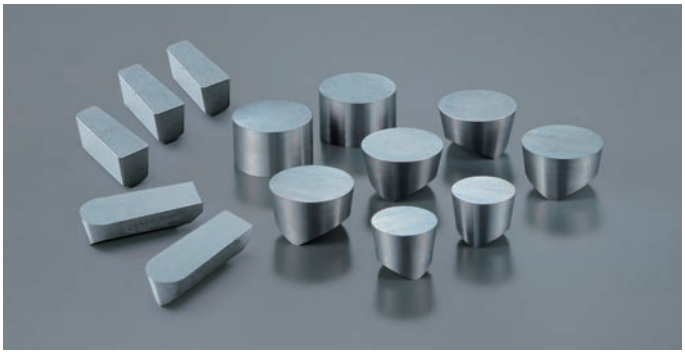
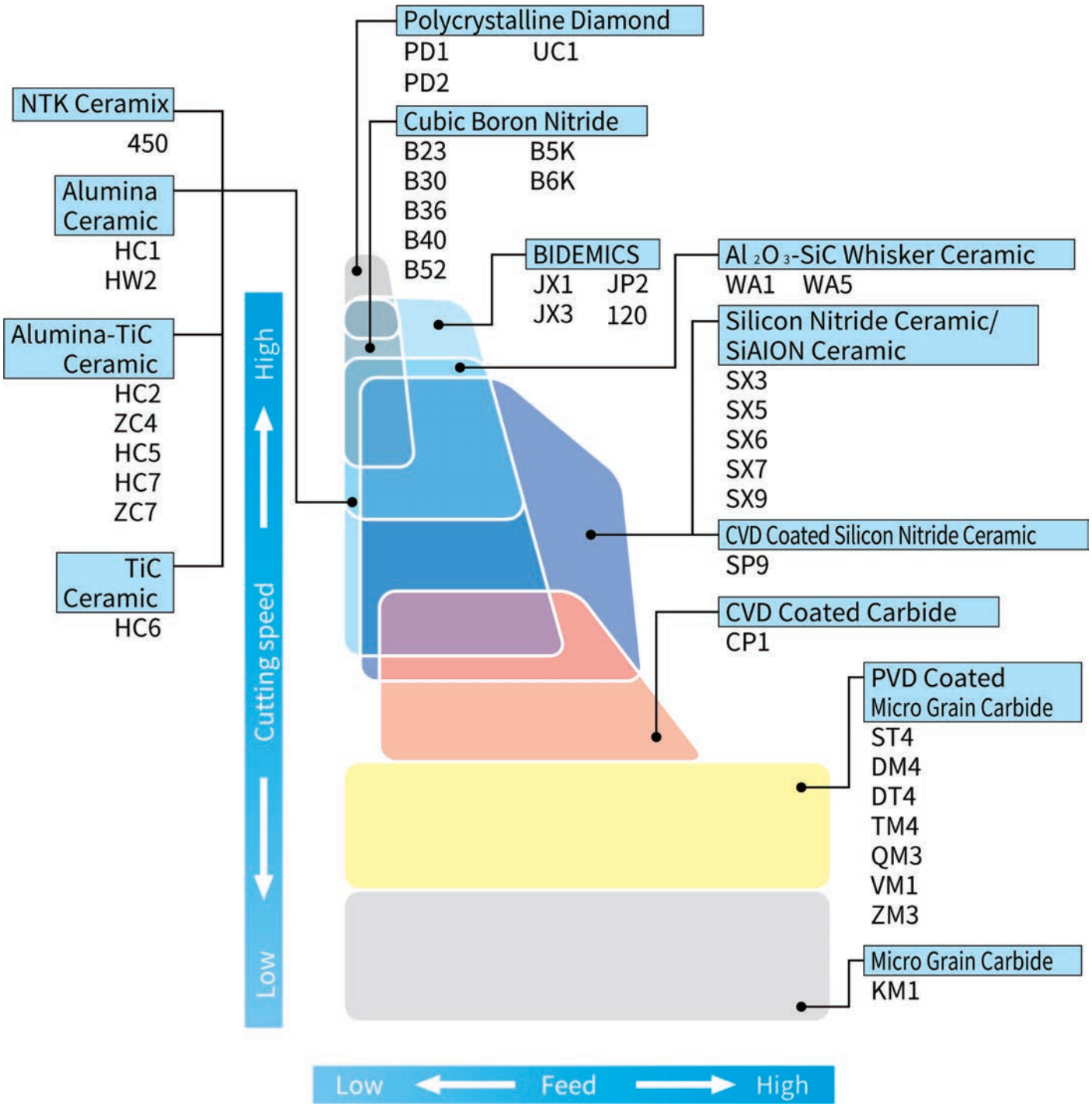


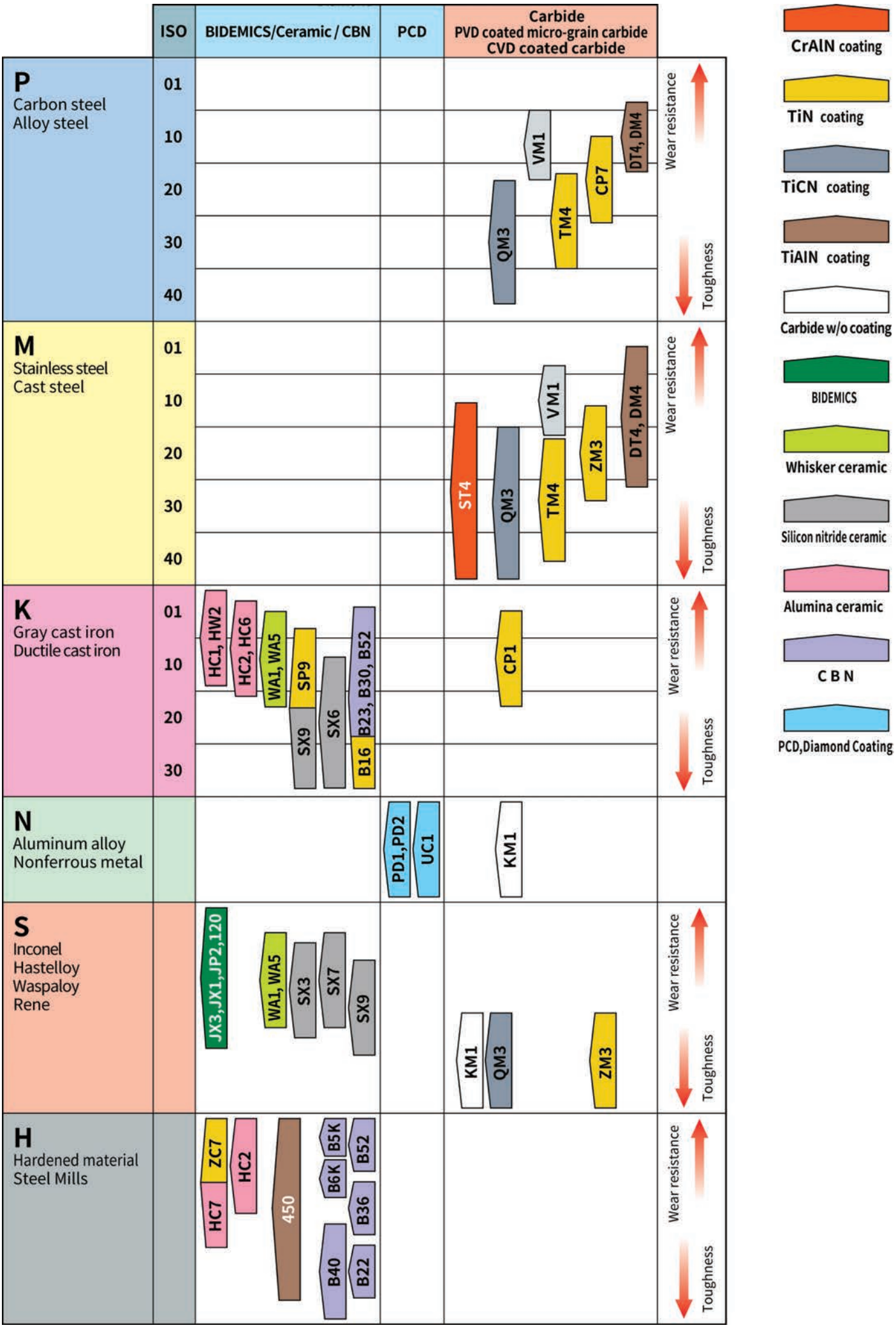
Tool Materials/Selection Guide

Insert Grade Map C02
Application area C03
Recommended Cutting Conditions C04
ISO Insert Code C06
BIDEMICS C10
Ceramics / NTK CeramiX C14
CBN C30
PCD / Diamond Coating C38
Carbides C42
Chipbreakers C54

Application Range of NTK Insert Grades



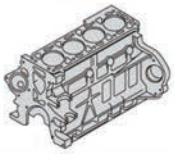
Insert grade recommendation by work material type



Recommended Cutting Conditions

BIDEMICS, Ceramics, CBN, NTK CeramiX

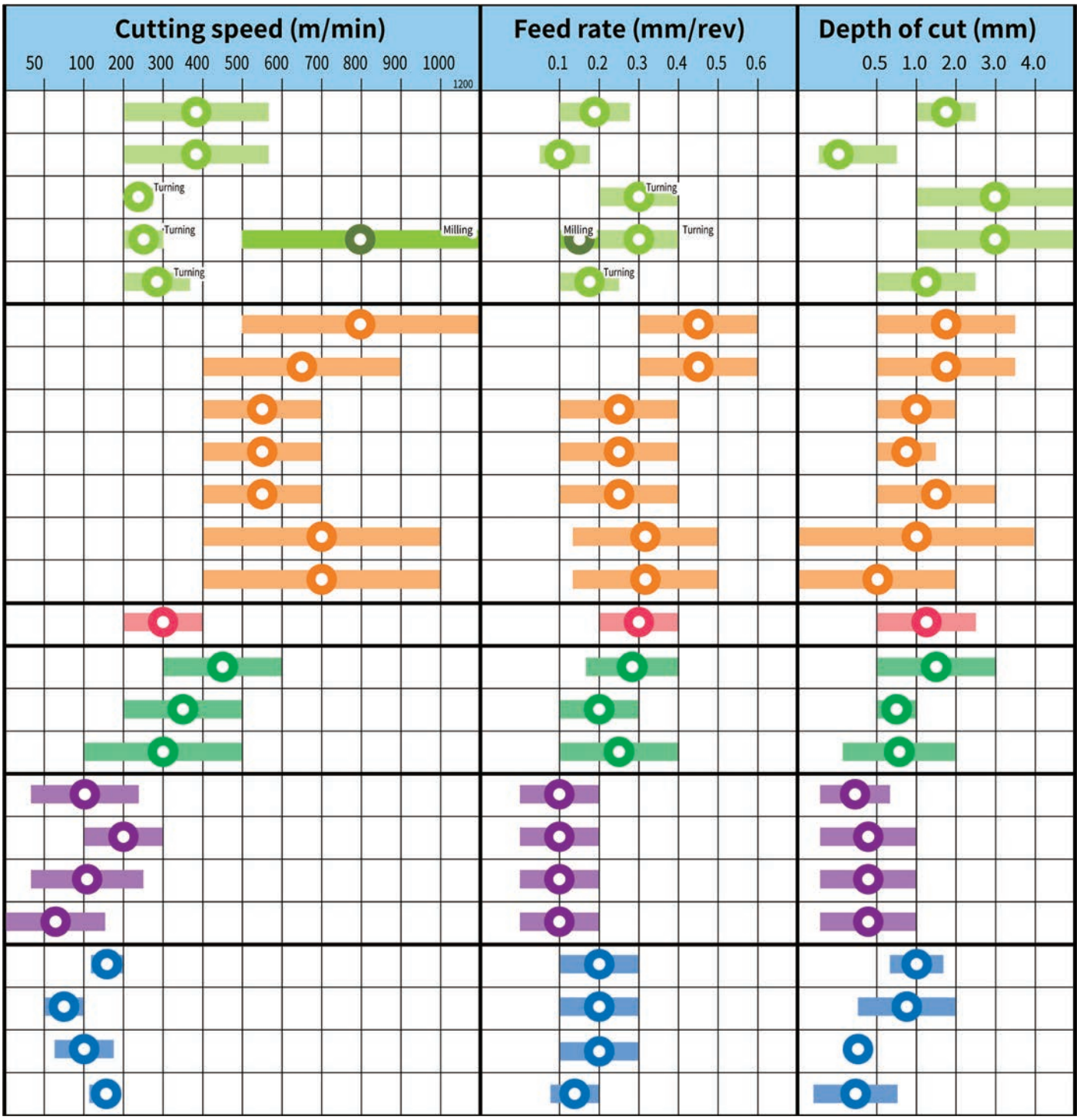
●First Choice ○Second Choice

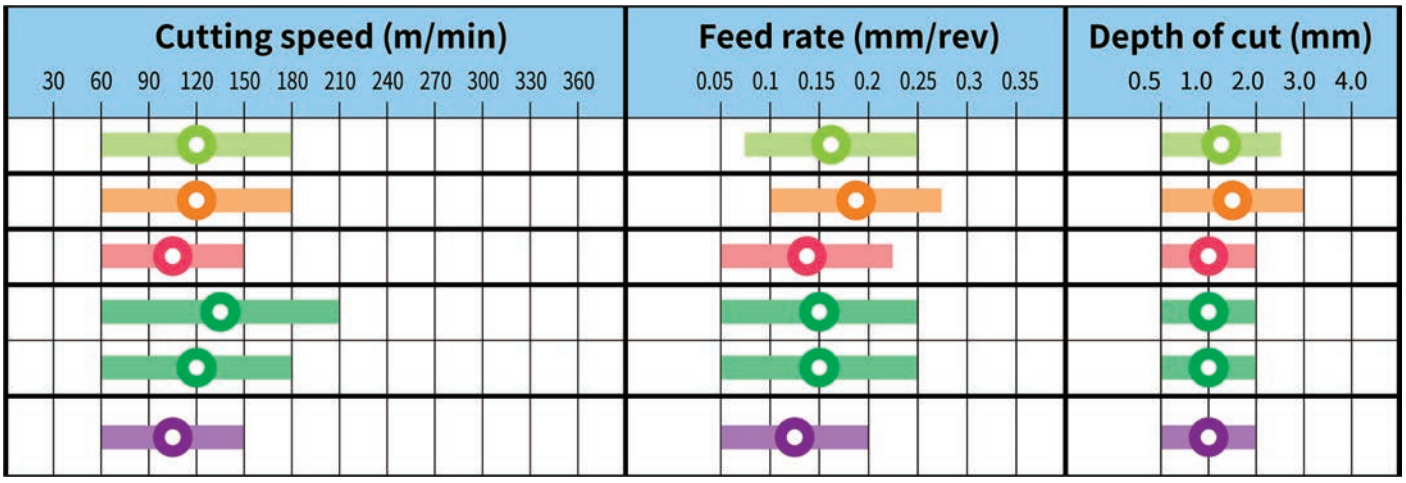
Work material	Tool Grade		Application: Roughing	Application: Semi-finishing	Application: Finishing	Continuous	Light interruption	Interruption	Coolant: Dry	Coolant: Wet
Heat-resistant alloy  * Based on Using 12.7mm IC Insert except JP2	BIDEMICS	JX1/ JX3		●	●	●				●
	BIDEMICS	JP2/120		●	●	●				●
	Ceramic	SX5	●				●	●		● (Turning)
	Ceramic	SX3 / SX7 / SX9	●	●			●	●	● (Milling)	● (Turning)
	Ceramic	WA1/WA5	●	●		●			○	●
Gray cast iron  	Ceramic	SX6	●	●			●	●	●	●
	Ceramic	SP9	●	●	●		●	●	●	○
	Ceramic	HC1 / HW 2			●	●			●	
	Ceramic	HC2 / HC6			●	●			●	●
	Ceramic	WA1			●		●	●	●	●
	CBN	B23 /B30		●	●		●	●	●	●
	CBN	B16	●					●	○	●
Chilled Liners 	Ceramic	HW2	●	●	●	●			●	
Ductile cast iron 	Ceramic	SP9	●	●			●	●	○	●
	Ceramic	HC6			●	●			○	●
	CBN	B52			●	●			○	●
Hardened material 	Ceramic	450/HC4/ZC7			●	●			●	●
	CBN	B5K / B52	●	●	●	●			○	●
	CBN	B6K / B36	●	●			●	●	●	●
	CBN	B40	●				●	●	●	○
Rolls  Steel, Cast iron Ductile iron	Ceramic	HC5 / HC7	●	●			●	●	●	
Carbide	Ceramic	WA1	●	●			●	●	●	
	CBN	B30		●	●		●	●	●	
* Based on Using 12.7mm IC Insert CPM	Ceramic	HC5 / ZC4 / HC7	●	●			●	●	●	

Carbide

●First Choice ○Second Choice

Work material		Tool Grade		Application: Roughing	Application: Semi-finishing	Continuous	Light interruption	Interruption	Coolant: Dry	Coolant: Wet
400 series Stainless	Hardness (HB) 160-350	Carbide	QM3/DM4/DT4/ST4	●	●		●			●
300 series Stainless	Hardness (HB) 200-350	Carbide	QM3/DM4/DT4/ST4	●	●		●			●
Precipitation Hardness (17-4PH etc)	Hardness (HB) 175-350	Carbide	QM3/DM4/DT4	●	●		●			●
Carbon Steels Alloy Steels	Hardness (HB) 130-300	Carbide	QM3/DM4/DT4	●	●		●			●
	300-400	Carbide	QM3/DM4/DT4	●	●		●			●
Tool Steels	Hardness (HRC) -45 Turning	Carbide	QM3/DM4/DT4	●	●		●			●

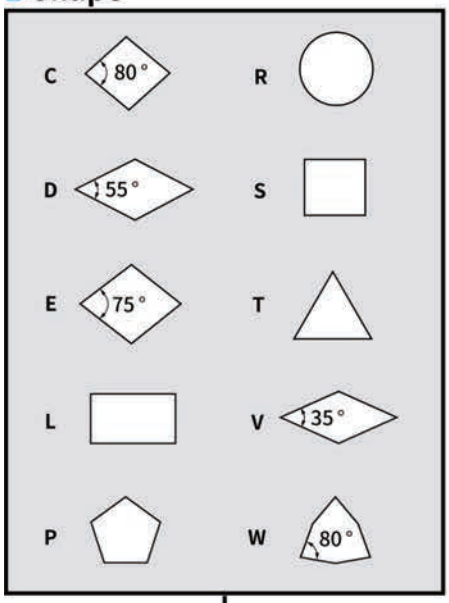

Cutting speed (m/min)
50 100 200 300 400 500 600 700 800 900 1000 1200
Turning
Turning
Milling
Turning
Feed rate (mm/rev)
0.1 0.2 0.3 0.4 0.5 0.6
Turning
Milling
Turning
Turning
Depth of cut (mm)
0.5 1.0 2.0 3.0 4.0


Cutting speed (m/min)
30 60 90 120 150 180 210 240 270 300 330 360
Feed rate (mm/rev)
0.05 0.1 0.15 0.2 0.25 0.3 0.35
Depth of cut (mm)
0.5 1.0 2.0 3.0 4.0

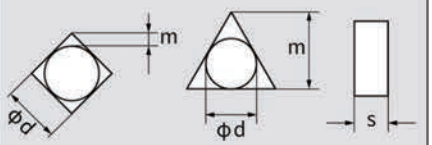
ISO insert code

BIDEMICS / Ceramics

1 Shape



3 Tolerance Class



Symbol	d (mm)	m (mm)	s (mm)
A	±0.025	±0.005	±0.025
F	±0.013	±0.005	±0.025
C	±0.025	±0.013	±0.025
H	±0.013	±0.013	±0.025
E	±0.025	±0.025	±0.025
G	±0.025	±0.025	±0.013
J	±0.05	±0.05	±0.013
K	±0.05 ~±0.13	±0.013	±0.025
L	±0.05 ~±0.13	±0.025	±0.025
M	±0.05 ~±0.13	±0.08 ~±0.08	±0.013
N	±0.05 ~±0.13	±0.08 ~±0.08	±0.025
U	±0.08 ~±0.25	±0.13 ~±.015	±0.013

