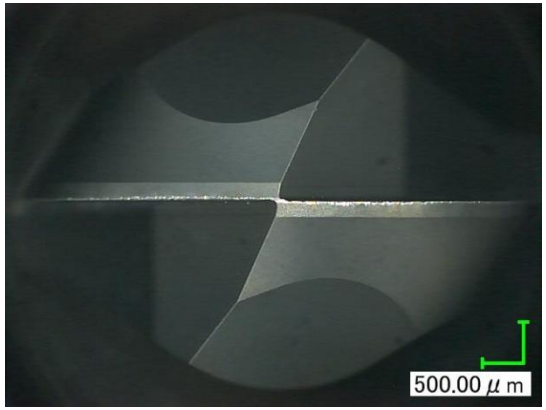
UDC ULTRA DIAMOND COAT

Tool : **2-Flute High-Grade Ball**
UDCBF 2060-0420 (R3 x 4.2)
Work material : **Cemented carbide VU-70 (83HRA)**
MRV : **3762mm³**



Work size : 40 x 20 x t40 mm
Model size : 32.3 x 32.2 (upper surface)
Depth 12.5 mm

Milling mode	Roughing
Spindle Speed min^{-1}	5,500
Feed Rate mm/min	280
Axial depth(ap) mm	0.65
Radial depth(ae) mm	0.28
Coolant	Air blow
Cycle time	50min22sec



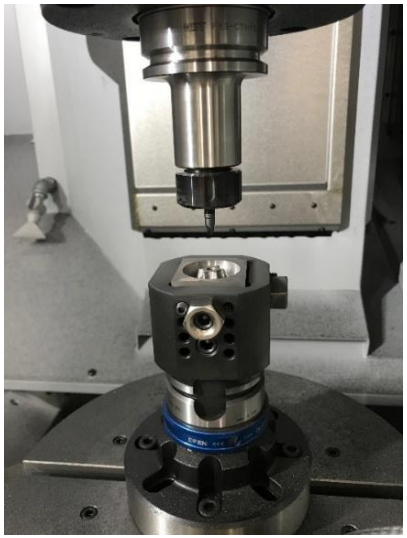
UDCBF Cemented Carbide Roughing of Large Hexalobular

UDC ULTRA DIAMOND COAT

Tool : 2-Flute High-Grade Ball
UDCBF 2060-0420 (R3 x 4.2) 2 pcs.
Work material: Cemented carbide VU-70 (83HRA)
Milling size : ϕ34 x 7 mm (4,575 mm^3)
Coolant : Air blow

Tool	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p (mm)	a_e (mm)	Cycle time
UDCBF 2060-0420	5,500	280	0.65	0.28	**About 56 min**

Work size: 40 x 40 x 20 mm



UDCBH Lens shaped milling example

Work material : VM-40 (90 HRA)
Work size : 50 x 50 x 10 mm
Pocket size : Top ϕ10 x depth 3.5 mm
MRV : 160 mm^3/Pocket
Coolant : Air blow

UDCBH is…

7.5times efficiency

Over **4** times the removal volume

Milling condition

Tool	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p (mm)	a_e (mm)
UDCBH 2020-0140 (R1 x 1.4)	12,000	6,000	0.6	3
UDCBF 2020-0140 (R1 x 1.4)	12,000	6,000	0.7	0.7

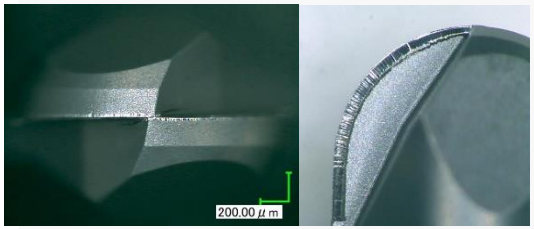
Result

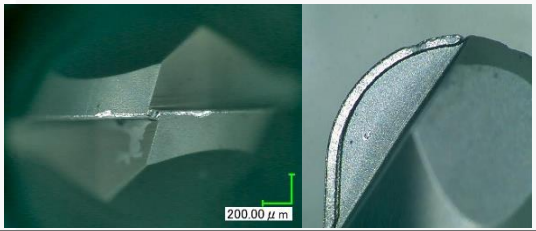
1 side 16 pockets…

1 Tool milling time **76 sec**

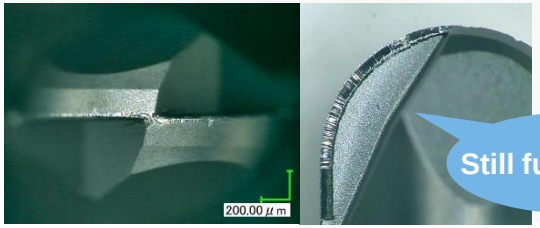
4 tool milling time 7 hr 28min

Tool after milling 4 pockets





Tool after milling 16 pockets



Still functional !

