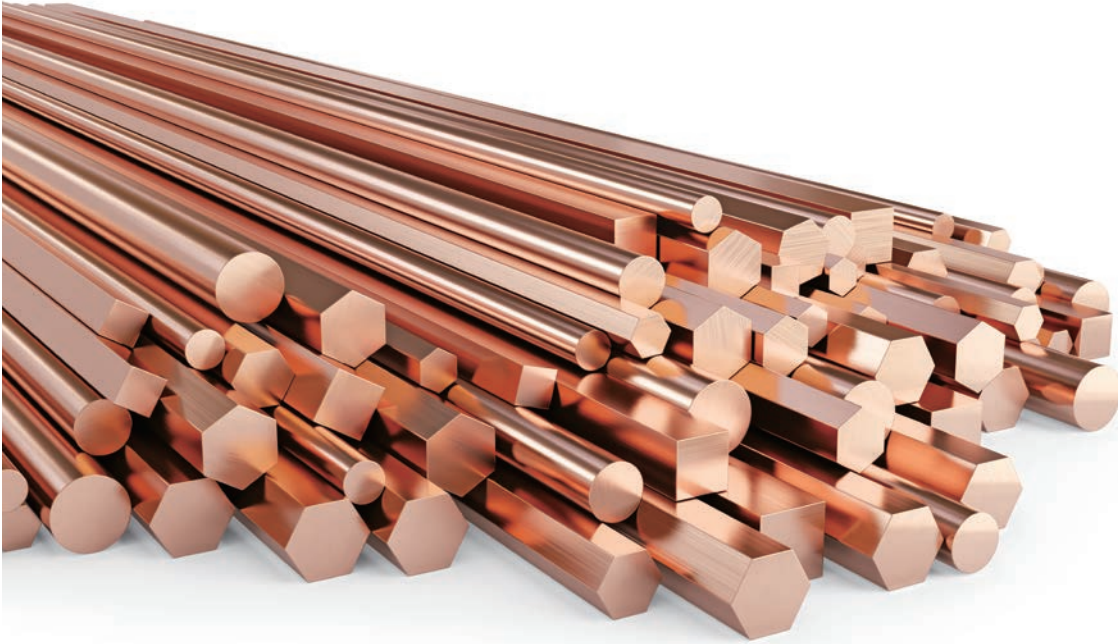
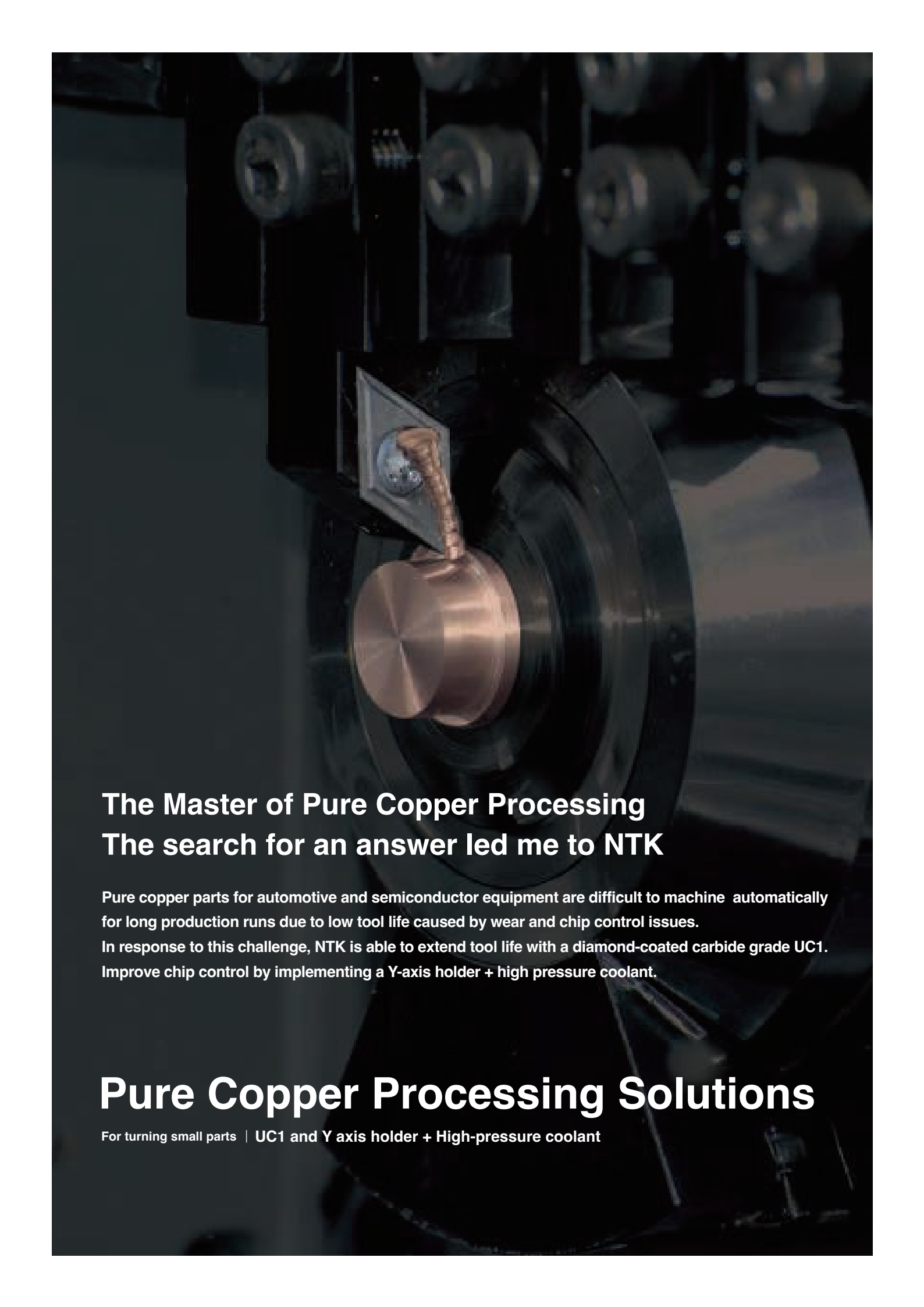