Accuracy of J,K,L,M,N,U class by form size
For inserts with apex angles greater than 55°

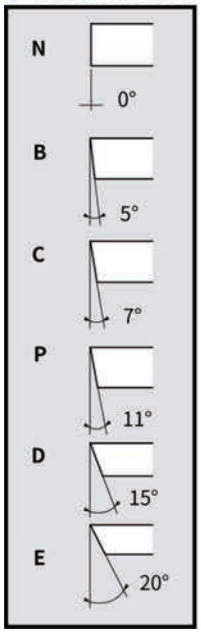
Inscribed Circle	d (mm)	m (mm)
6.35	±0.05	±0.08
9.525	±0.05	±0.08
12.7	±0.08	±0.13
15.875	±0.05	±0.15
19.05	±0.05	±0.15
25.4	±0.13	±0.08

For Class M inserts with apex angles of 55° (D), 35° (V), and 25° (Y)

Inscribed Circle	d (mm)	m (mm)
6.35	±0.05	±0.05
9.525	±0.05	±0.05
12.7	±0.08	±0.15
15.875	±0.05	±0.15
19.05	±0.05	±0.08

	1	2	3	4
Inch	S	N	G	A
Metric	S	N	G	A

2 Clearances



4 Type

Type	Symbol	Type	Symbol
	N (E)	70°–90°	H
	F		
	R	70°–90°	B
	A		
	G	40°–60°	T
	M	40°–60°	W
Special design	X		

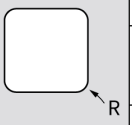
6 Thickness

Thickness S (mm)	Inch	Metric
2.38	1.5	02
3.18	2	03
3.97	2.5	T3
4.76	3	04
5.56	4	06
6.35	5	07
7.94	6	09
12.7	8	12

5 Symbol for Insert Size

Inch		Metric						
Inscribed Circle		C	D	R	S	T	V	W
5.56	2	06	07	06		11	11	04
7.94	3	09	11	09		16	16	06
12.1	4	12	15	12		22	22	08
15.875	5	16	19	15		27	27	10
19.05	6	19	23	19		33	33	13
25.4	8	25	31	25		44	44	17

7 Corner Radius

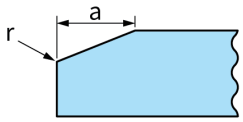
Corner Radius	Inch	Metric
	0.4	1	04
	0.8	2	08
	1.2	3	12
	1.6	4	16
	2.0	5	20
	2.4	6	24
	3.2	8	32

4	3	3	T	04	20
5	6	7	8	9	10
12	04	12	T	010	20

8 Edge Condition

Sharp	F
Honed	E
Chamfered	T
Chamfered and Honed	Z
	S
	U
Double Chamfered	K
Double Chamfered and Honed	J
	P
	Q

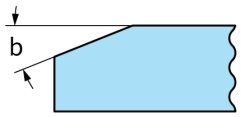
9 Negative Land Width



	Description		a (metric)	r (metric)
	inch	metric		
E	01	002	–	0.03
	02	004	–	0.05
T	02	005	0.05	–
	03	008	0.08	–
	04	010	0.10	–
	05	012	0.13	–
	06	015	0.15	–
	08	020	0.2	0.03
Z	04	010	0.10	0.03
	08	020	0.2	0.05
S	04	010	0.10	0.05
	08	020	0.2	0.08
U	16	040	0.4	–
K	28	070	0.7	–
J	60	150	1.5	0.03
P	71	180	1.8	0.05
Q	95	240	2.4	0.08

Note: K, J, P & Q show its primary land width

10 Negative Land Angle

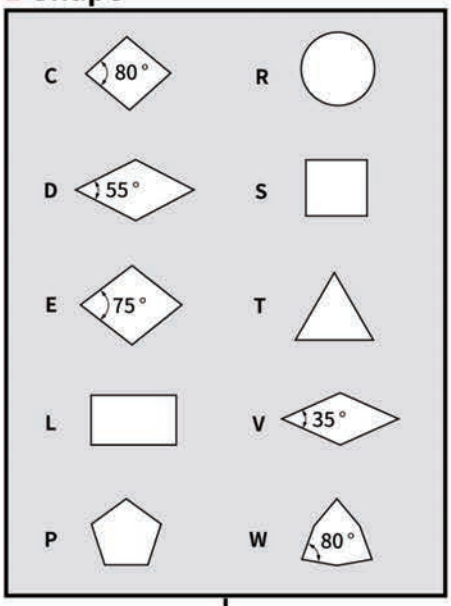


Description	b
10	10°
15	15°
20	20°
25	25°
30	30°

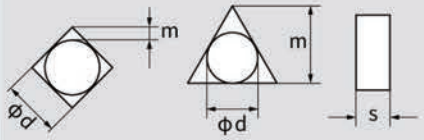
ISO insert code

Carbide

1 Shape



3 Tolerance Class



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A	±0.025	±0.005	±0.025
F	±0.013	±0.005	±0.025
C	±0.025	±0.013	±0.025
H	±0.013	±0.013	±0.025
E	±0.025	±0.025	±0.025
G	±0.025	±0.025	±0.013
J	±0.05	±0.05	±0.013
K	±0.05 ~±0.13	±0.013	±0.025
L	±0.05 ~±0.13	±0.025	±0.025
M	±0.05 ~±0.13	±0.08 ~±0.08	±0.013
N	±0.05 ~±0.13	±0.08 ~±0.08	±0.025
U	±0.08 ~±0.25	±0.13 ~±.015	±0.013

Accuracy of J,K,L,M,N,U class by form size
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For Class M inserts with apex angles of 55° (D), 35° (V), and 25° (Y)

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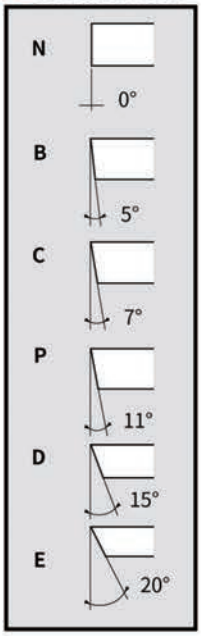
12.7	±0.08	±0.15
15.875	±0.05	±0.15
19.05	±0.05	±0.08

	1	2	3	4
Inch	C	C	G	T
Metric	C	C	G	T

2 Clearances



4 Type

Type	Symbol	Type	Symbol
	N (E)	70°–90°	H
	F		
	R	70°–90°	B
	A		
	G	40°–60°	T
	M	40°–60°	W
Special design	X		

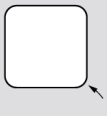
6 Thickness

Thickness S (mm)	Inch	Metric
2.38	1.5	02
3.18	2	03
3.97	2.5	T3
4.76	3	04
5.56	4	06
6.35	5	07
7.94	6	09
12.7	8	12

5 Cutting Edge Length

Inch		Metric						
Inscribed Circle		C	D	R S	T	V	W	
5.56	2	06	07	06	11	11	04	
7.94	3	09	11	09	16	16	06	
12.7	4	12	15	12	22	22	08	
15.875	5	16	19	15	27	27	10	
19.05	6	19	23	19	33	33	13	
25.4	8	25	31	25	44	44	17	

7 Nose Radius

Corner Radius	Inch	Metric
	0.03	01	00
	0.08	04M	01M
	0.1	04	01
	0.18	08M	02M
	0.2	08	02
	0.38	1M	04M
	0.4	1	04
	0.8	2	08

3	2.5	08M	F	N	AM3
5	6	7	8	9	10
09	T3	02M	F	N	AM3

8 Edge Sharpness

F	Up-sharp edge (without any edge preparation)
(Blank)	Non up-sharp edge

9 Hand of Chipbreaker

N	Neutral*
R	Right-hand
L	Left-hand

* Omitted when edge is not "up-sharp"

10 Type of Chipbreaker

11 Wiper insert

"-WP" after chipbreaker

BIDEMICS

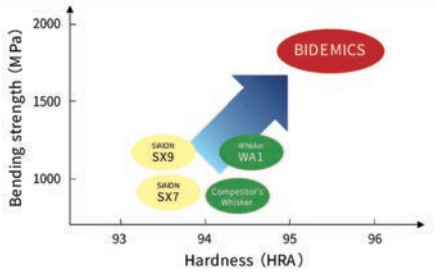
Heat-resistant alloys, which are mainly used in the aircraft industry, have low thermal conductivity, high temperature strength, high work hardening, and high adhesion to tool materials, making them extremely difficult to cut, and improving production efficiency has been a key issue.
BIDEMICS is a new category of material that combines various materials to achieve high strength and high hardness. It enables highly efficient machining that exceeds the performance of conventional carbide and ceramics.

Insert grade, applications, and features

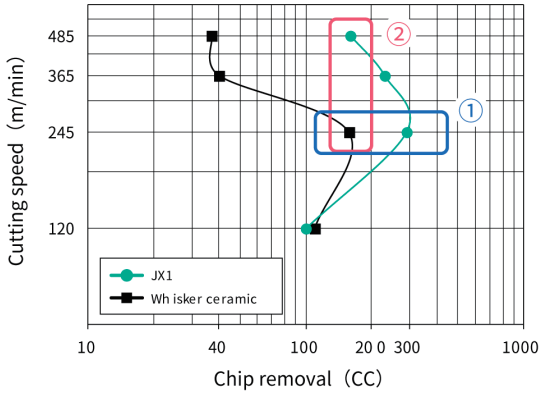
Work material	Grade	Application
S Heat resistant alloy	JX1	Semi-finishing/rough machining of heat-resistant alloys (non scale) Cutting speed up to Vc=500m/min. Longer life and better machined surface compared to ceramic grades
	JX3	Semi-finishing/rough machining of heat-resistant alloys (non scale) Cutting speed up to Vc=480m/min. Longer life and better machined surface compared to ceramic grades
	120	Finish machining of heat-resistant alloys Cutting speed up to Vc=500m/min. Longer life and better machined surface compared to carbide tools
	JP2	Finish machining of heat-resistant alloys Cutting speed up to Vc=480m/min. Longer life and better machined surface compared to carbide tools

Physical properties

Grade	Hardness HRA	Bending Strength MPa	Thermal Conductivity W/m・K
JX1	95.5	1,800	40
WA1	94.5	1.200	35



Machining productivity comparison between JX1 and Whisker Ceramics



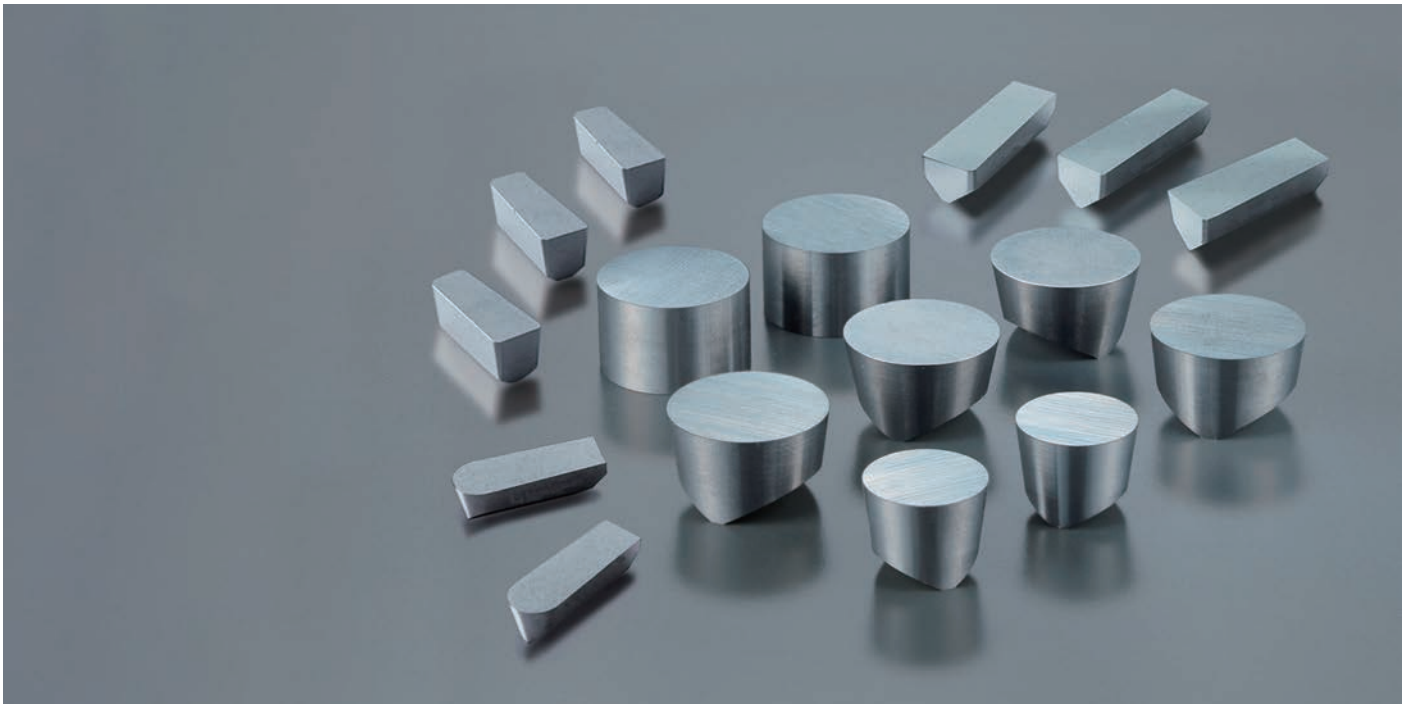
①Longer tool life
JX1/JX3's combination of High Hardness,Superior Thermal Conductivity and Improved Strength compared to Whisker ceramics results in significantly longer tool life when applied at typical Whisker ceramic speeds, feeds, and depth of cut.

②Higher Speeds, More Productivity
JX1/JX3's superior physical properties compared to Whisker ceramic enable you to increase speeds; potentially as much as 2X Whisker ceramic speeds; increasing productivity and potentially offsetting the need for additional equipment to meet increasing demands.

Chips break easily at higher cutting speeds vs the typically continuous chips of HRSA materials. The result is more efficient chip removal.

Recommended Cutting Conditions

Grade	Work material	Application	Process	Cutting speed (m/min)	Feed (mm/rev)	Depth of cut (mm)	Coolant
JX1	heat-resistant alloys	turning	roughing	180-**480**	0.15-0.30	1.0-2.5	WET
JX3			roughing	180-**480**	0.10-0.25	0.5-2.0	WET
120	heat-resistant alloys	turning	finishing	180-**500**	0.05-0.20	0.1-0.7	WET
JP2			finishing	180-**520**	0.10-0.25	0.25-1.0	WET



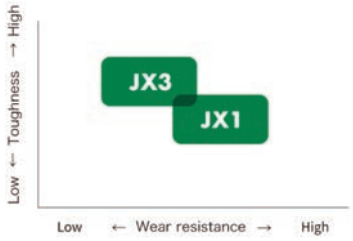
Heat-resistant alloys for rough to semi-finishing | BIDEMICS

JX1 / JX3

Ultra-high speed machining of heat-resistant alloys at Vc = 480 m/min
Longer life & higher quality machined surface compared to whisker ceramics
Applicable to new materials for aircraft parts

Performance

Significantly longer life than whisker ceramics
Twice" the cutting speed is possible. Good machined surfaces are achieved.
Suitable for machining heat-resistant alloys made of powder alloys

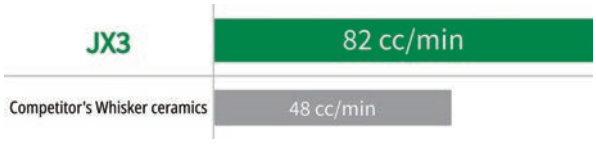


Application

Heat-resistant alloys
Turning / Grooving / Profiling
Rough to semi-finishing with non-scale

Case study Turbine disk

Work material	Inconel 718
Cutting speed	Competitor: 200 m/min NTK: 350 m/min
Feed	0.15 mm/rev
Depth of cut	1.5 mm
Coolant	WET



Heat-resistant alloys for finishing | BIDEMICS

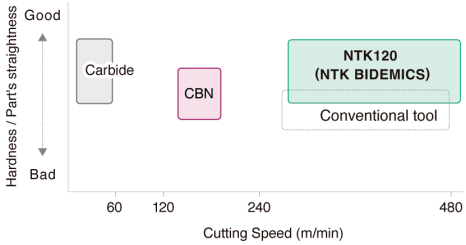
JP2 / 120

For high-speed finishing

Ultra-high-speed finishing of heat-resistant alloy machining.
15 times faster than carbide and 3 times faster than CBN.

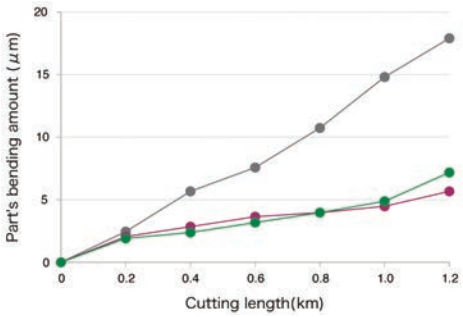
Performance

Improves the wear-resistant performance of BIDEMICS and good for part's straightness performance of workpiece in finishing operations. Finish machining of heat-resistant alloys at a cutting speed of 500 m/min is achieved.



Part's Straightness Performance

[cutting conditions] material: Inconel 718
vc=320m/min (carbide vc=50m/min)
f=0.2mm/rev ap=0.1mm WET

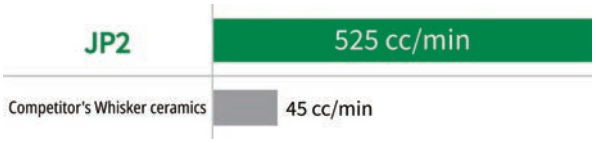


Application

Heat resistant alloys
Finishing

Case study Turbine disk (finishing)

Work material	Inconel 718
Cutting speed	Competitor: 20 m/min NTK: 240 m/min
Feed	0.08 mm/rev
Depth of cut	0.25 mm
Coolant	WET



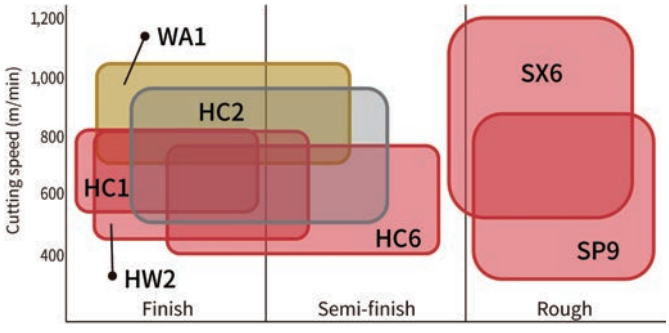
Ceramics / NTK CeramiX

NTK ceramic inserts provide highly efficient machining with excellent high-temperature hardness, heat resistance, and chemical stability.
NTK offers various types and geometries of silicon nitride, alumina, and whisker ceramic inserts to meet the needs of each application and support highly efficient machining and high-speed cutting.