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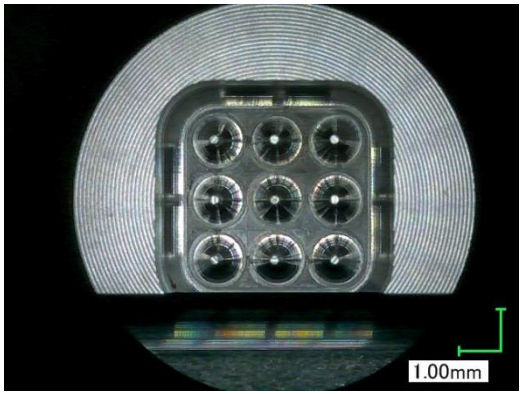
UNION TOOL CO.

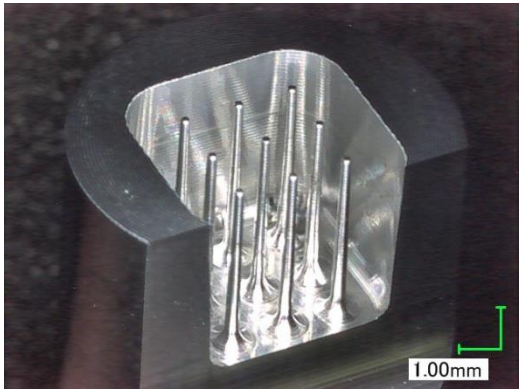
UDCLB Cemented Carbide Micro Needles

UDC ULTRA DIAMOND COAT

Model

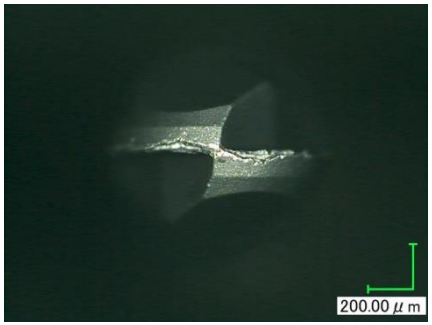
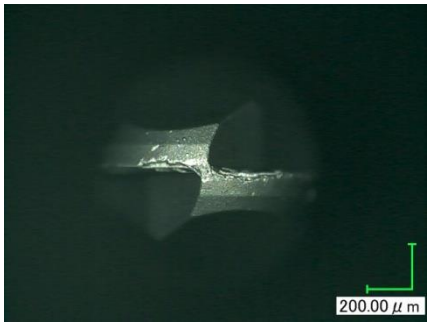
Micro needles
Size: 6 x 6 x Depth 5.0 mm





Milling Condition

Work material: Super micro grain cemented carbide VF-20 (92.5HRA)

No.	1 (To depth 2.5 mm)	2 (To depth 5.0 mm)
Tool	2-Flute Long Neck Ball UDCLB 2010-0500 (R0.5 x L5) Used 1 pc. each for No. 1 & 2, total 2 pcs.	
Spindle Speed n	30,000 min^{-1}	
Feed Rate Vf	300 mm/min	
a_p	0.1 mm	
a_e	0.05 mm	0.05 mm (Bottom surface 0.02 mm)
Milling Time	52 min	39 min
MRV	80.1 mm^3	76.5 mm^3
Coolant	Air blow	
Tool after milling		

Note: Used 1 pc. of UDCLB 2030-0800 (R1.5 x L8) to cut off and remove the wall.
Milling time: 29 min n=27,500 min^{-1} Vf=275 mm/min a_p=0.125 mm a_e=0.33 mm

UNION TOOL CO.