Pure Copper Processing Solutions

For turning small parts | UC1 and Y axis holder + High-pressure coolant

NTK
CUTTING TOOLS





The Master of Pure Copper Processing The search for an answer led me to NTK

Pure copper parts for automotive and semiconductor equipment are difficult to machine automatically for long production runs due to low tool life caused by wear and chip control issues.

In response to this challenge, NTK is able to extend tool life with a diamond-coated carbide grade UC1. Improve chip control by implementing a Y-axis holder + high pressure coolant.

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NTK's Work Changing Concept

Diamond-coated carbide : Longer tool life with UC1

Improved chip control with Y-axis tool holder + high-pressure coolant

Performance

- High purity, high hardness diamond coating, and excellent adhesion performance enable long-term stable machining.
- Improved chip control by applying Y-axis direction machining with high-pressure coolant.

Applications

Pure copper (C1020/C1100) machined using Sliding head automatic lathes or CNC-lathes.

(Machining Property of C1100 Tough Pitch Copper)

Diamond-coated carbide: UC1 with excellent wear resistance & welding resistance is recommended because tooling tends to wear and the machined surface deteriorates due to welding, resulting in short tool life.

A good machined surface can be obtained by applying the appropriate cutting condition (low cutting depth/low feed) which reduces the chip thickness.

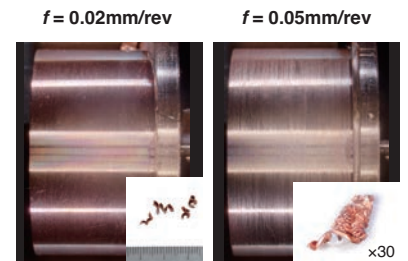
Case Study

Battery connector : C1100 ϕ 10 - 20		
	NTK	Competitor
Tool	UC1 DCMT11T302 FNAM3	PVD super coat DCGT11T302 molded chipbreaker
Speed (m/min)	55 - 110	
Feed (mm/rev)	0.03	
DOC (mm)	0.2	
Coolant	WET	
Tool life	1000 pcs.	50 pcs.

Electrode part : C1100 ϕ 12		
	NTK	Competitor
Tool	UC1 DCMT11T301 FNAM3	PVD super coat DCGT11T301 molded chipbreaker
Speed (m/min)	80	
Feed (mm/rev)	0.05	
DOC (mm)	1.0	
Coolant	WET	
Tool life	2000 pcs.	100 pcs.

Machined Surface Comparison

Part material : C1100 $v_c = 80\text{m/min}$ $a_p = 1.0\text{mm}$ WET
Tool : DCMT11T302FNAM3 UC1



If the cutting conditions cause the chips to become thick (high cutting depth or high feed) then the machined surface will deteriorate due to chip clogging.

Cutting conditions

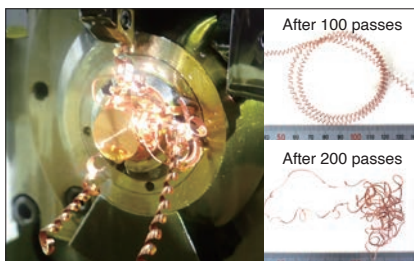
Grade	Material	Operation	Machining	Speed (m/min)	Feed (mm/rev)	DOC (mm)	WET
UC1	Tough pitch copper C1100	Turning	Rough - Finish	50 - 150	0.02 - 0.05	0.2 - 2.0	●

Using the cutting conditions shown, chips can be segmented and controlled with AM3 chipbreaker.
When machining at large depths of cut and high feed rate, select CL or ZP chipbreakers to suppress chip clogging.