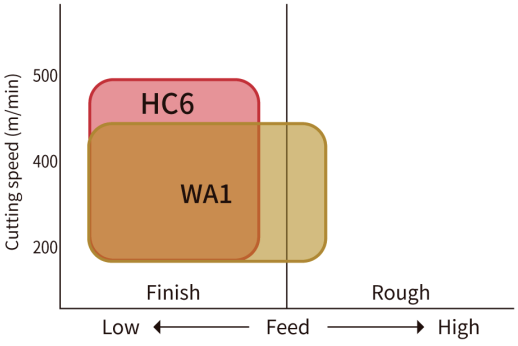
Insert grade, applications, and features

Work material	Grade	Structure	Color	Application	Hardness HRA	Toughness Mpa	Thermal conductivity W/m.K
K Cast iron	HC1	Al_2O_3	White	Semi-finishing of gray cast iron Pipe bead cutting	94	700	17
	HW2	Al_2O_3	Pink	Semi-finishing of gray cast iron / liners Reinforced toughness	94	750	19
	HC6	TiC+Al_2O_3	Black	Semi-finishing of ductile cast iron Semi-finishing of gray cast iron with coolant	94	800	29
	SX6	Si_3N_4	Gray	Turning/milling of gray cast iron Reinforced VB wear resistance	93.5	1,200	29
	SP9	SiAlON	Yellow	Turning of heat-resistant alloy Roughing of gray cast iron High-precision machining by low-resistance edge treatment + CVD coating	93.5	1,200	15
H Hardened material	450	TiAlN coating	Black	Continuous finishing of hardened material (HRC 55-65)	95.5	1200	31
	HC2/HC5	Al_2O_3+TiC	Black	Semi-finishing of hardened materials and gray cast iron	94.5	800	21
	HC4/ZC4	Al_2O_3+TiC	Black / Gold	Finishing of hardened materials (e.g. removal of carburized layers)	95.5	1,000	25
	HC7/ZC7	Al_2O_3+TiC	Black / Gold	Finishing of hardened materials (e.g. removal of carburized layers)	95	1,100	23
S Heat resistant alloy	SX3	SiAlON	Gray	Roughing with scale to Semi-finishing of heat-resistant alloys Excellent balance between wear and chipping resistance	93	1,100	12
	SX5	SiAlON	Gray	Rough turning of heat-resistant alloy (Waspaloy)	92.5	1100	18
	SX7	SiAlON	Gray	Turning/Milling of Heat-Resistant Alloys Good wear resistance	93	900	11
	SX9	SiAlON	Gray	Rough turning/milling of heat-resistant alloys and gray cast iron Excellent chipping resistance	93.5	1,200	15
	WA1	Al_2O_3+SiC	Light green	Turning of heat-resistant alloys/gray cast iron Excellent chipping resistance	94.5	1,200	35
	WA5	Al_2O_3+SiC	Light green	Turning heat-resistant alloys/gray cast iron Excellent wear resistance	94.5	1,200	35

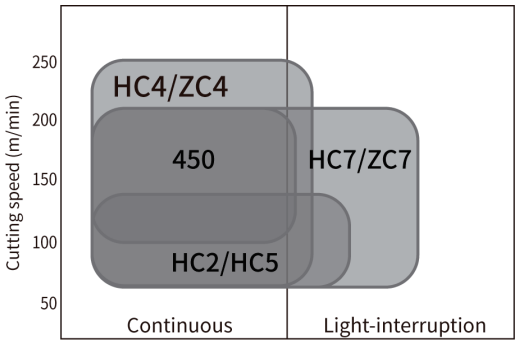
For gray cast iron



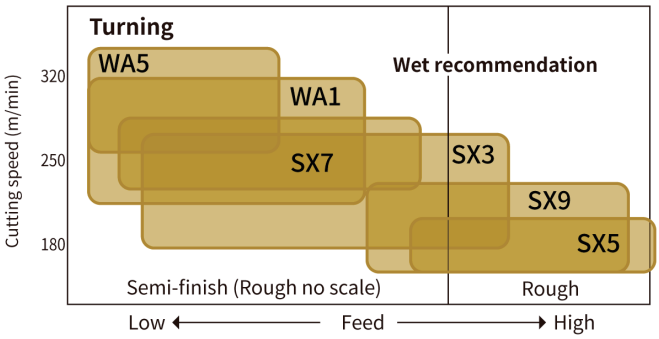
For ductile cast iron

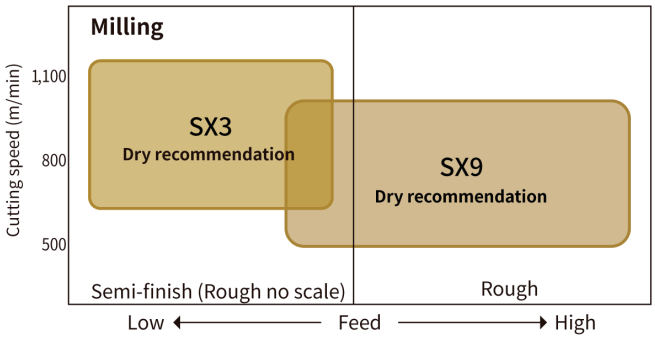


For hardened materials



For heat-resistant alloys





For continuous machining of hardened materials | NTK CeramiX

NTK450

NTK CeramiX, a new material that maximizes the performance of ceramics, is born
Establishing an intermediate position between CBN and ceramics
Higher economic efficiency enables insert cost reduction

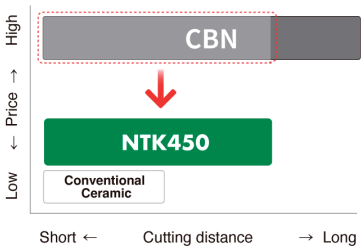
Performance

- Higher wear resistance performance with newly developed coating and dense, homogenized base material structure
- Ideal for small-lot production or single-part production when balancing tooling cost and performance

Application

Hardened materials
Continuous machining HRC55-65

Insert cost and cutting distance

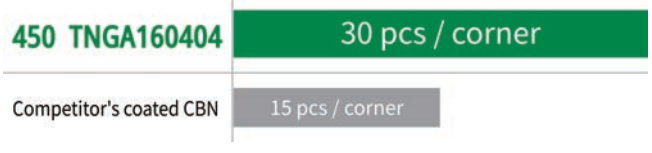


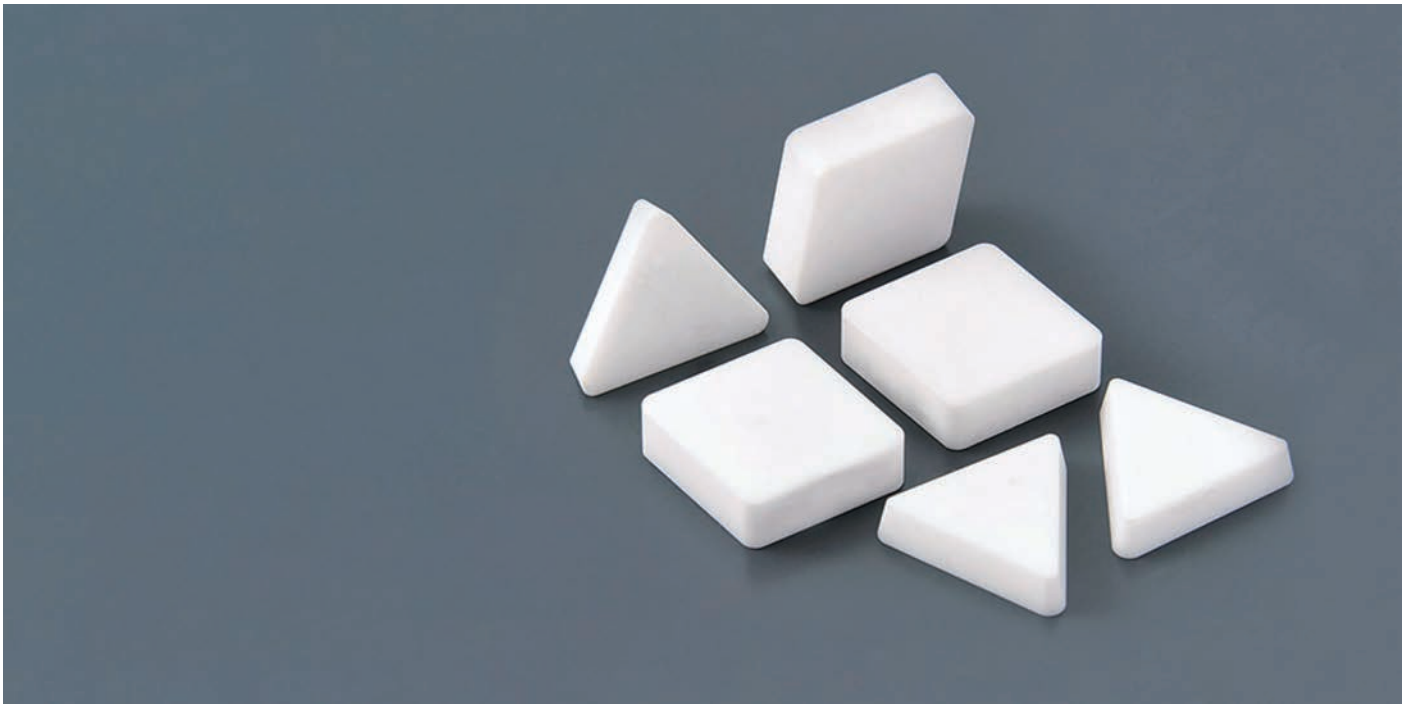
Case study Industrial robot parts machining

NTK CeramiX "450" achieves twice the machining capability of competitor CBN.
In addition, annual tooling costs have been reduced by approximately 70%.

Work material	SCM415 (HRC 58-62)
Cutting speed	200 m/min
Feed	0.05 mm/rev
Depth of cut	0.1mm
Coolant	WET

Machining dia. : φ60





Gray cast iron continuous finishing | Alumina ceramics

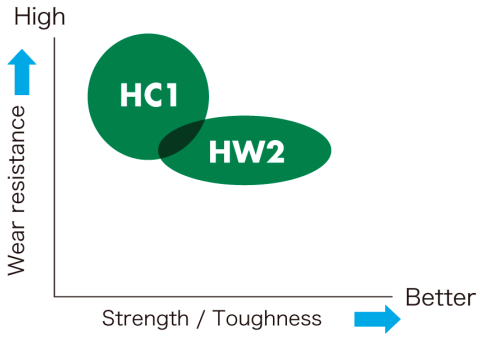
HC1

First recommended grade for finishing ordinary gray cast iron

High-speed machining at Vc = ~700 m/min

Performance

- Dedicated grade for high-speed finishing
- Excellent wear resistance performance
- Highly heat resistant due to high-purity alumina components, ideal for high-speed and high-temperature machining



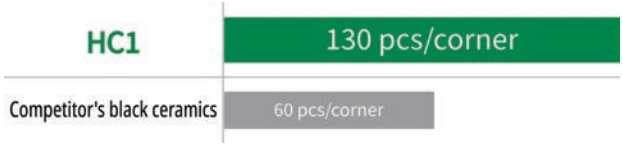
Application

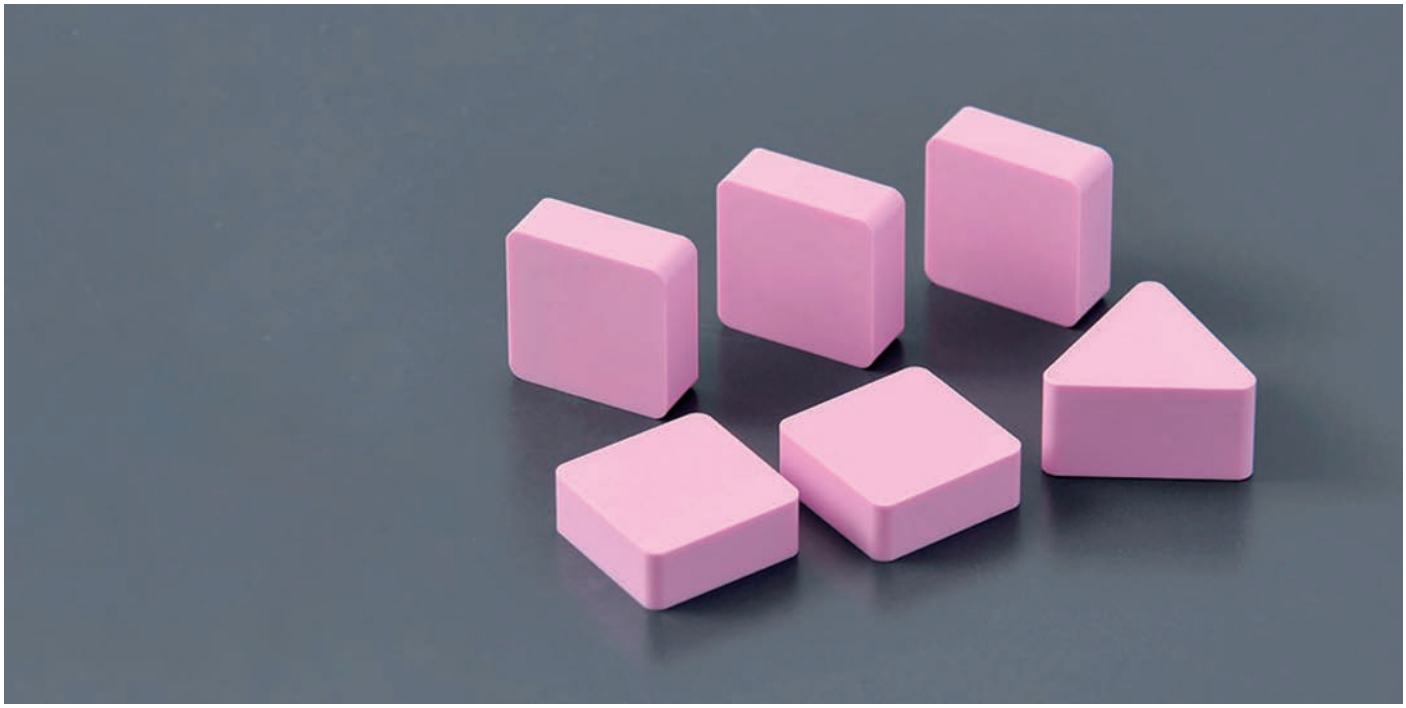
Gray cast iron turning
Finishing

Case study disc brake

HC1 has twice the amount of tool life compared to other competitors' black ceramics.

Work material	FC250
Cutting speed	630 m/min
Feed	0.3 mm/rev
Depth of cut	0.5 mm
Coolant	DRY





Gray cast iron continuous finishing | Alumina ceramics

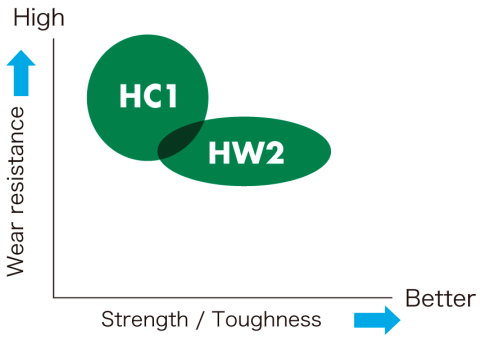
HW2

Stable high-speed finish machining is achieved by alumina particles with excellent high-temperature hardness and strength.

High-speed machining at Vc = ~700 m/min

Performance

- High-speed finishing material
- High-strength and high-toughness grade using high-purity alumina with zirconia added.



Application

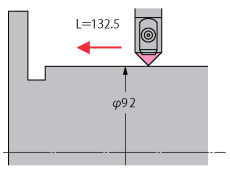
Gray cast iron

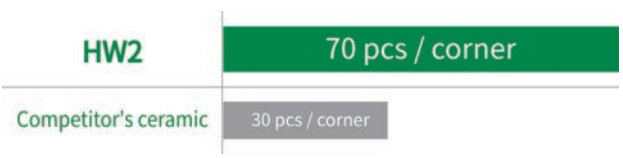
Finishing light interrupted to continuous turning

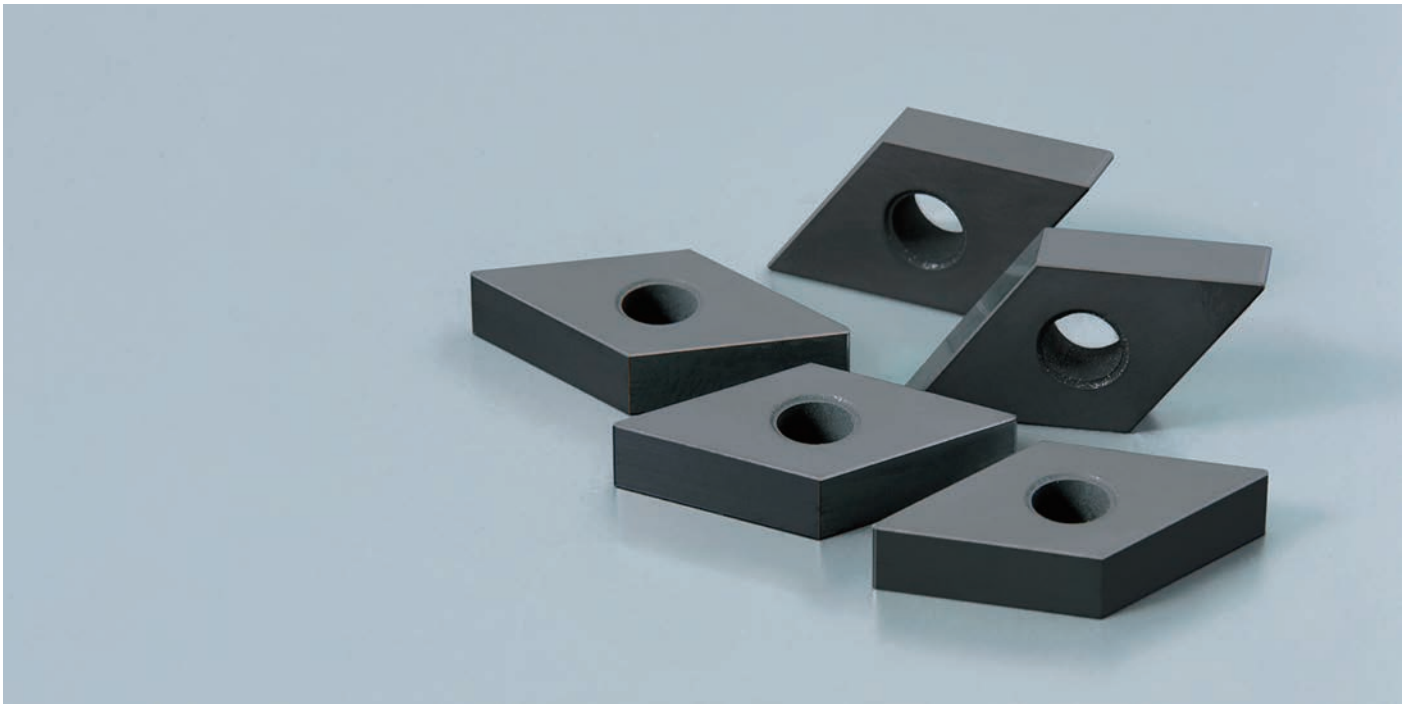
Case study Cylinder liner machining

HW2 has twice the amount of tool life than the competitor's grade, as well as a higher quality machined surface.