UDCLB Cemented Carbide Hexalobular Shape

UDC ULTRA DIAMOND COAT

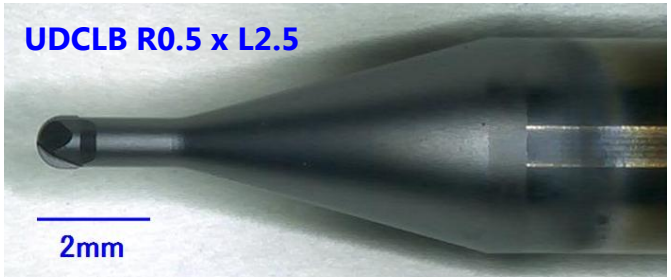
Milling Condition

No.	Process	Tool Geometry	Series / Size	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p (min)	a_e (min)	Milling Depth	Milling Time	MRV
1	Roughing	2-Flute Long Neck Ball	UDCLB R0.5 x L2.5	30,000	300	0.05	0.30	to 3.5mm	58 min	152.8 mm^3
2	Roughing	2-Flute Long Neck Ball	UDCLB R0.5 x L5			0.05	0.25	to 5.997mm	64 min	120 mm^3
3	Finishing					0.03	Finishing allowance 0.005	-	34 min	1.6 mm^3
								Total	156 min (Roughing	274.4 mm^3 2.2 mm^3/min)

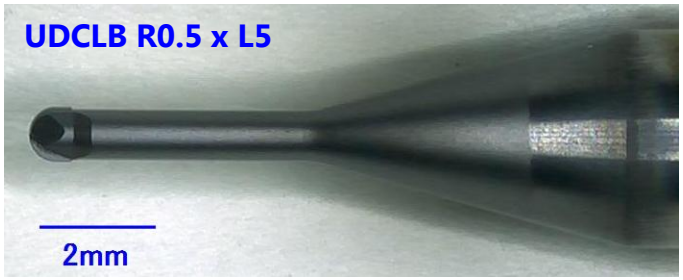
Work material : Super micro grain cemented carbide VF-20 (92.5HRA)
Coolant : Air blow

Model

Hexalobular shape
Size: ϕ9 x Depth 6 mm



•Used L2.5 mm tool for Roughing to depth 3.5mm.

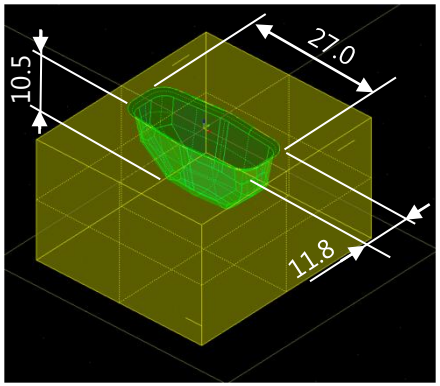


•Used L5 mm tool for Roughing & Finishing.

UNION TOOL CO.

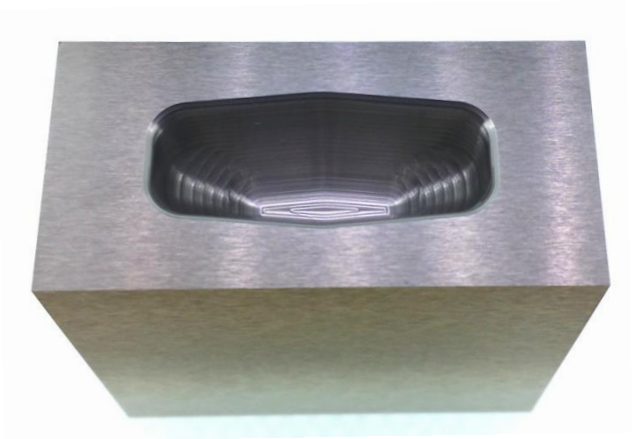
UDCLB Cemented Carbide (Low-hardness) Roughing

UDC ULTRA DIAMOND COAT



Work size: 40 x 20 x t 40 mm
Model size: 27.0 x 11.8 (Upper surface)
Depth 10.5 mm

Tool : 2-flute long neck ball
UDCLB 2050-1000 (R2.5 x L10)
Work material: Cemented carbide
VU-70 (RT55 83HRA)
MRV : 1570 mm³



MRV 1570 mm³ with 1 tool!