(Machining Properties of C1020 Oxygen-free Copper)

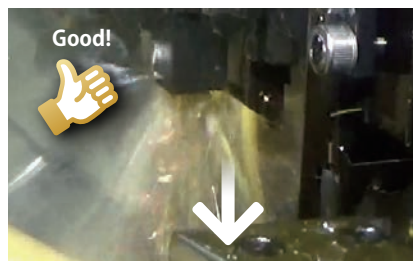
Stable chip generation may be difficult with a chip breaker alone, it is recommended to add a Y-axis holder + high pressure coolant

Example of Chip Issues



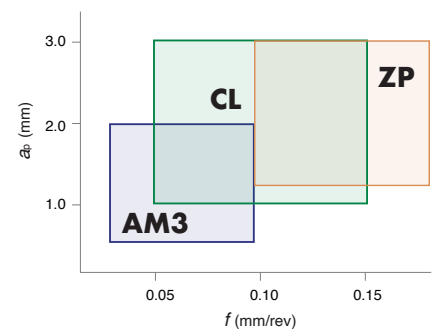
Even if good chip control is obtained at initial stage of machining, sudden chip entanglement can occur leading to tool wear.

Y-axis holder + high-pressure coolant



Chip tangling can be suppressed by Y-axis machining with high-pressure coolant.

Chip breaker machining range

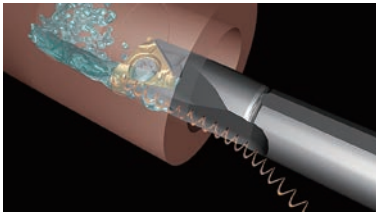


Cutting Conditions

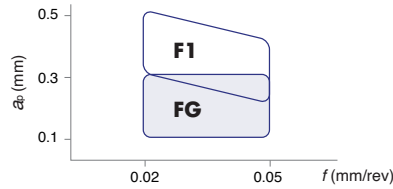
Grade	Material	Operation	Machining	Speed (m/min)	Feed (mm/rev)	DOC (mm)	WET
UC1 TM4	Oxygen-free copper C1020	Turning	Rough - Finish	50 - 150	0.02 - 0.20	0.5 - 3.0	●

Refer to content above to select cutting conditions and chip breaker to obtain good chip control.
If you want longer tool life than PVD Carbide: TM4, use Diamond-Coated Carbide: UC1.

(**Boring**) Improve chip control by using FG/F1 chip breakers to evacuate chips backwards and high-pressure coolant



FG / F1 chipbreaker chip control range



Example of FG chip breaker chips

Part material : C1020
 $V_c = 80\text{m/min}$
 $f = 0.02\text{mm/rev}$
 $a_p = 0.2\text{mm}$
 Internal coolant



Cutting Conditions

Grade	Material	Operation	Machining	Speed (m/min)	Feed (mm/rev)	DOC (mm)	WET
UC1 TM4	C1100 C1020	Turning	Finish	50 - 150	0.02 - 0.05	0.1 - 0.5	●

If you want longer tool life than PVD Carbide: TM4, use Diamond-Coated Carbide: UC1.

ISO insert lineup

*For details, please refer to the NTK General Catalog or Swiss Tooling Catalog.

Shape	EDP	ISO Item Number	Corner R	Grade		Dimensions (mm)	
				UC1	TM4	IC	Thickness
AM3 2 corners available	5970728	DCMT 11T301FN AM3	0.1	●		9.525	3.97
	5970736	DCMT 11T302FN AM3	0.2	●			
	5970744	DCMT 11T304FN AM3	0.4	●			
F1* 3 corners available	5970702	TPMH 110302FR F1	0.2	●		6.35	3.18
	5970710	TPMH 110304FR F1	0.4	●			
ZP 6 corners available	5970686	TNMG 160402FN ZP	0.2	●		9.525	4.76
	5967351	TNMG 160404FN ZP	0.4	●			
	5970694	TNGG 160408FN ZP	0.8	●			
ZP 4 corners available	5970660	CNMG 120404FN ZP	0.4	●		12.7	4.76
	5970678	CNMG 120408FN ZP	0.8	●			
AM3	5694633	DCGT 11T301MFN AM3	0.1		●	9.525	3.97
	5694641	DCGT 11T302MFN AM3	0.2		●		
	5693783	DCGT 11T304MFN AM3	0.4		●		
CL*2	5757091	DCGT 11T301M CL	0.1		●	9.525	3.97
	5758040	DCGT 11T302M CL	0.2		●		
	5765730	DCGT 11T304M CL	0.4		●		
FG* R-hand shown	5790100	TPGH 090202R FG	0.2		●	5.56	2.38
	5790092	TPGH 090204R FG	0.4		●		
	5790142	TPGH 110302R FG	0.2		●	6.35	3.18
	5790134	TPGH 110304R FG	0.4		●		
ZP	5731146	TNGG 160402FN ZP	0.2		●	9.525	4.76
	5731211	TNGG 160404FN ZP	0.4		●		

* The R symbol (01M,02M,04M,08M) can be used for machining where the R indication of the workpiece part is less than or equal to R0.1,R0.2,R0.4,R0.8.

* Right-hand inserts with FG and F1 chip breakers should be used with right-hand holders

*2 The CL breaker differs slightly from the above dimensions due to product specifications, but there is no problem with machining.



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