Work material	cast iron
Cutting speed	600 m/min
Feed	0.32 mm/rev
Depth of cut	3.0mm
Coolant	DRY







Ductile cast iron finishing | TiC based ceramic + alumina

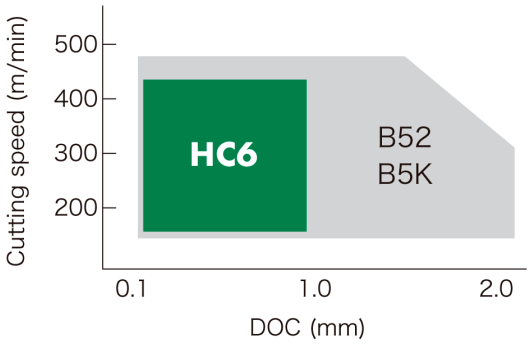
HC6

Ceramic grade specifically designed for ductile iron machining

Ideal for high-speed finishing at Vc = ~400 m/min

Performance

- Specially developed ceramic grade for ductile cast iron machining
- The world's first TiC-based ceramic material put into practical use
- Longer tool life and stable machining even under high-speed machining



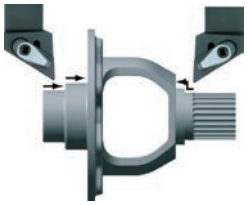
Application

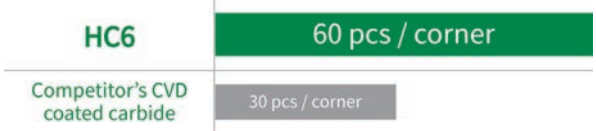
Ductile cast iron
Finish turning

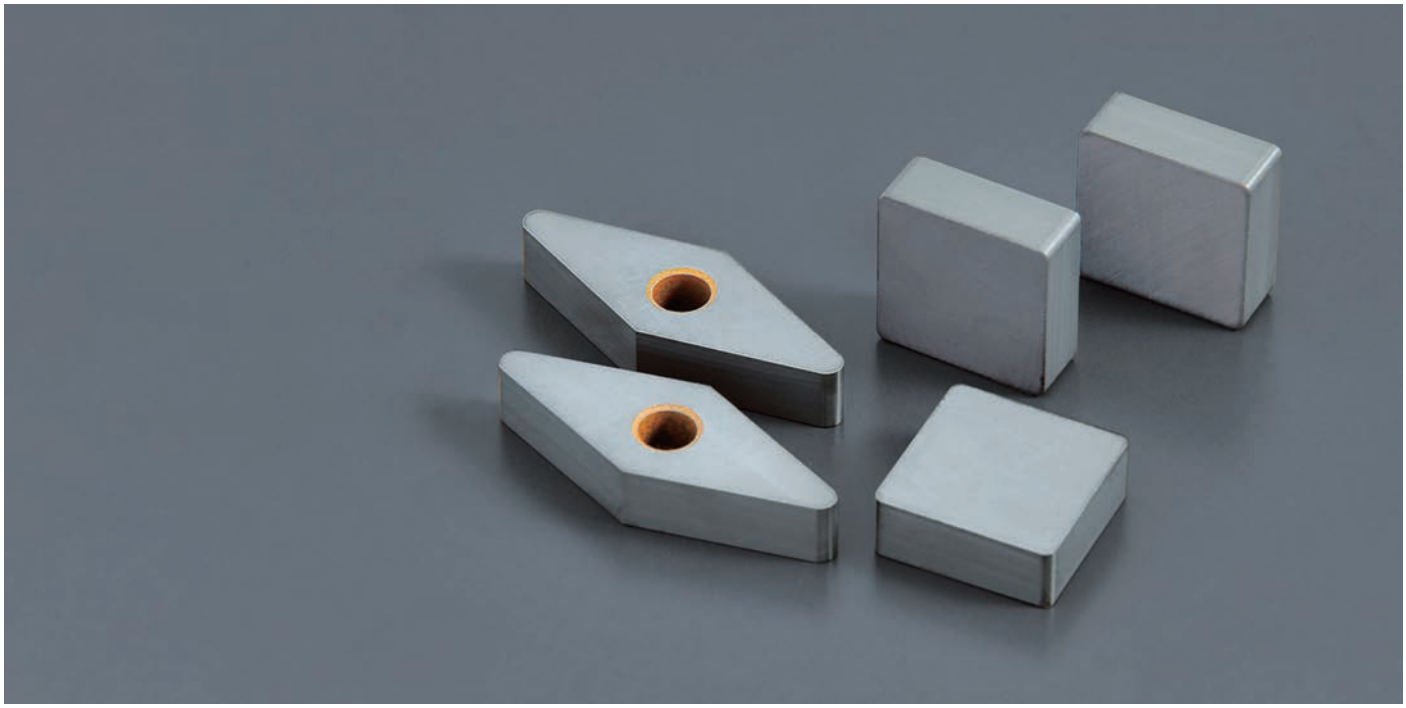
Case study Differential case machining

HC6 has achieved twice the tool life improvement compared to competitor's CVD coated carbide.

Work material	Ductile cast iron
Cutting speed	270 m/min
Feed	0.2 mm/rev
Depth of cut	0.5 mm
Coolant	WET







Gray Cast iron with scale machining, excellent wear resistance | Silicon nitride ceramic

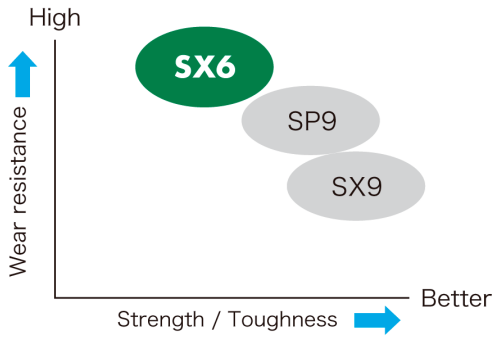
SX6

Machining gray cast iron at Vc = ~1,200 m/min

Outstanding notch wear resistance and thermal shock resistance

Performance

- Significantly reduces the progress of notch wear, achieving high-speed and longer tool life machining.
- Excellent thermal shock resistance, and can be used for WET machining.



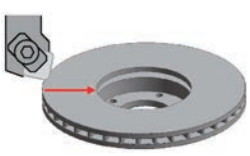
Application

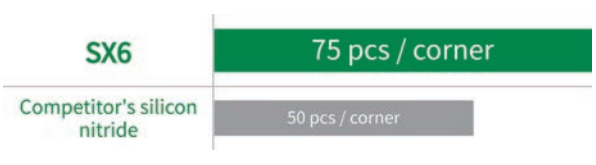
Gray cast iron with scale
Turning / Milling

Case study brake disc

SX6 has a 1.5 times longer tool life than other competitors' silicon nitride.

Work material	FC150 with scale
Cutting speed	1,100 m/min
Feed	0.5 mm/rev
Depth of cut	2.0~3.0 mm
Coolant	WET





Ductile cast iron / Gray cast iron for roughing with scale to finishing | Coated silicon nitride ceramics

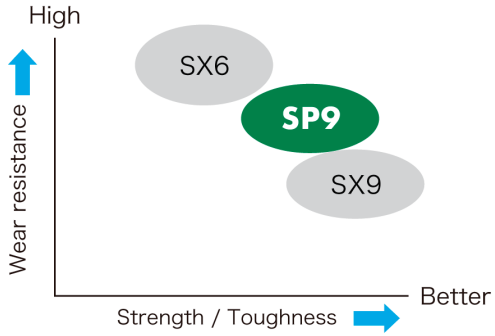
SP9

Excellent chipping resistance and wear resistance due to combination of high toughness material and CVD coating

CVD coating enables longer tool life even in the low-speed range at Vc = 300 m/min.

Performance

- Combination of high-toughness material and CVD coating provides both excellent chipping resistance and wear resistance
- Minimum cutting edge treatment reduces cutting resistance
- Finishing is also available.



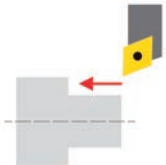
Application

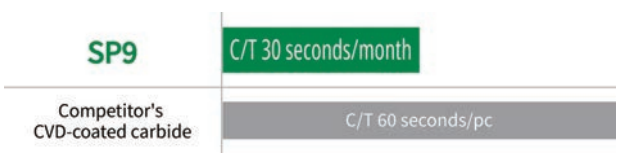
Ductile cast iron / Gray cast iron
Turning / Milling roughing with scale to finishing

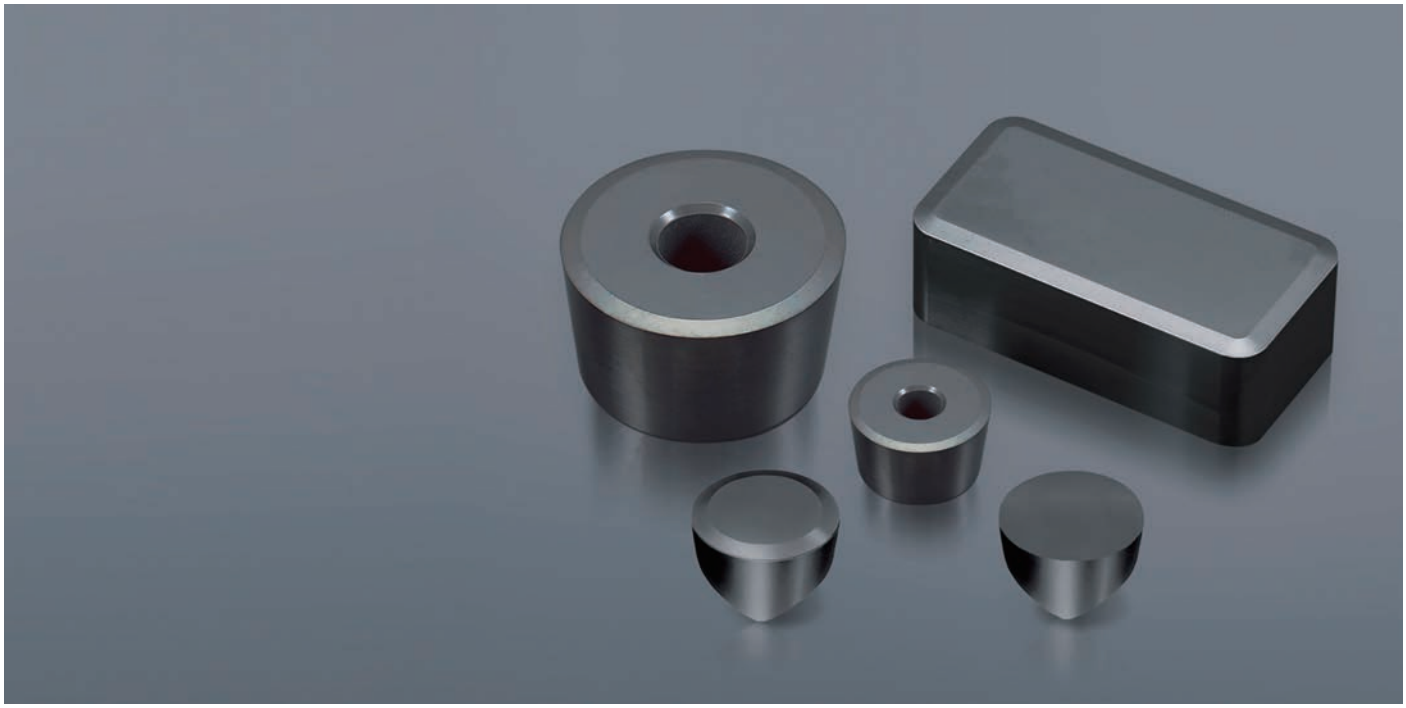
Case study Differential case machining

SP9 can machine faster than other competitors' CVD coated carbide, and the C/T reduced to 1/2.

Work material	Ductile cast iron with scale
Cutting speed	450m/min (SP9) 200m/min (CVD coated carbide)
Feed	0.35 mm/rev
Depth of cut	1.5mm
Coolant	DRY







For continuous machining of gray cast iron and hardened materials | Alumina TiC based ceramics

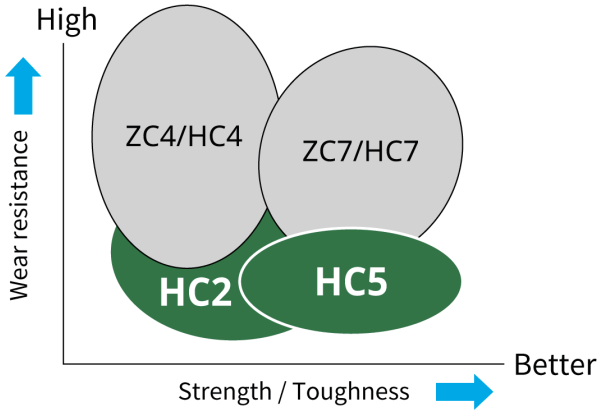
HC2 / HC5

All-purpose grade for machining gray cast iron and hardened materials

Well balanced grade between wear resistance and chipping resistance

Performance

Excellent insert hardness, low plastic deformation at high temperatures, and excellent performance in turning gray cast iron and hardened materials



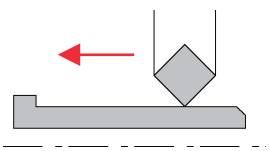
Application

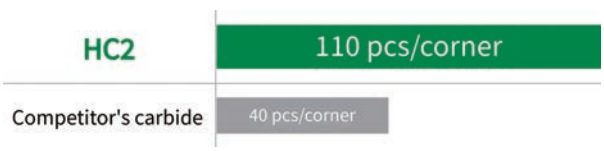
Gray cast iron / Semi to finishing with continuous machining
Hardened materials / Finishing
Hardened and cast iron mill rolls / Semi to finishing

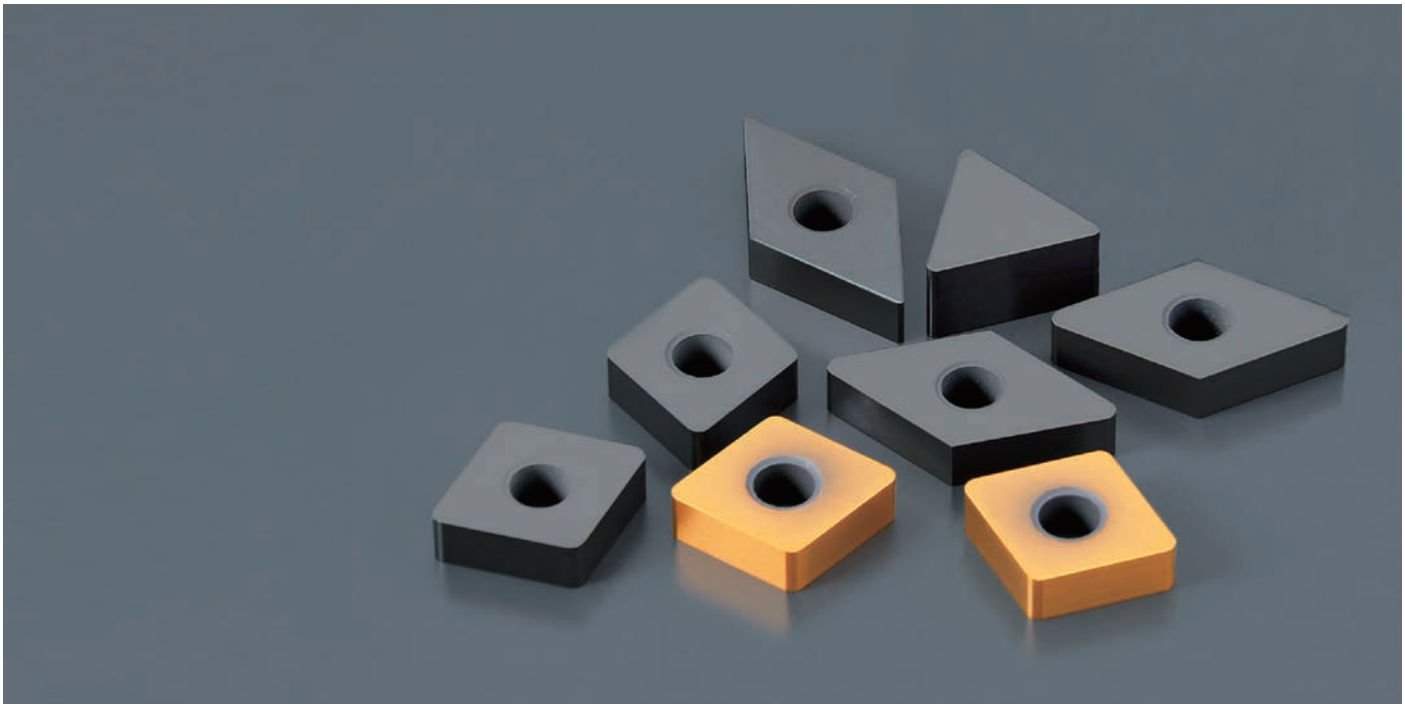
Case study cylinder liner machining

HC2 achieves 1.3 times higher machining efficiency and nearly three times longer tool life than other competitors' carbide.

Work material	Gray cast iron
Cutting speed	600 m/min (HC2) 400 m/min(competitor's carbide)
Feed	0.5 mm/rev
Depth of cut	0.7 mm
Coolant	DRY







Hardened materials for continuous machining | Alumina TiC based ceramics

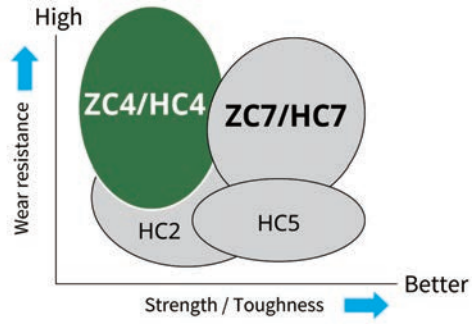
ZC4 / HC4

Ceramic grade best for hardened materials

Excellent performance by increasing the hardness and strength of the insert base material.
Suitable for hardened materials in the range of HRC 55-70

Performance

- Excellent chipping resistance and wear resistance due to combination of high toughness material and CVD coating
- Significant tool cost reductions are achieved by replacing CBN
- Inserts with a wiper flat or a chipbreaker are available to further improve machining efficiency



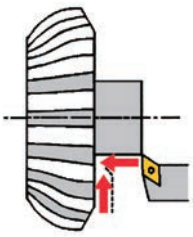
Application

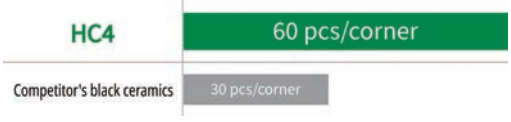
Continuous machining of hardened materials HRC 55-70

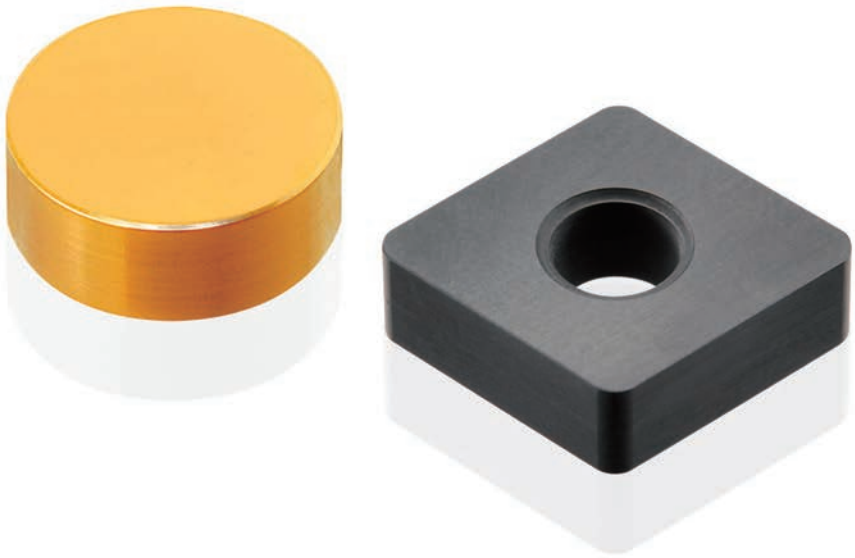
Case study Gear machining

HC4 has superior wear resistance and twice the tool life extension compared to competitors' tool.

Work material	Carburized and hardened steel (HRC 63)
Cutting speed	121 m/min
Feed	0.03~0.04 mm/rev
Depth of cut	0.15 mm
Coolant	DRY







Hardened materials for continuous machining | Alumina TiC based ceramics

ZC7 / HC7

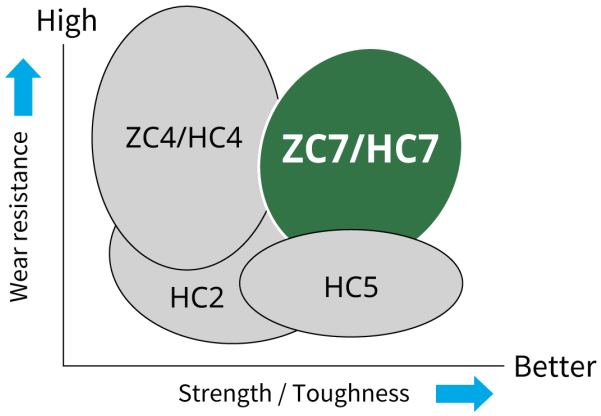
Suitable for work materials with a wide range of hardness

Reduces insert cost by replacing CBN

Suitable for hardened materials with hardness of HRC 30-62

Performance

- Ideal for finishing of hardened materials due to the insert's high temperature hardness and low plastic deformation at high temperatures.
- Reduces tool cost significantly by replacing CBN.
- Inserts with a wiper and chipbreaker types are also available.