Process	Roughing
Spindle Speed	4,300 min^{-1}
Feed Rate	215 mm/min
Axial depth (a_p)	0.6 mm
Radial depth (a_e)	0.25 mm
Coolant	Air blow
Cycle time	25 min 16 sec

UNION TOOL CO.

UDCLB/UDCLBF
Cemented Carbide Mold

UDC
ULTRA DIAMOND COAT

Cemented carbide mold (Bevel gear)

- Work material : Cemented carbide **RT55** (83HRA, CIS Standard: VU-70)
- Milling size : ϕ44 x 12.75 mm
- Coolant : Air blow
- Machine : YASDA YBM640V Ver.III
- CAD/CAM : C&G SYSTEMS **CAM-TOOL**

Used 16 pcs
Completed in 15hr

Process	Tool Geometry	Series / Size	Spindle Speed (min^{-1})	Feed Rate (mm/min)	Axial Depth a_p(mm)	Radial Depth a_e(mm)	Stock (mm)	No. of pcs	Milling Time
Roughing 1	2-Flute Long Neck Ball	UDCLB R2xL8	8,250	300	0.5	0.2	0.03	3	2:12:31
	"	UDCLB R2xL10	8,250	300	0.5	0.2	0.03	2	0:29:24
Roughing 2	"	UDCLB R1.5xL6	11,000	280	0.38	0.15	0.03	1	0:22:33
	"	UDCLB R1.5xL10	11,000	280	0.3	0.15	0.03	1	0:23:27
Semi-finishing	"	UDCLB R1.5xL10	11,000	280	(0.005)	–	0.015	1	1:08:35
	"	UDCLB R1.5xL10	11,000	280	(0.002)	–	0.005	1	1:36:52
Corner finishing	"	UDCLB R1xL6	16,500	420	0.12	0.05	0.015	1	0:52:28
	"	UDCLB R1xL8	16,500	420	0.12	0.05	0.015	1	0:49:56
	"	UDCLB R1xL8	16,500	420	0.09	–	0.005	1	1:09:32
Finishing	2-Flute High-Grade Long Neck Ball	UDCLBF R1xL8	20,000	200	–	0.12	0	1	0:41:20
	"	UDCLBF R1xL8	20,000	200	(0.001)	–	0	2	3:39:54
	"	UDCLBF R1xL8	20,000	200	0.09	–	0	1	0:34:00
	"	UDCLBF R1xL8	20,000	200	–	0.08	0		1:04:00
							Total	**16**	**15:04:32**

Cooperation with: CAM-TOOL CAD/CAM System for Molds & Dies

UNION TOOL CO.

UDCLRS
Mirror Finishing of Cemented Carbide

UDC ULTRA DIAMOND COAT

Milling condition

Tool: 2-flute long neck radius UDCLRS ϕ2 x CR0.05 x L2
(Used 1 pc. each for roughing & finishing)
Work material: Cemented carbide VM-40 (90HRA)

Process	Roughing	Finishing
Spindle Speed (min^{-1})	20,000	20,000
Feed Rate (mm/min)	750	100
a_p (mm)	0.9	0.01 (Bottom) 0.9 (Side)
a_e (mm)	0.01	0.01
Coolant	Air blow	Oil mist

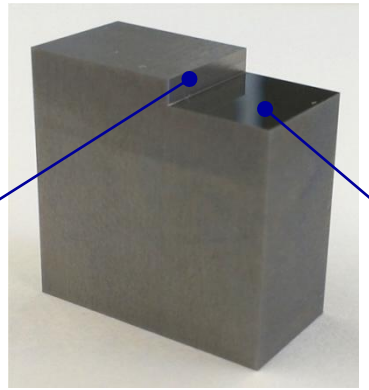
MRV: 144mm^3

Milling shape

Side milling
Size: 10 x 8 x Depth 1.8 mm

Surface roughness

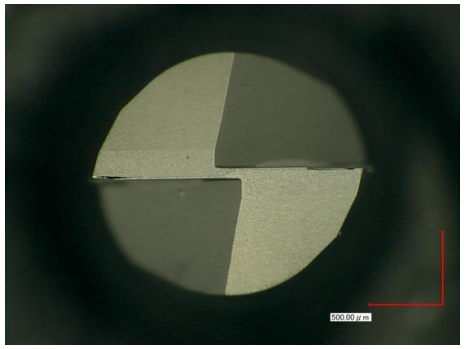
Side surface
Ra: 0.069 μm
Rz: 0.535 μm
Cutoff: 0.25 mm