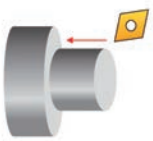
Application

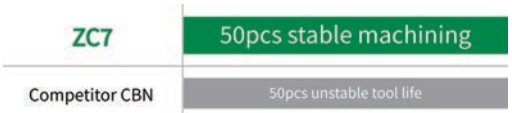
Continuous machining of hardened materials HRC 30-62

Case study Tool parts machining

ZC7 can machine the same number of pieces as CBN and has a stable tool life. Significant cost reductions are now achieved.

Work material	SCr42H
Cutting speed	120 m/min
Feed	0.15 mm/rev
Depth of cut	0.4 mm
Coolant	WET





Heat-resistant alloys for scale to semi-finishing | SiAlON ceramics

SX3

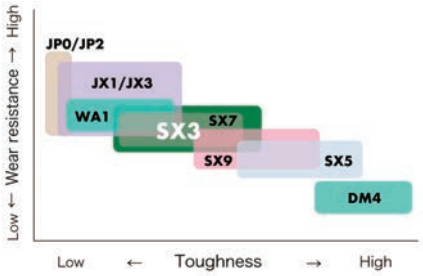
Covers wide range of machining:Roughing with scale to semi-finishing

Ceramic grade combining toughness and wear resistance

High speed and stable machining in turning and milling

Performance

- Excellent wear and chipping resistance. Versatile ceramic grade.
- Covers a wide range of heat-resistant alloy machining from scale to semi-finishing
- High-efficiency machining in milling and turning



Application

Heat-resistant alloys

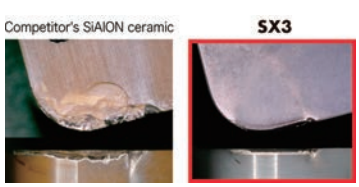
Turning / Profiling / Milling

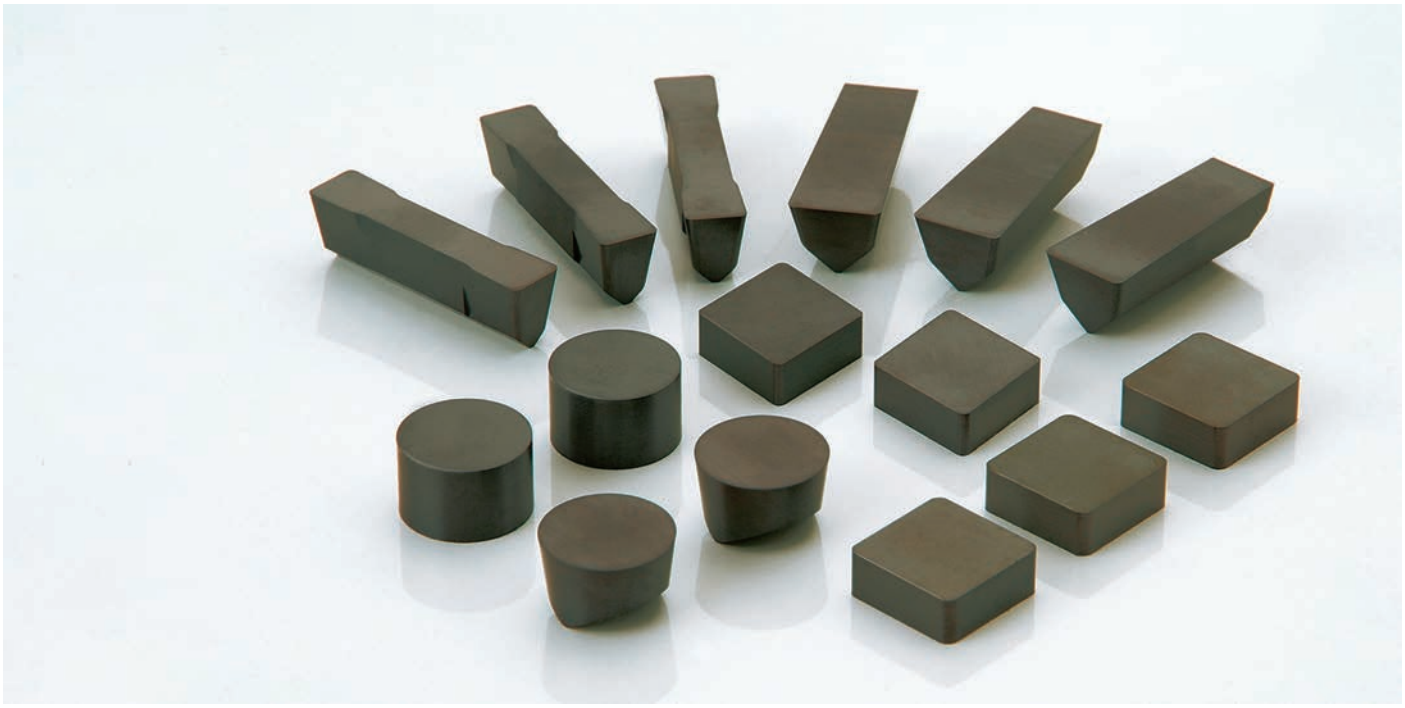
Roughing with scale to semi-finishing

Case study Rene130 with scale machining

In scale machining, SX3 was in good condition with no defects, whereas the competitor's SiAlON resulted in defects.

Work material	Rene130
Cutting speed	115 m/min
Feed	0.15 mm/rev
Depth of cut	-
Coolant	WET





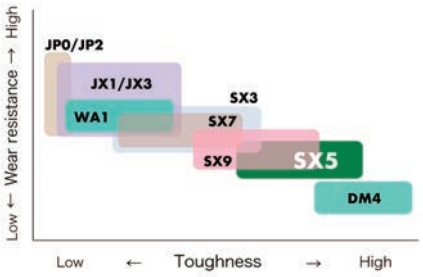
Heat-resistant alloys for scale machining | SiAlON ceramics

SX5 [Made-to-order]

First recommendation for machining through scale
Excellent notch wear resistance ideal for machining scale
Made-to-order

Performance

- Ceramic with the highest fracture resistance
- Best for machining where scale or interruptions exist
- Best grade for roughing Waspaloy with scale



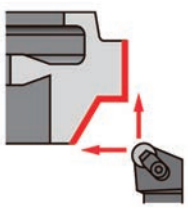
Application

Heat resistant alloys
Turning / grooving through scale

Case study Aircraft part (Roughing with scale)

SX5 insert had more stable performance and no edge chipping compared to the competitor's SiAlON grade.

Work material	Inconel718
Cutting speed	200 m/min
Feed	0.2 mm/rev
Depth of cut	2.5 mm
Coolant	WET



Roughing (no scale) to semi-finishing heat resistant alloys | SiAlON ceramic

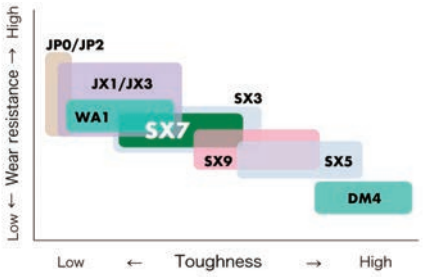
SX7

Better notch resistance than whisker ceramics

Improved boundary wear resistance to prevent cutting edge wear and breakage

Performance

- Better notching resistance compared to whisker ceramics
  No need to program ramping to shift wear on insert
- Better flank wear resistance compared to other SiAlONs.
- Ideal for semi-finishing Inconels and Waspaloy



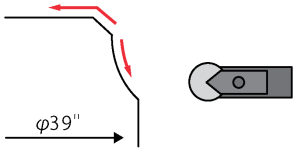
Application

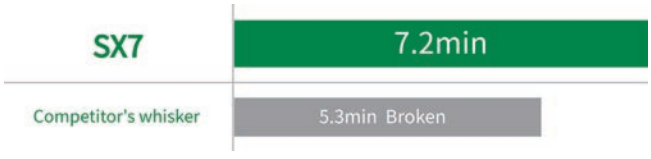
Roughing with no scale to semi-finishing heat resistant alloys
Turning/Grooving/ Milling

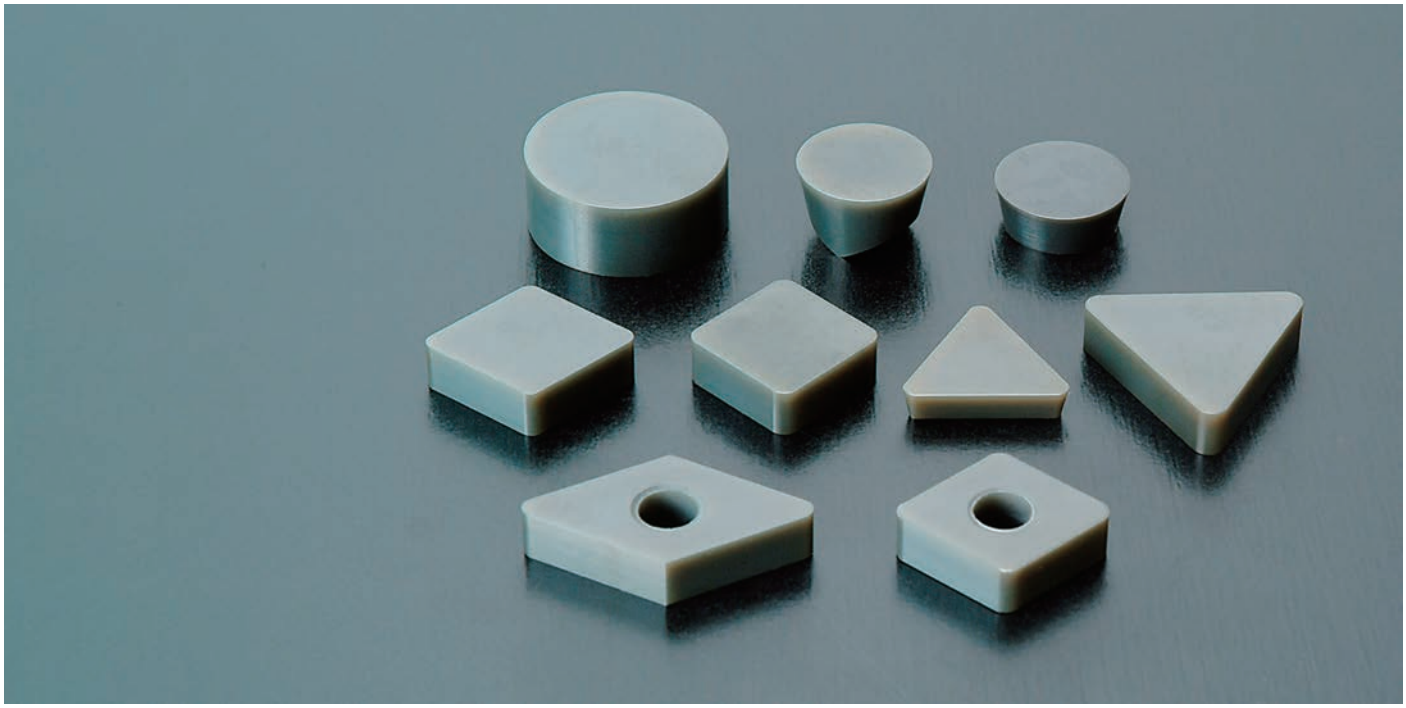
Case study Turbine case (semi-finishing)

SX7 insert achieved more stable machining due to its excellent notching resistance compared to the competitor's whisker insert.

Work material	Waspaloy
Cutting speed	240 m/min
Feed	0.3 mm/rev
Depth of cut	Varied depth of cut
Coolant	WET







Machines through scale on heat resistant alloys | SiAlON ceramic

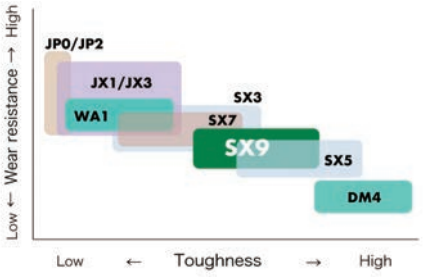
SX9

SiAlON ceramic grade material with improved chipping resistance

Best grade for roughing heat resistant alloys like Inconel 718 with scale

Performance

- SiAlON with excellent notch and flank wear resistance
- Superior toughness compared to whisker ceramics
- Best thermal shock resistance, perfect for milling applications
- Best grade for roughing Inconel with scale



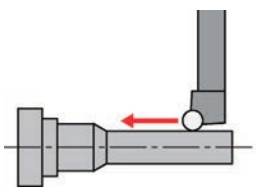
Application

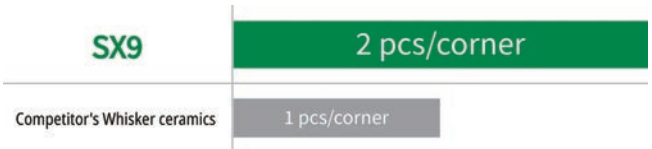
Heat resistant alloys
Turning / Milling / End milling: roughing operations

Case study Aircraft part (with scale)

SX9 is a significant cost advantage and double the tool life compared to competitor's whisker insert.

Work material	Inconel718
Cutting speed	180 m/min
Feed	0.2 mm/rev
Depth of cut	- 0.6 mm
Coolant	WET





Roughing (no scale) to semi-finishing heat resistant alloys | Whisker ceramic

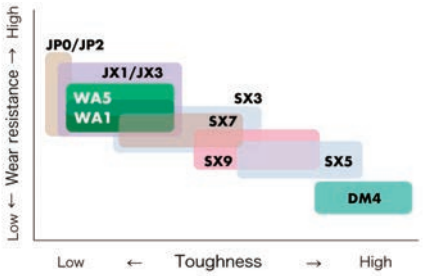
WA1 / WA5

High speed and efficient machining of heat resistant alloys

SiC fibers in the material provide strength, flank wear resistance and thermal shock resistance

Performance

- Alumina ceramic material with enhanced toughness due to the addition of SiC whiskers
- High-speed machining is possible due to flank and notch wear resistance and toughness



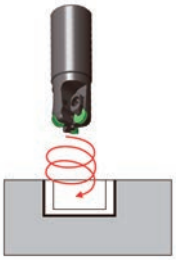
Application

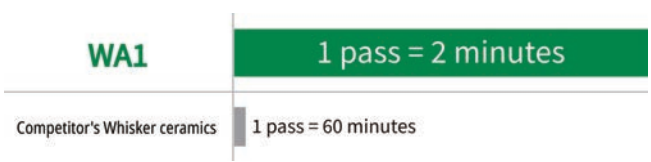
Roughing (no scale) to semi-finishing heat resistant alloys
Turning/Grooving/Milling

Case study Gas turbine case

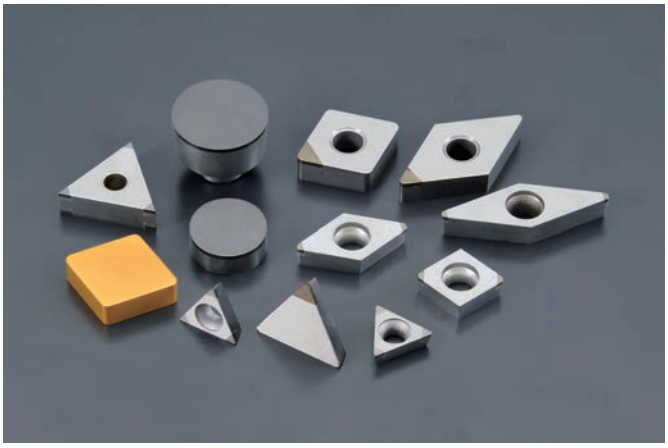
WA1 significantly reduced cycle time compared to the competitor's carbide end mill.

Work material	Inconel718
Cutting speed	800 m/min
Feed	0.10 mm/rev
Depth of cut	2 mm
Coolant	DRY





CBN/Ultra-high pressure sintered body

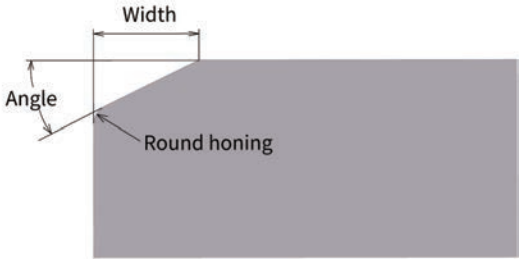


CBN grade inserts are composed mainly of CBN (Cubic Boron Nitride) particles with a special ceramic binder. The material has excellent cutting material properties including high hardness at normal and highly elevated temperatures, as well as little chemical reactions with work materials. CBN inserts can be used for machining hardened materials and high speed machining of cast iron.