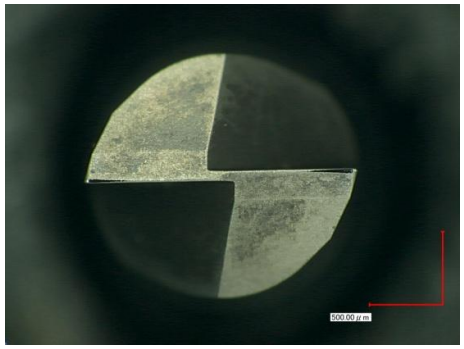
Bottom surface
Ra: 0.010 μm
Rz: 0.078 μm
Cutoff: 0.08 mm

Tool damage

After roughing



After finishing



Bottom surface appearance

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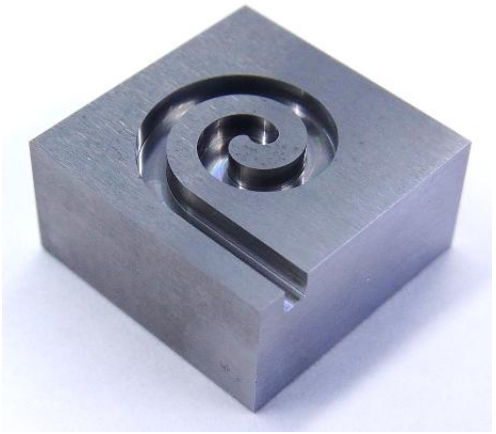
UDCLRS
Spiral Slotting on Cemented Carbide

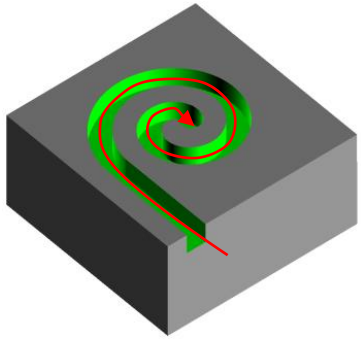
UDC ULTRA DIAMOND COAT

Milling shape

Slotting Milling depth: 2 mm
Work size: 20 x 20 x Height 10 mm



Milling path



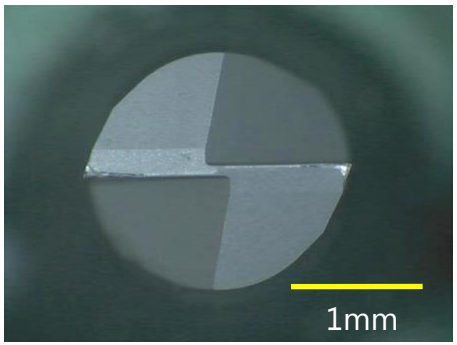
Milling condition

Tool : 2-flute long neck radius
UDCLRS ϕ2 x CR0.05 x L2
(Used 1 pc. each for roughing & finishing)
Work material : Cemented carbide VM-40 (90HRA)

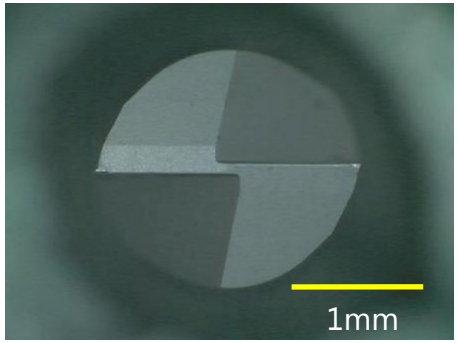
Process	Roughing	Finishing
Spindle Speed (min^{-1})	20,000	20,000
Feed Rate (mm/min)	185	185
a_p (mm)	0.02	0.01 (Bottom finishing allowance)
Coolant	Air blow	Air blow
MRV (mm^3)	196	
Cycle time (min)	33	

Tool appearance

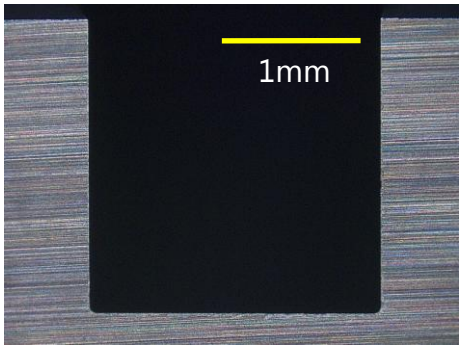
After roughing



After finishing



Entering part appearance



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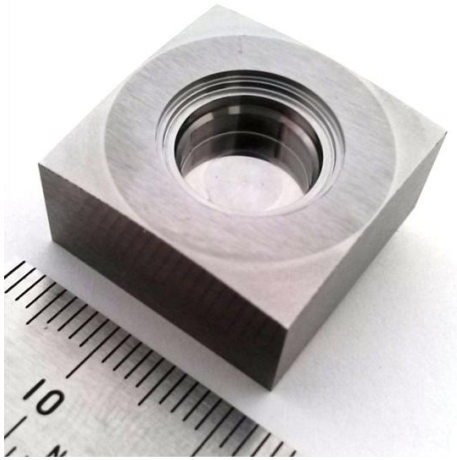
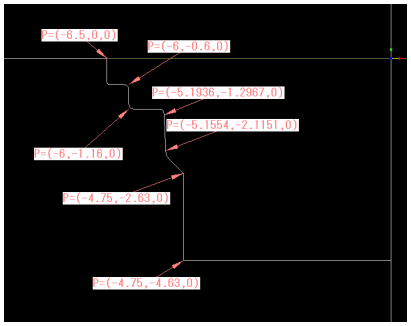
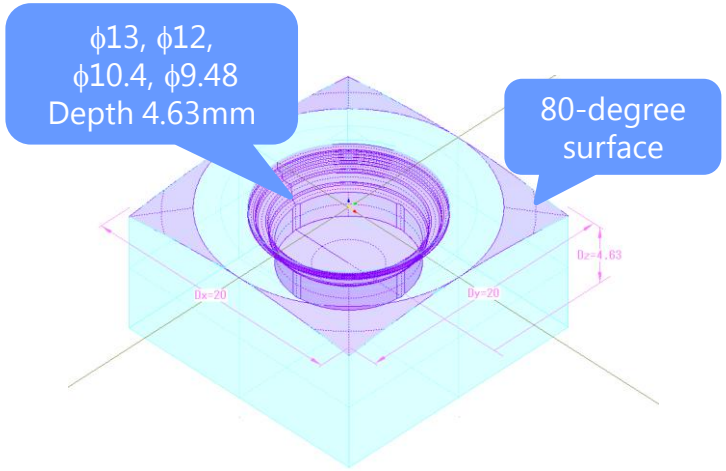
UDCLB / UDCLRS Cemented Carbide Bulb Shape Mold Part

UDC ULTRA DIAMOND COAT

Tool : 2-flute long neck ball UDCLB 2020-0600 (R1 x L6)
2-flute long neck radius UDCLRS 2020-005-020 (ϕ2 x CR0.05 x L2)
Work material: Cemented carbide VM-40 (90HRA)
Coolant : Air blow (Nozzle)







Work size: 20 x 20 x Thickness 10 mm

No.	Process	Series / Size	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p (mm)	a_e (mm)	MRV (mm^3)	Cycle time
1	Roughing	UDCLB R1 x L6	30,000	300	0.1	0.3	399.4	1:41:21
2		UDCLRS ϕ2 x CR0.05 x L2	20,000	750	0.0075	1	22.2	0:23:22
3	Finishing	UDCLB R1 x L6	30,000	300	0.045	0.05	2.5	0:39:21
4		UDCLRS ϕ2 x CR0.05 x L2	20,000	750	0.0075	0.1		0:29:27
Total		Used 4 pcs						3 hr 14 min