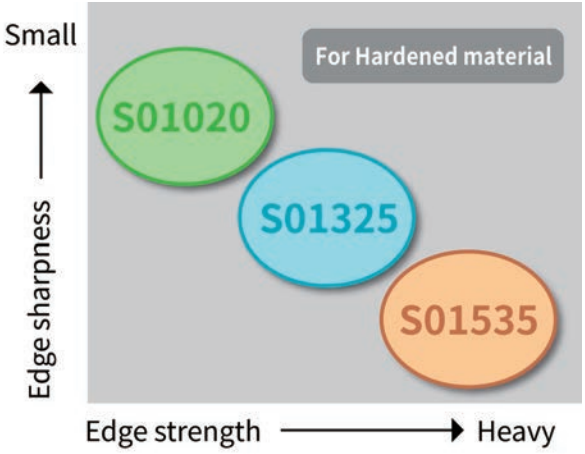
Features

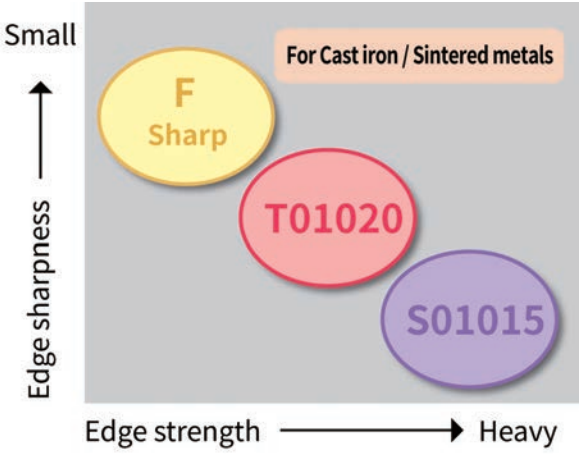
Work material	Grade	Coating	Corner	Application	CBN content	Main binder
H Hardened material	B36	-	multi	Light to heavy interrupted machining of hardened materials	65%	TiCN
	B40	-	multi	Heavy interrupted machining of hardened materials	65%	TiN
	B52	-	multi	Finishing of ductile iron Continuous machining of hardened materials	50%	TiC
	B5K	TiCN	multi	Continuous to light interrupted machining of hardened materials Finishing of ductile iron	50%	TiC
	B6K	TiCN	multi	Middle to heavy interrupted machining of hardened materials	65%	TiCN
K Cast iron	B16	-	solid	Roughing to finishing of gray cast iron Machining of sintered metals	82%	TiN
	B22	-	top-surface	Turning of hardened mill rolls Roughing to finishing of gray cast iron	80%	TiN
	B23	-	multi	Roughing of gray cast iron Machining of sintered metals	90%	Ti
	B30	-	multi	Finishing of gray cast iron Machining of sintered metals	95%	Ti

Edge treatment

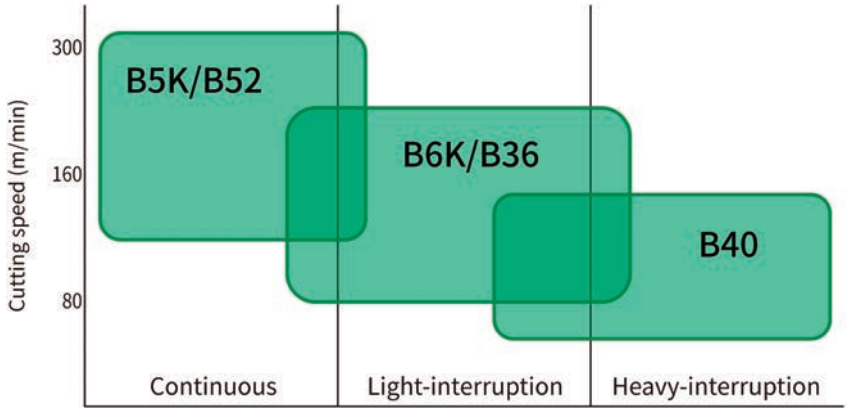


Code	Width	Angle	R-honing
F(sharp-edge)	0.00	0°	none
T01020	0.10	20°	none
S01015	0.10	15°	yes
S01020	0.10	20°	yes
S01325	0.13	25°	yes
S01535	0.15	35°	yes

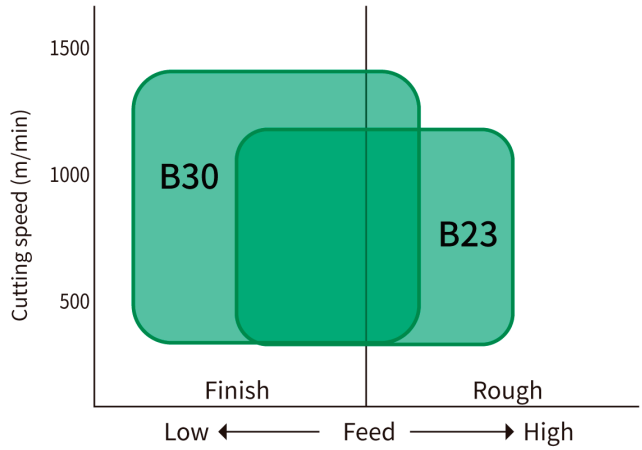




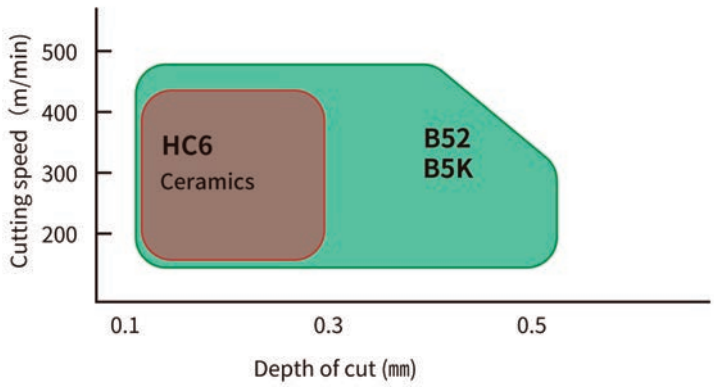
Hardened material



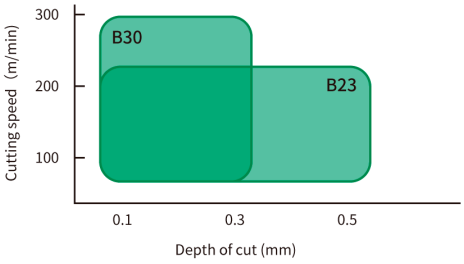
Gray cast iron

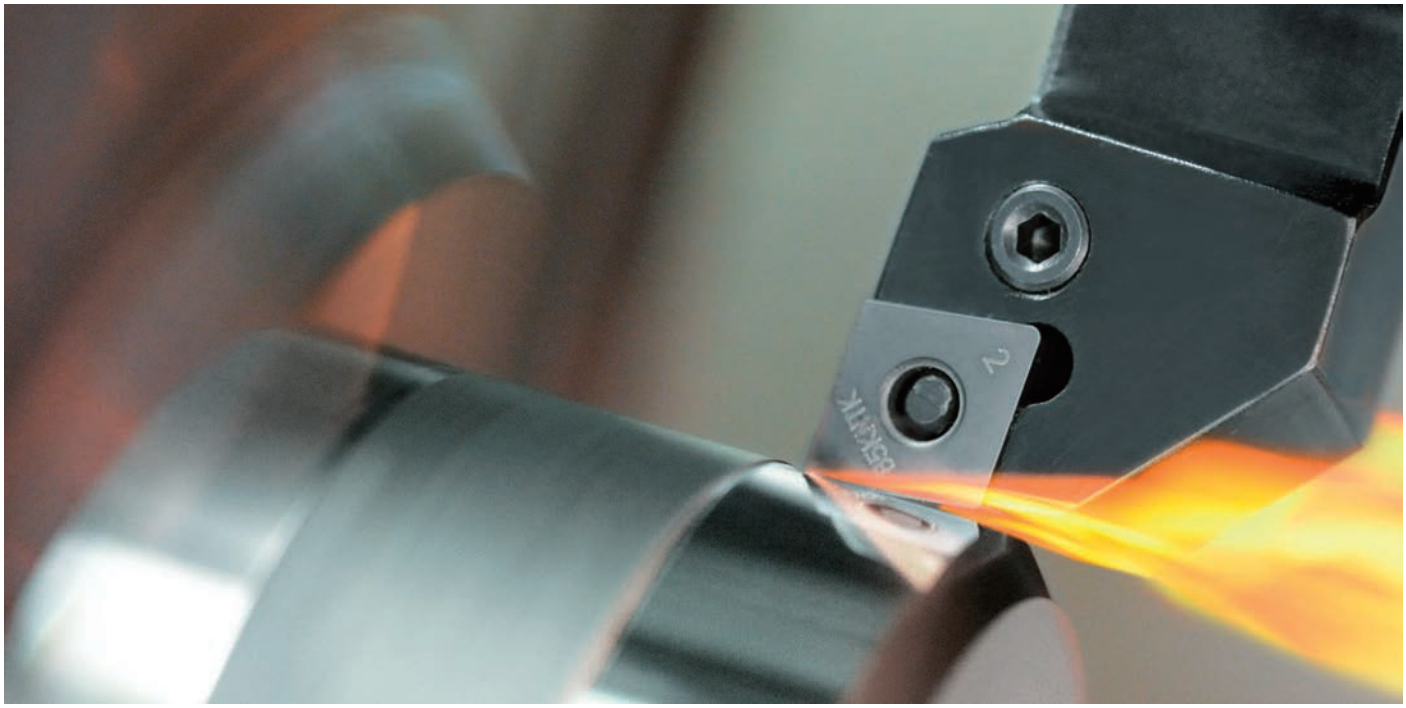


Ductile cast iron



Sintered metals





For continuous machining | CBN for hardened materials

B5K / B52

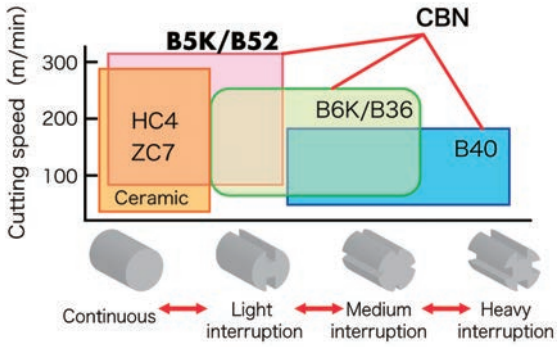
CBN grades ideal for high-precision machining

Roughing to finishing continuous cut operations

Ideal for hardened materials of HRC 60 or higher

Performance

- Excellent wear resistance due to optimum CBN content and special TiC binders
- Continuous machining



Application

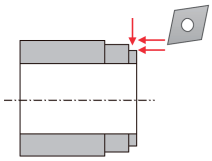
Continuous machining for hardened materials at HRC60 or higher

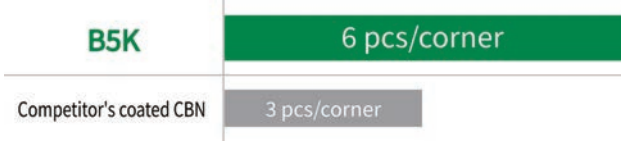
Case study OD Turning of shaft parts

B5K achieved 2 times longer tool life.

Due to dimensional changes and deterioration of the machined surface the competitor's coated CBN needed to be changed.

Work material	SUS440C(HRC58-60)
Cutting speed	150m/min
Feed	0.1mm/rev
Depth of cut	0.2mm
Coolant	DRY





For light to medium interrupted machining | CBN for hardened materials

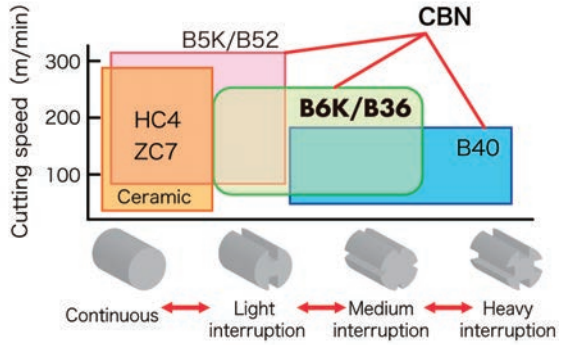
B6K / B36

Recommended for continuous to interrupted cuts

Versatile CBN designed for machining hardened materials at HRC 60 or above with light to medium interruptions

Performance

- CBN with a special TiCN binder achieves a combination of wear resistance and fracture resistance
- Stable performance through light to medium interrupted machining

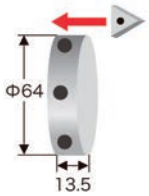


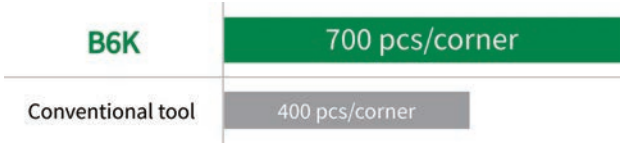
Application

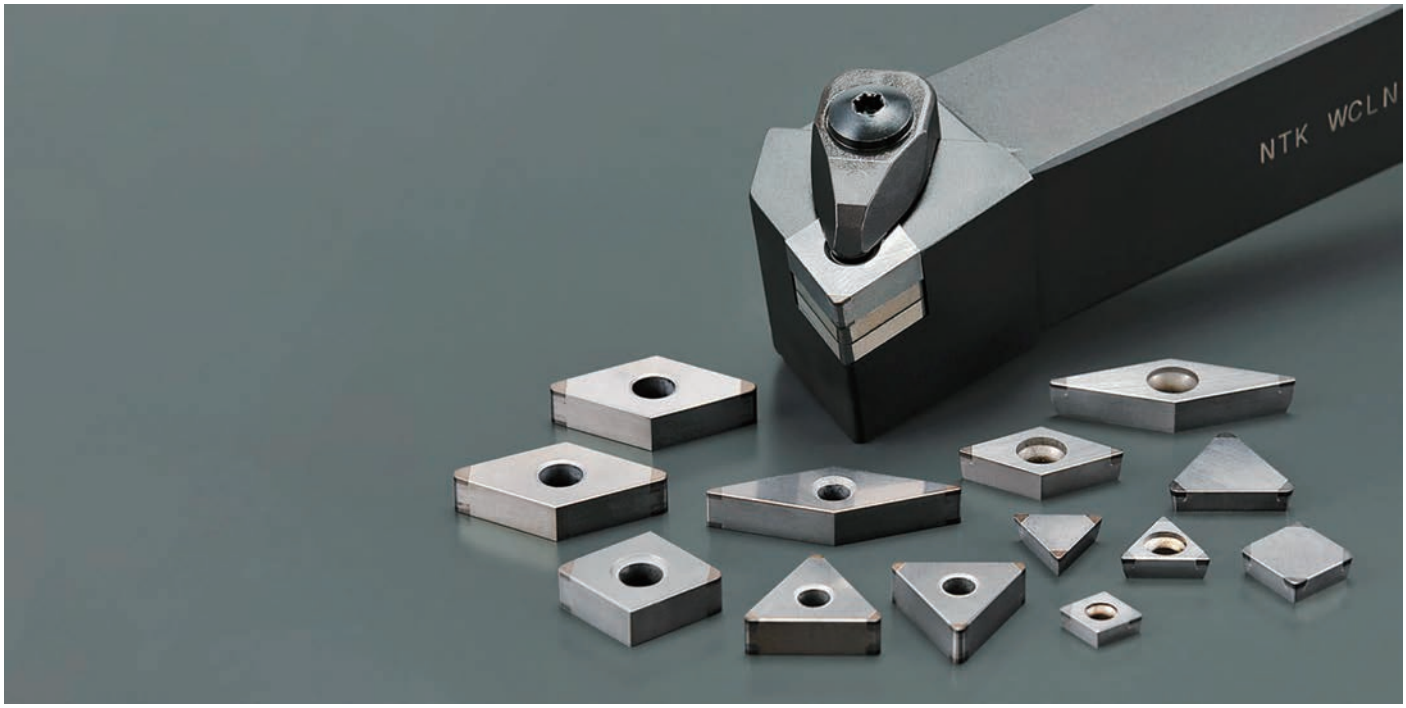
Light to medium interrupted machining of hardened materials of HRC 60 or higher

Case study Interrupted OD turning of machine parts

Work material	STKM(HRC50) interrupted
Cutting speed	210-220m/min
Feed	0.08 mm/rev
Depth of cut	0.2 mm
Coolant	WET







For heavy interrupted machining | CBN for hardened materials

B40

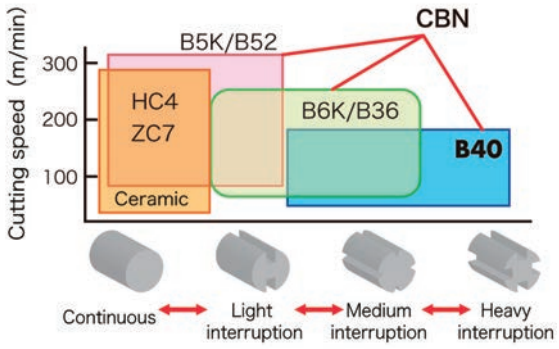
CBN material specialized for heavy intermittent machining

Excellent chipping resistance and stable machining

Best suited for machining of hardened materials over HRC60

Performance

- CBN with a special TiN binder enhances chipping resistance
- CBN material specialized for heavy interrupted machining



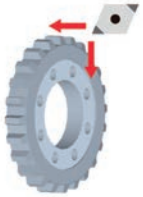
Application

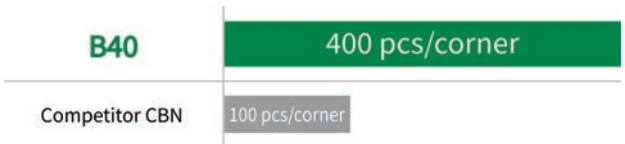
Hardened materials interrupted machining HRC60 or more

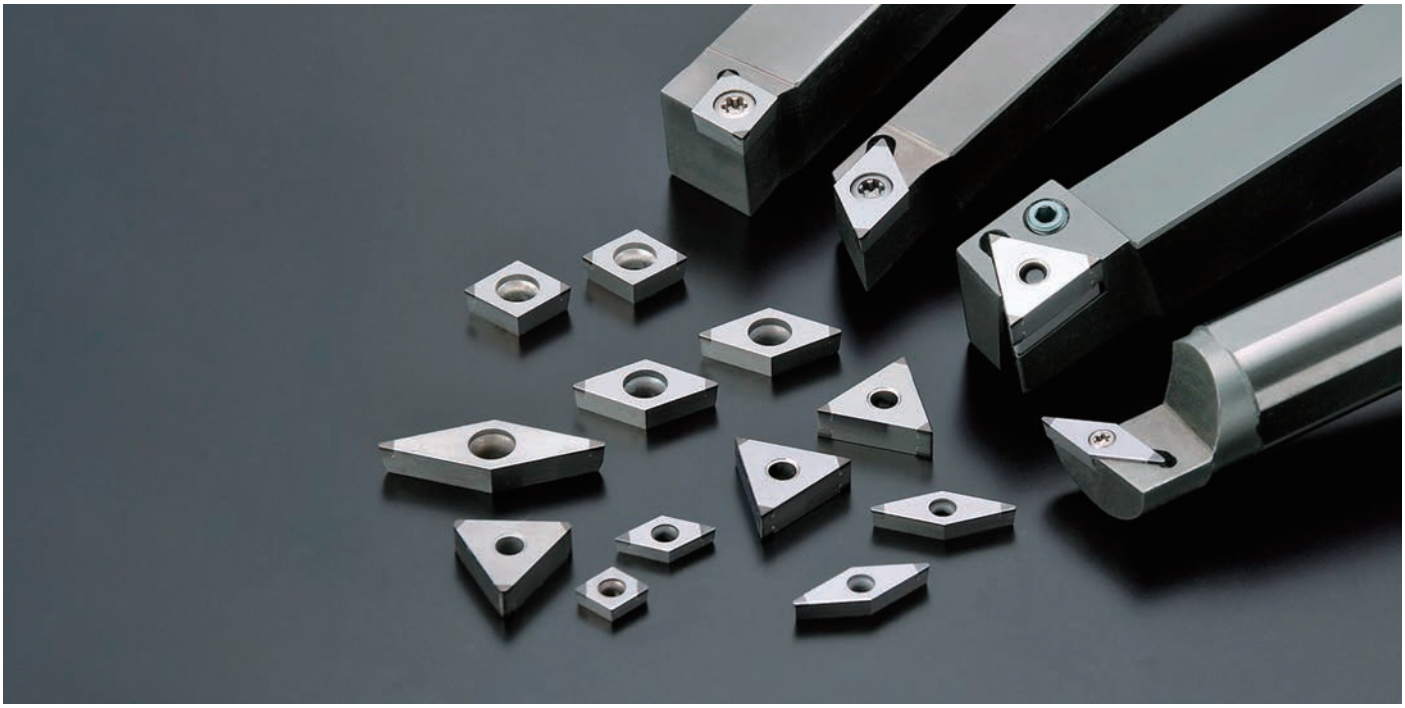
Case study gear parts

Although insert damage due to interrupted machining have been a problem, B40, with its superior resistance to wear, achieved a 4X longer tool life.

Work material	S50C(HRC61)
Cutting speed	28 m/min
Feed	0.12 mm/rev
Depth of cut	0.25 mm
Coolant	WET







High-speed machining of cast iron and sintered alloys | Non-coated CBN

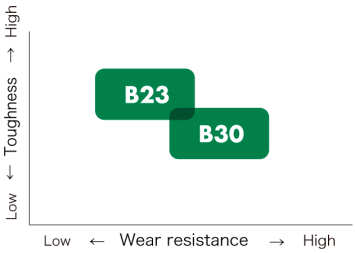
B23 / B30

High-speed machining at Vc=~1,200m/min

Highly efficient machining that significantly outperforms ceramics

Performance

- Specialized in high-speed roughing of gray cast iron
- Ultra high-speed machining at a maximum Vc-1,200m/min

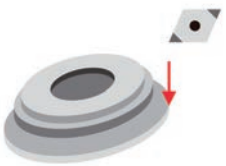


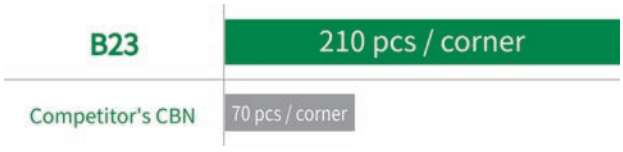
Application

Gray cast iron
Turning scale machining to semi-finishing

Case study Oil pump housing

Work material	FC250
Cutting speed	250 m/min
Feed	0.2 mm/rev
Depth of cut	2.0 mm
Coolant	WET





Gray cast iron for high-speed roughing | Solid type CBN

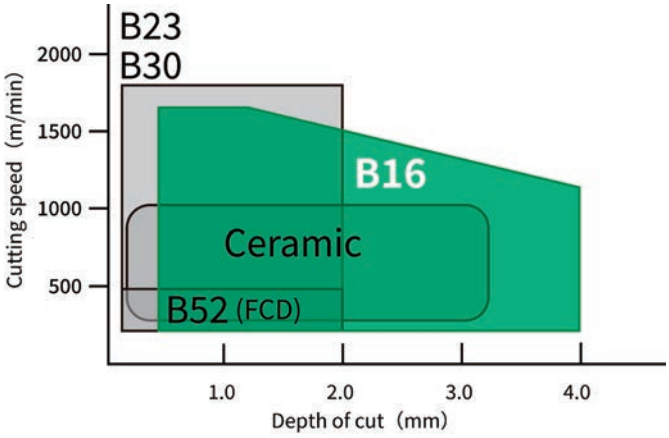
B16

Ideal for high-efficiency machining of cast iron

Solid CBN does not have the depth of cut limitations of brazed CBN, making it ideal for machining with large depths of cut.