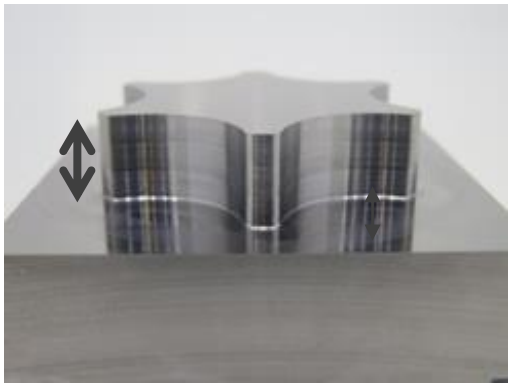
UDCRRS Punching die milling example

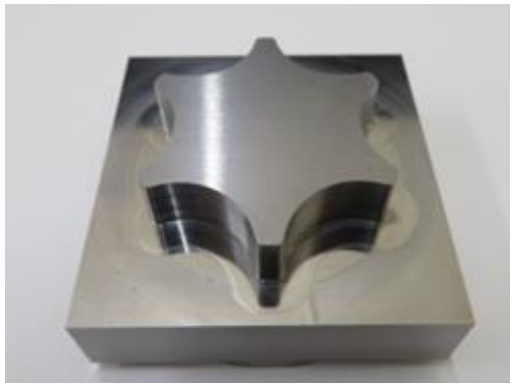
Tool : UDCRRS ϕ4 x CR0.2 x EL10
Work material : VM-40 (90HRA)
Size : 50 x 50 x 9 mm
Coolant : Air blow
Cycle time : 93 min

～ Milling condition ～

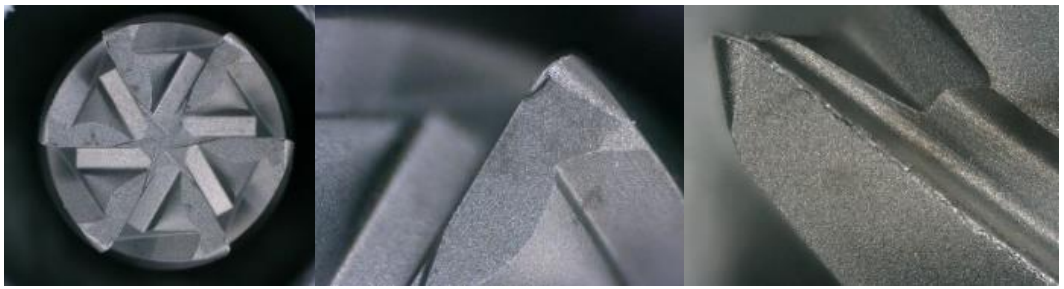
Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p (mm)	a_e (mm)
15,000	375	3	0.25

" Depth 9 mm "
Ap 3 mm × 3 times





～ Tool after milling ～



Milling volume 15,953 mm^3 with a single tool in 93 min.
Tool damage is limited and continuous cutting is possible.

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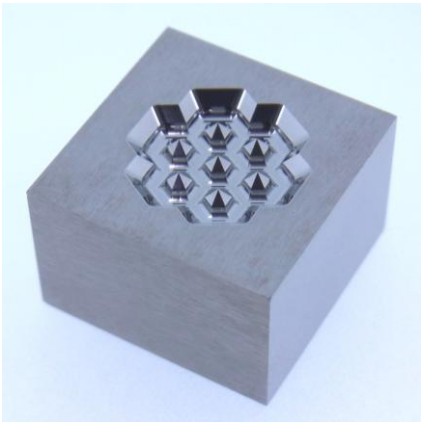
UPDLB
Finishing on Cemented Carbide

UPD Series

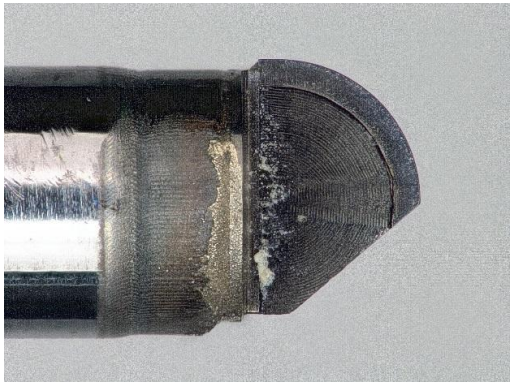
UDC ULTRA DIAMOND COAT

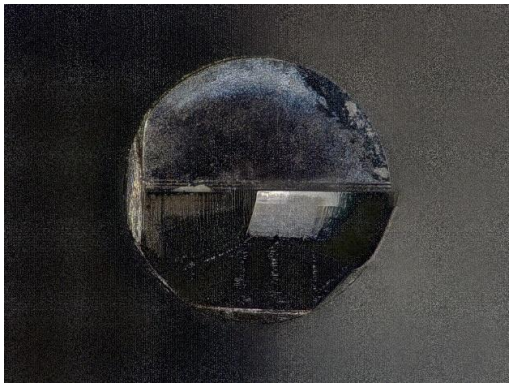
Tool for finishing : Single-flute long neck ball **UPDLB R0.5 x L2**
Model : Hexagonal pyramid shape
Work material : Cemented carbide VF-20 (92.5HRA)