Performance

- Succeeded in developing CBN tool materials with a wide range of application areas other than hardened steel by increasing CBN content and using a binder with high bonding strength
- Solid CBN with multi-corner specifications
- Coating makes it easy to identify the corner to be used



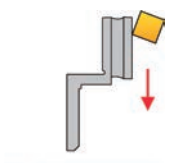
Application

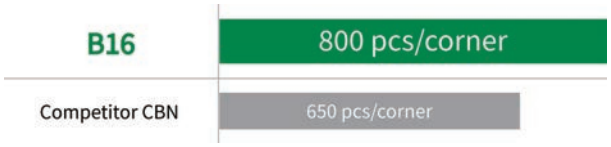
High-speed roughing to finishing of gray cast iron
Machining sintered metal

Case study Roughing for disc brake

B16 has a longer tool life of approximately 1.2 times that of competitors' products.

Work material	FC250
Cutting speed	1000 m/min
Feed	0.7 mm/rev
Depth of cut	1.0 mm
Coolant	WET





For hardened mill rolls turning | Top-surface CBN

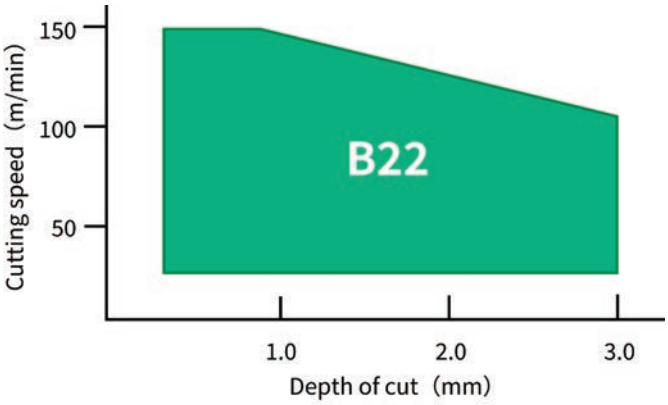
B22

Ideal for machining hardened mill rolls

Since the entire top surface is CBN, there is no limit to the depth of cut as with brazed CBN, making it ideal for machining with a large depth of cut.

Performance

- Multi-corner design with top-surface CBN
- High strength with special binder



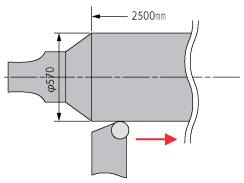
Application

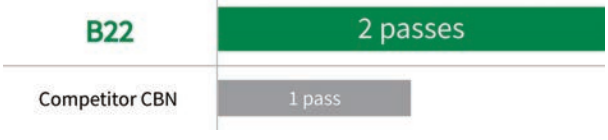
Turning of hardened mill rolls
High-speed roughing to finishing of gray cast iron

Case study Mill rolls

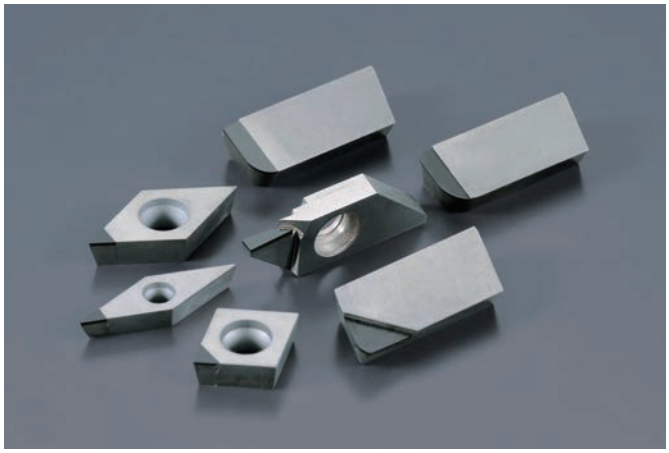
B22 has twice the amount of tool life than other competitors' CBNs.

Work material	High Chromium Cast Iron
Cutting speed	60 m/min
Feed	0.2 mm/rev
Depth of cut	2.0 mm
Coolant	WET





PCD / Diamond sintered grade

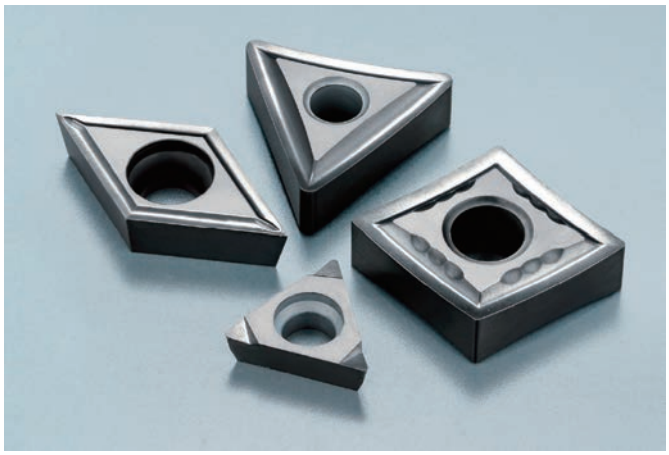


Diamond has low affinity with non-ferrous materials, providing excellent adhesion resistance, a high hardness, and wear resistance, but when used as a cutting tool, it has low strength, which causes a problem with its chipping resistance.

PCD is a material that solves the strength problem without losing the original characteristics of the diamond by sintering the diamond in a fine-grained, polycrystalline state.

Compared to carbide tools used in nonferrous metal machining, PCD enables high-speed machining.

Diamond Coating



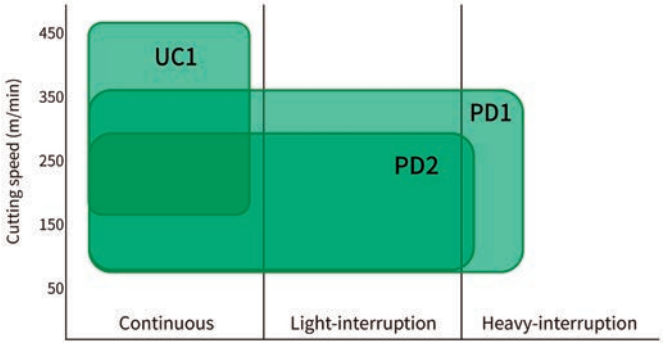
Highly pure diamond layer is precisely coated with high adhesion to our special carbide base material using a state of the art surface treatment technology.

Superior wear resistance compared to conventional PCD tools, especially in difficult-to-machine materials such as carbon and ceramic materials.

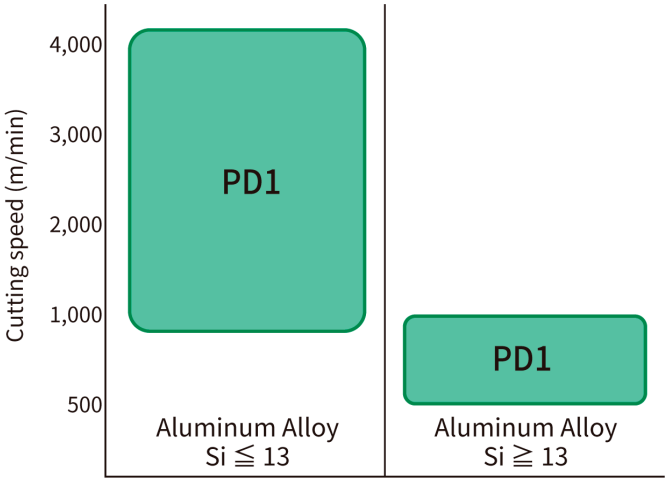
Features

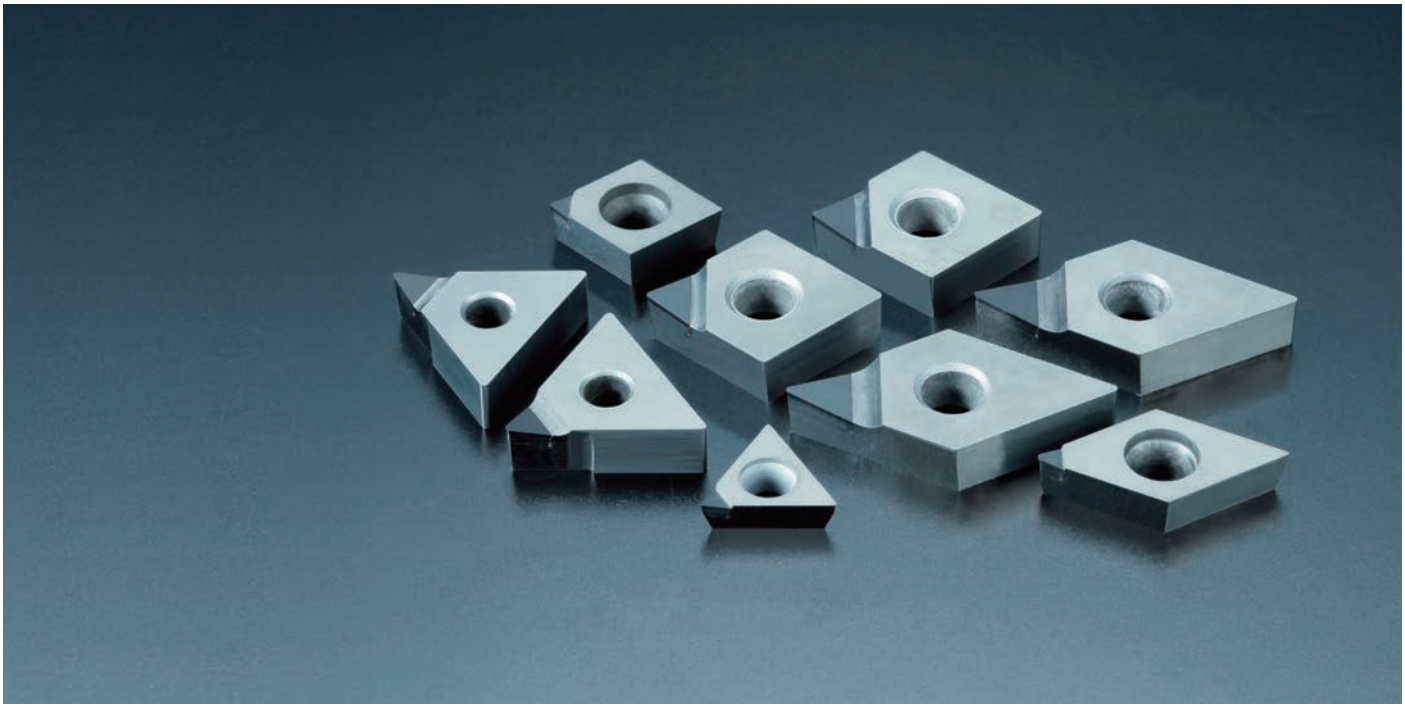
Work material	Grade	Component	Ave. particle size(μm)	Application
N Non-ferrous material	**PD1**	Diamond sintered	10	Machining of non-ferrous metals such as aluminum, brass, resin, copper, carbon, ceramics, etc. Superior adhesion resistance enables high-speed machining compared to carbide
	PD2	Diamond sintered	1	Nonferrous metal machining such as aluminum, brass, resin, copper, carbon, ceramics, etc. Improved sharpness and chipping resistance by ultrafine particle size of carbide base material
	UC1	Diamond Coating	0.1	Nonferrous metal machining such as aluminum, brass, resin, copper, carbon, ceramics, etc. Wear resistance is improved compared to PCD tools by coating a high-purity diamond layer.

Aluminum alloy/brass machining (turning)



Aluminum alloy (Milling)





Non-ferrous material machining | PCD grades

PD1 / PD2

Faster speed capabilities compared to carbide inserts

Optimum machining efficiency for non-ferrous materials PCD demonstrates excellent durability with sharp cutting edge and increased chipping resistance

PCD demonstrates excellent durability with sharp cutting edge and increased chipping resistance

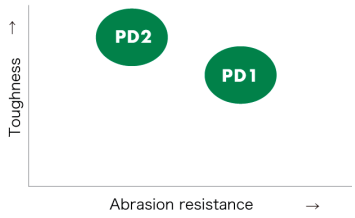
Performance

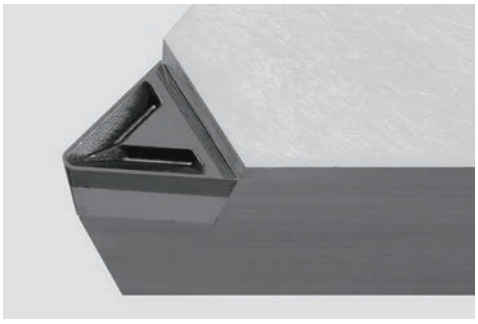
- The hardest fine grain diamond inserts.
- Achieves outstanding edge sharpness and high-speed machining compared to carbide
- The characteristics of diamonds prevent the formation of a built up edge, enabling high-precision and stable machining.

3D molded chipbreaker

Curl & control small chips, and provide high cutting performance.
Suitable for finish machining area (ap=0.5mm)

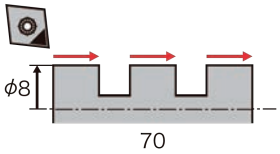
Performance

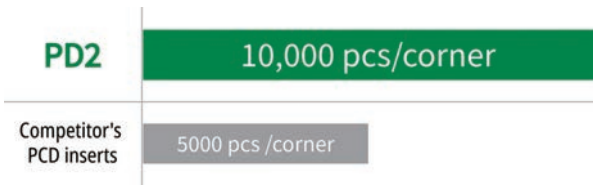


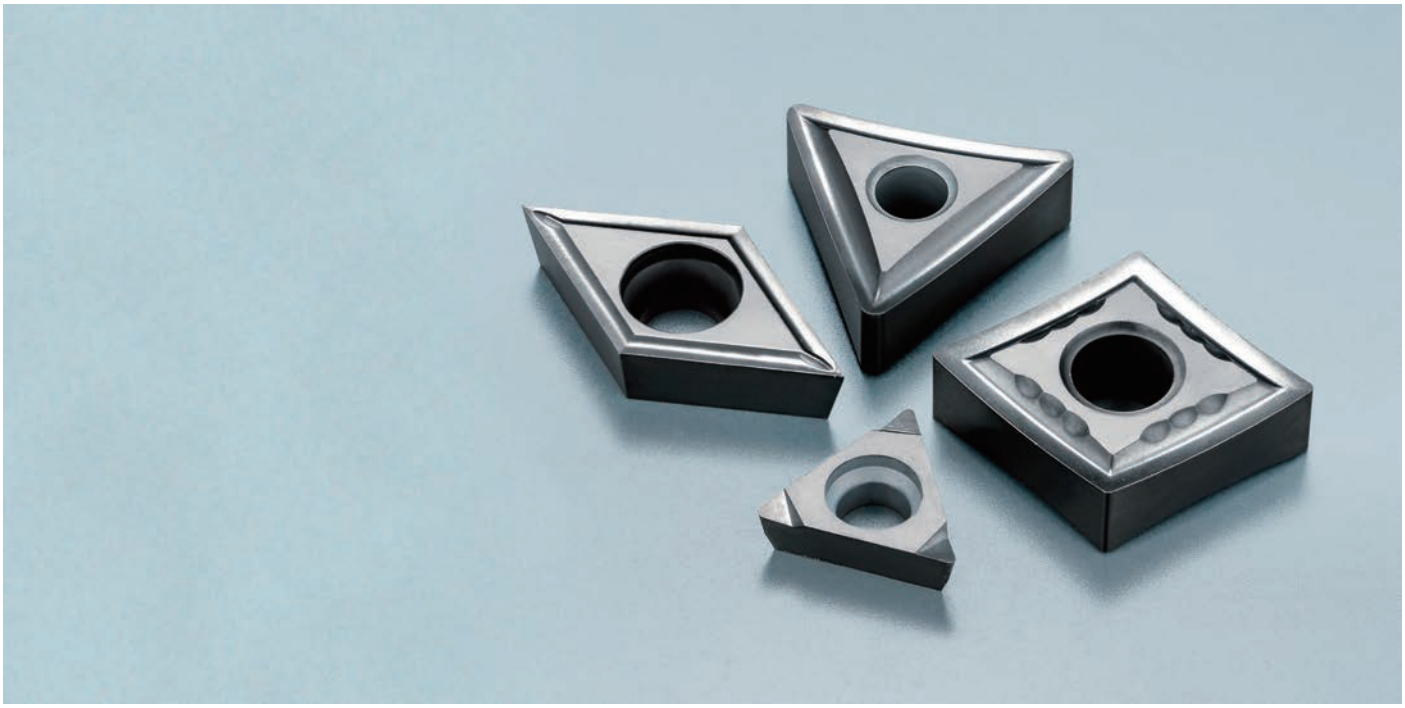


Case study Spool parts

Work material	A6061
Cutting speed	170m/min
Feed	0.06mm/rev
Depth of cut	0.15mm
Coolant	WET







For nonferrous metals and non-metallic machining | Diamond coating

UC1

Ideal for machining difficult-to-machine materials such as carbon and ceramic raw materials

Coated with a high-purity, high-hardness diamond layer with excellent wear resistance

Longer life in difficult-to-machine materials compared to conventional PCD tools and DLC

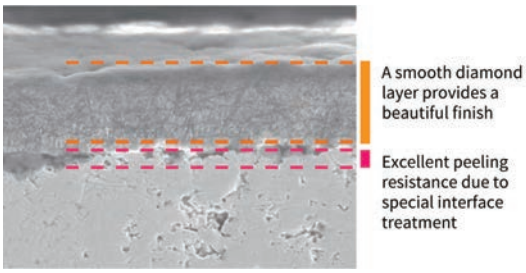
Performance

The dense coating of high-purity, high-hardness diamond layers provides superior wear resistance compared to conventional PCD tools, and can be used for carbon cutting and machining of raw ceramic materials, contributing to cost reduction.

	DLC	PCD	UC1
Binder	none	Co, Ni	none
Diamond grain size	Amorphous	10μm	<0.1μm
Diamond surface roughness	0.25	0.2S	2S
Hardness(GPa)	10	75	90

Good coating adherence

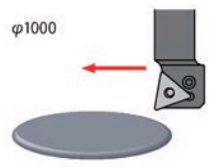
NTK's carbide base material and state of the art surface treatment ensures good coating adherence to reduce flaking which provides stable cutting and long tool life

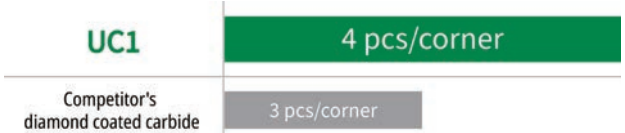


Case study carbon plate

UC1 has a 1.3 times longer tool life than the competitor's diamond coatings.