Milling area: 10.2 x 10.2 x Depth 1.4 mm
(Work size: 20 x 20 x 10 mm)

Tool after finishing





Process	Tool Geometry	Series / Size	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p (mm)	a_e (mm)	Finishing Allowance (mm)	Coolant	Cycle Time
Roughing	2-flute high grade ball	UDCBF R0.5 x 0.7	30,000	300	0.05	0.25	0.005	Air blow	30 min
Semi-finishing			30,000	300	0.001 (Cusp height)	0.06321	0.005		12 min
Finishing	Single-flute long neck ball	**UPDLB R0.5 x L2**	40,000	400	0.0035	0.00495	0	Oil mist	1 hr 30 min

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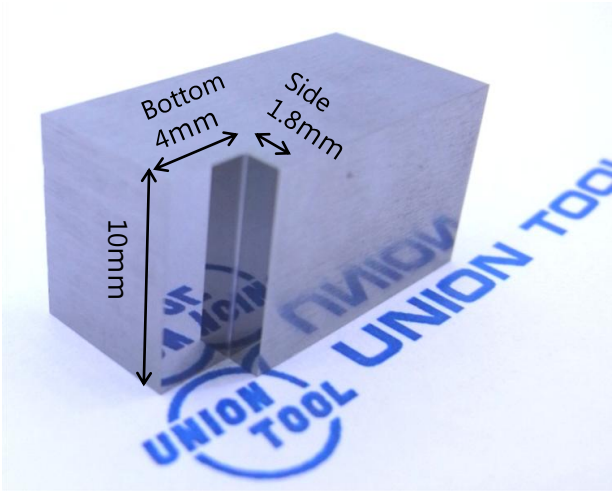
UPDLRS
Finishing on Cemented Carbide

UPD Series

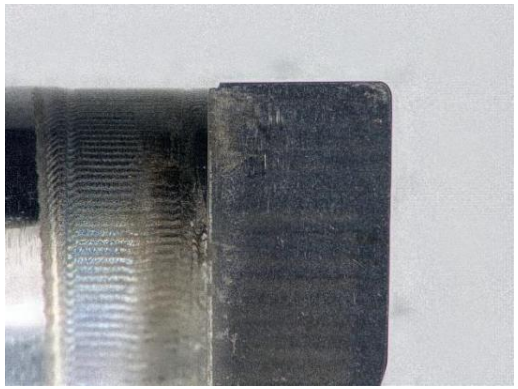
UDC ULTRA DIAMOND COAT

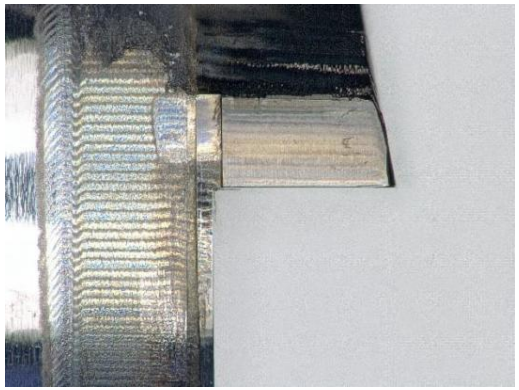
Tool for finishing : Single-flute long neck radius **UPDLRS ϕ2 x CR0.05 x L4**
Work material : Cemented carbide VF-20 (92.5HRA)



Milling area: 4 x 10 x Depth 1.8 mm
(Work size: 10 x 10 x 20 mm)

Tool after finishing





Process	Tool Geometry	Series / Size	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p (mm)	a_e (mm)	Finishing Allowance (mm)	Coolant	Cycle Time
Roughing	2-flute high grade long neck radius	UDCLRSF ϕ2 x CR0.05 x L2	20,000	400	0.9 x twice	0.01	0.005	Air blow	54 min
Finishing (bottom)	Single-flute long neck radius	UPDLRS ϕ2 x CR0.05 x L4	40,000	600	0.01	0.005	0		45 min
Finishing (side)			40,000	400	0.002	0.01	0		52 min