Work material	Carbon
Cutting speed	300m/min
Feed	0.1~0.4mm/rev
Depth of cut	1.0mm
Coolant	WET



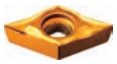
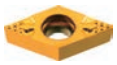
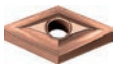
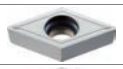
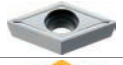
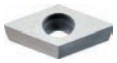


Micro-grain Carbide and PVD/CVD-coated Carbide

Excellence in precision machining and machining of hard-to-cut materials

These material grades use WC micro-grain carbide, the hard base material which is granulated to a micro size 1μm as the substrate. Furthermore, the substrate is coated using a PVD method with TiN, TiCN, and/ or TiAlN. The resulting materials are suitable for machining difficult-to-cut materials and demanding high precision small part applications. Inserts in these grades are tougher and harder than carbide and come with ultra sharp cutting edges. This selection of micro-grain carbide grades exhibit excellent wear resistance and thermal crack resistance.

Features

Work material	Grade		Coating		Application	Physical properties*					
						Density g/cm³	Hardness HRA	Bending strength Mpa	Young's modulus GPa	Thermal expansion coefficient ×10⁻⁶/K	Thermal conductivity W/m.K
M Stainless steel	ST4		thick PVD	CrAlN	Best grade for 304 SS	14.4	91.0	3000	580	5.8	63
	DT4		thin PVD	TiAlN	Excellent oxidation resistance for Swiss-type lathes	14.4	91.0	3000	580	5.8	63
	TM4		thin PVD	TiN-TiCN	Best combination of wear resistance, toughness and adhesion resistance for Swiss-type lathes	14.4	91.0	3000	580	5.8	63
	ZM3		thick PVD	TiN	Best adhesion resistance enables high accuracy machining	14.4	91.0	3000	580	5.8	63
	DM4		thick PVD	TiAlN	Best oxidation resistance enables high temperature machining	14.4	91.0	3000	580	5.8	63
P Steel	QM3		thick PVD	TiCN	Best wear resistance enables stable machining	14.4	91.0	3000	580	5.8	63
	VM1		thin PVD	TiCN	Best edge sharpness and good wear resistance	14.8	92.0	2500	640	5.7	84
	CP7		thick CVD	Al_2O_3-TiCN	Roughing to semi-finishing of steel	13.8	90.1	2200	580	-	-
K Cast iron	CP1		thick CVD	Al_2O_3-TiCN	For cast iron and ductile cast iron	14.9	92.0	2400	640	-	-
N Non-ferrous material	KM1		uncoated	-	Best for non-ferrous material with a polished mirror finish surface	14.8	92.0	2500	640	5.7	84
M P N	AC3		thin PVD	TiAlN-TiAlCrN	Developed for solid carbide endmills	14.2	91.0	3000	560	6.1	49

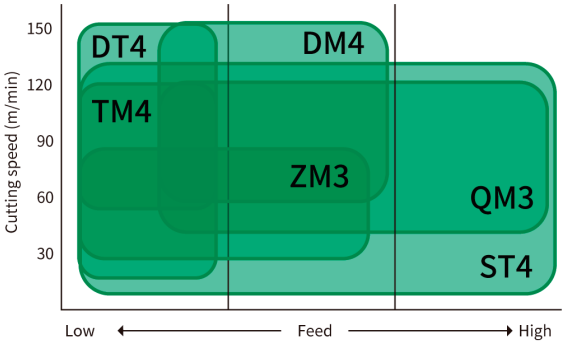
※The values of the base material are indicated.

Coating specifications

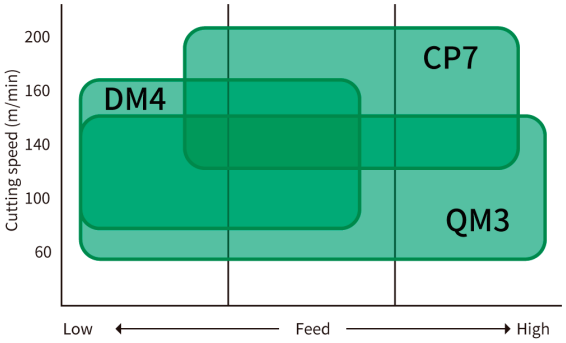
	ST4	QM3	DM4	DT4	TM4	VM1	ZM3
Thickness	Thick	Thick	Thick	Thin	Thin	Thin	Thick
Wear resistance	○	◎	○	○	○	○	
Heat resistance	○		◎	◎			○
Adhesion Resistance	◎				○		◎
Edge Sharpness				○	○	◎	
Composition	CrAlN	TiCN	TiAlN	TiAlN	TiN-TiCN	TiCN	TiN

◎1st choice ○2nd choice

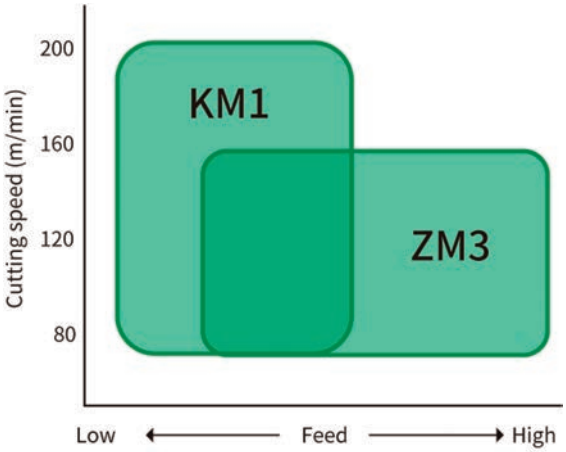
Stainless steel



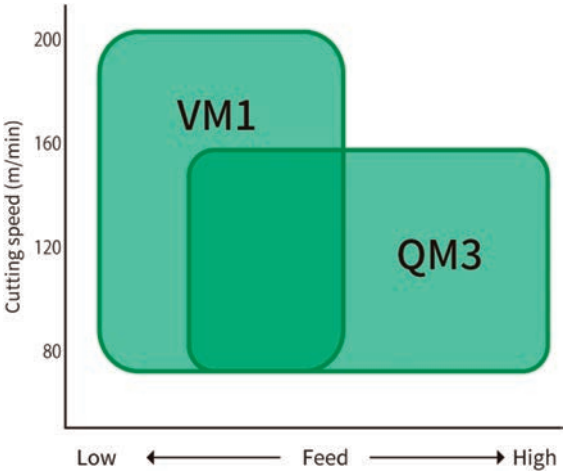
Carbon and alloy steel

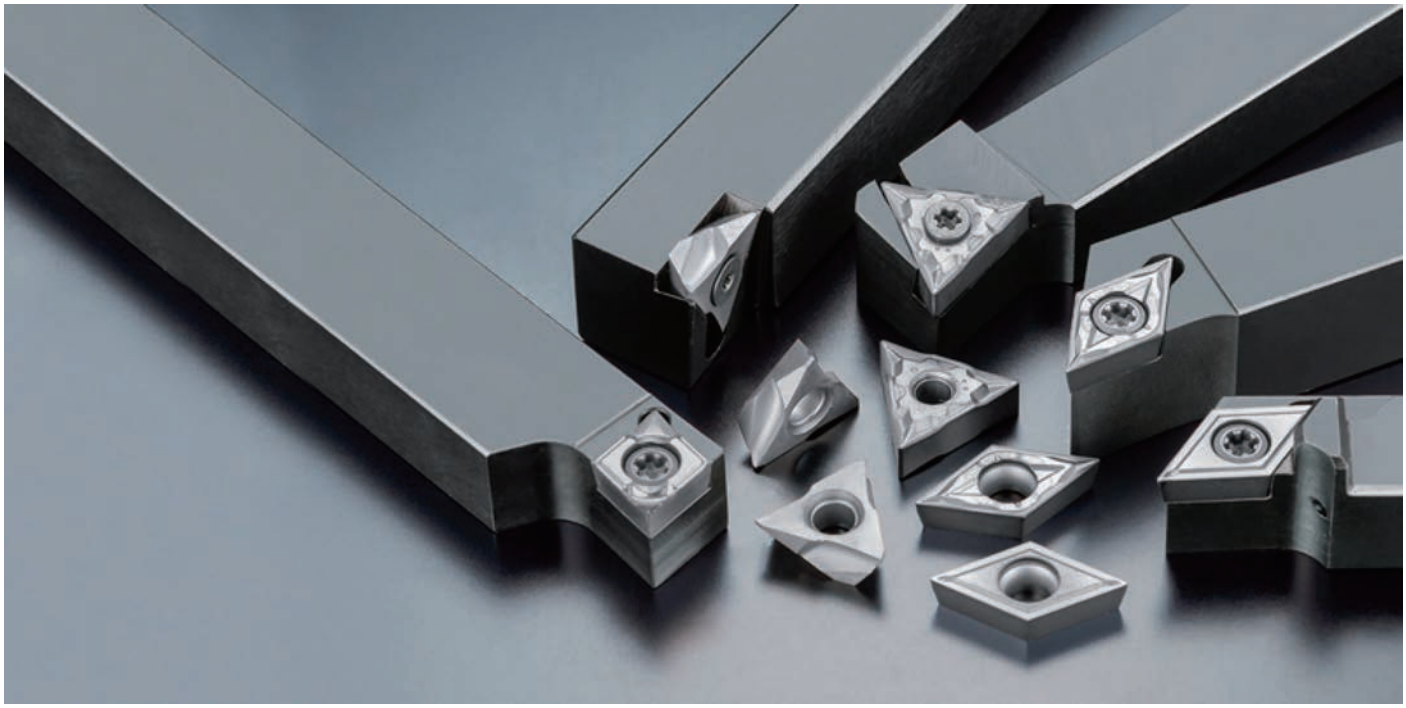


Aluminum and brass



Free-cutting steel





Ideal for stainless steel machining | PVD coated carbide

ST4

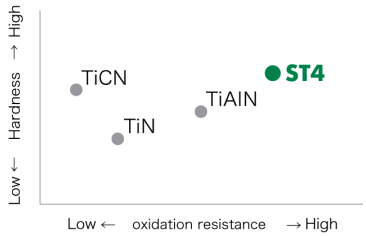
Stable and consistent performance machining tough materials like 304 SS

Solution for stainless steel machining issues like reduced tool life, inconsistency of part dimensions, and poor chip control.

Performance

Unique coating with a high aluminum composition dramatically improves hardness and oxidation resistance.
Extended tool life is achieved by suppressing wear from increased cutting temperatures.

Coating wear and oxidation chart



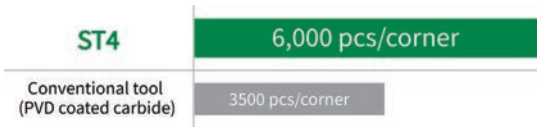
Coating layer adhesion strength

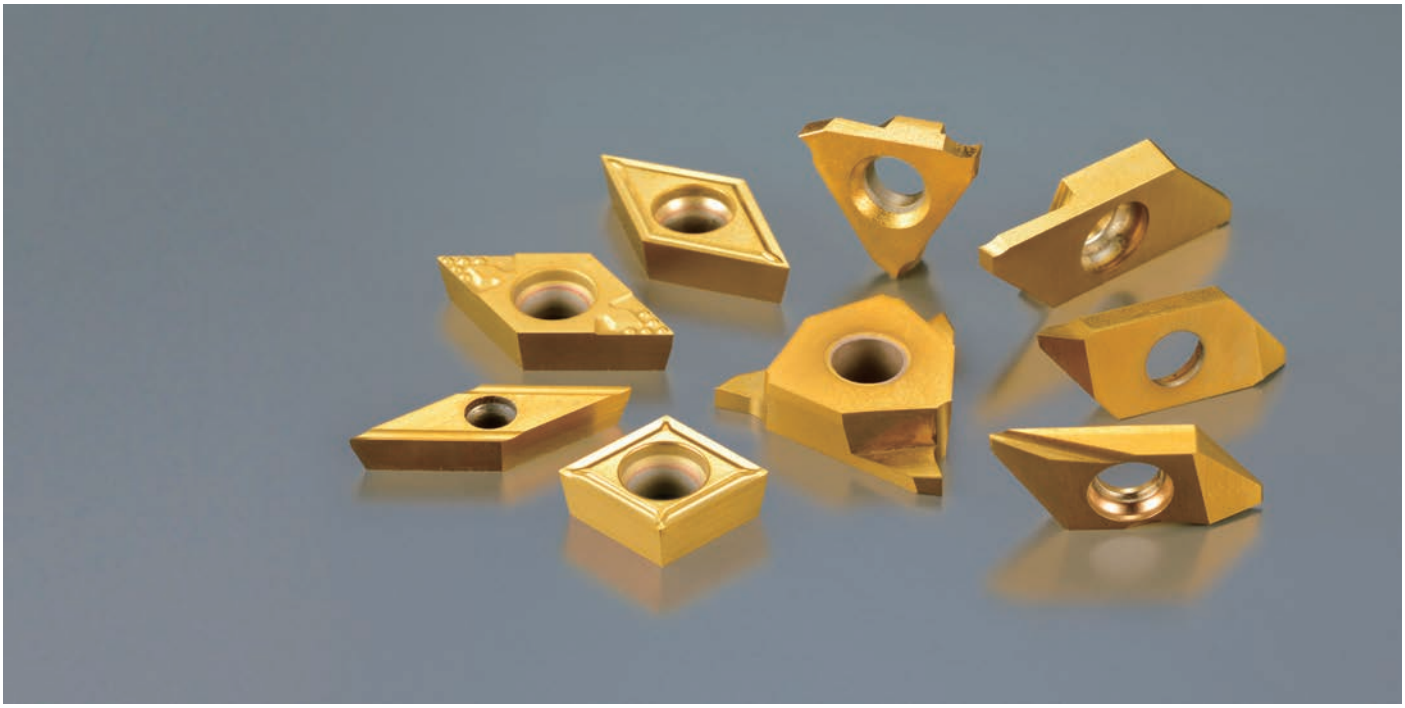
Significantly improved insert surface smoothness and coating adhesion.
Prevents adhesion to the cutting edge, which tends to occur in stainless steel machining, leading to stabilization of dimensional accuracy and machined surfaces.

Case study

ST4 has approximately 1.7 times longer tool life than competitor's tools.

Work material	SUS316L
Cutting speed	60m/min
Feed	End face 0.01mm/rev External 0.03mm/rev
Depth of cut	0.3 - 2.0mm
Coolant	WET





General-purpose machining with excellent adhesion resistance | PVD coated carbide

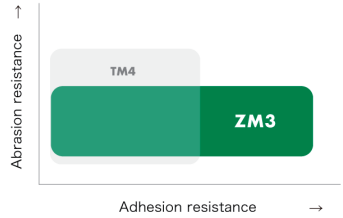
ZM3

Excellent adhesion resistance and dimensional stability, ideal for high-precision machining of small-diameter workpieces

Achieves stable machining with its resistance to built up edge

Performance

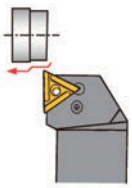
- Stable machining dimensions due to high adhesion of the coating
- Smooth TiN coating provides outstanding adhesion resistance

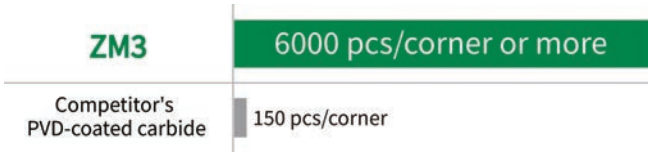


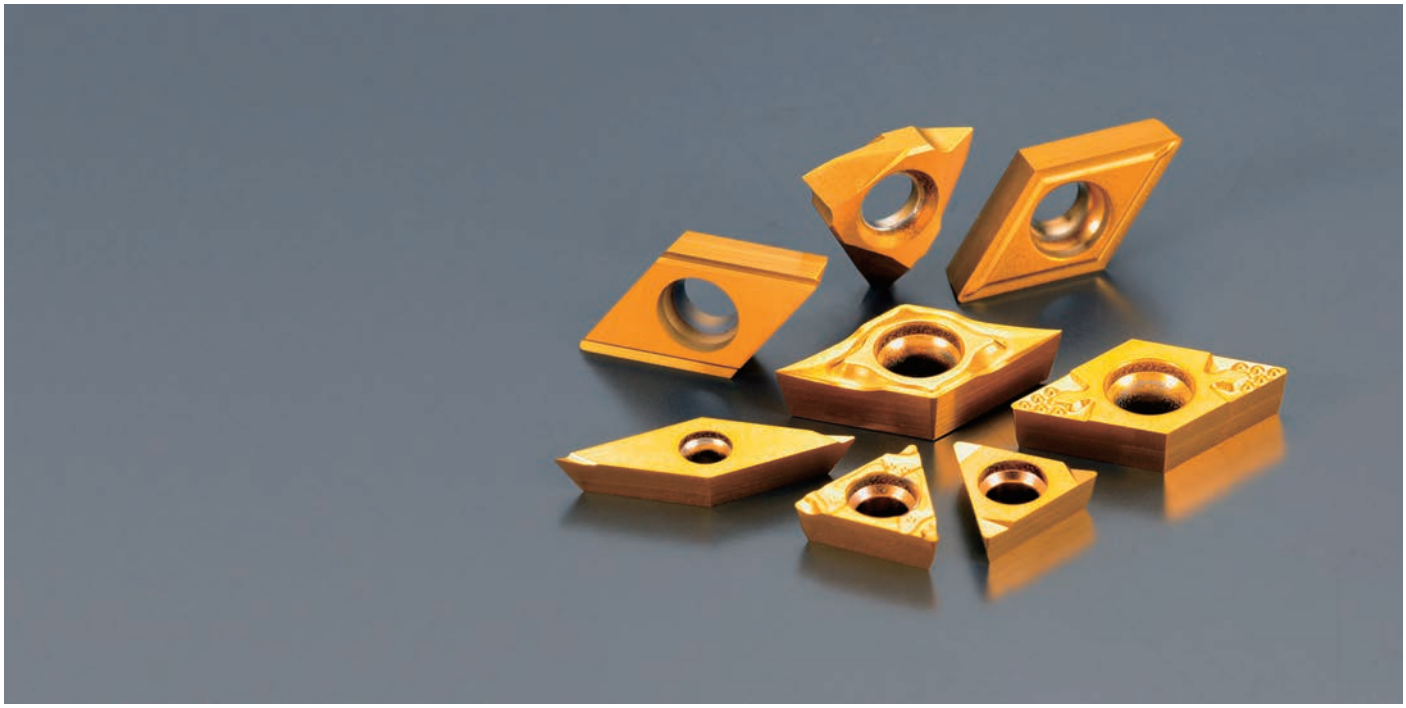
Case study

ZM3 offers outstanding adhesion resistance and dimensional stability with a tool life that is 40 times longer than that of competitor's tools.

Work material	S10C
Cutting speed	100m/min
Feed	0.12mm/rev
Depth of cut	0.3~0.4mm
Coolant	WET







General purpose machining with excellent wear resistance | PVD coated carbide

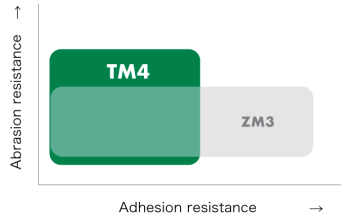
TM4

Versatile grade material for all types of work materials

Easy-to-use grade with excellent sharpness and adhesion resistance

Performance

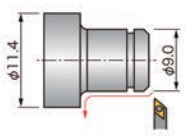
- Excellent workpiece dimensional stability and tool life due to multilayer coating
- A smooth hard coating with excellent adhesion resistance

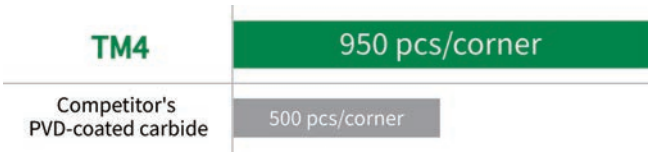


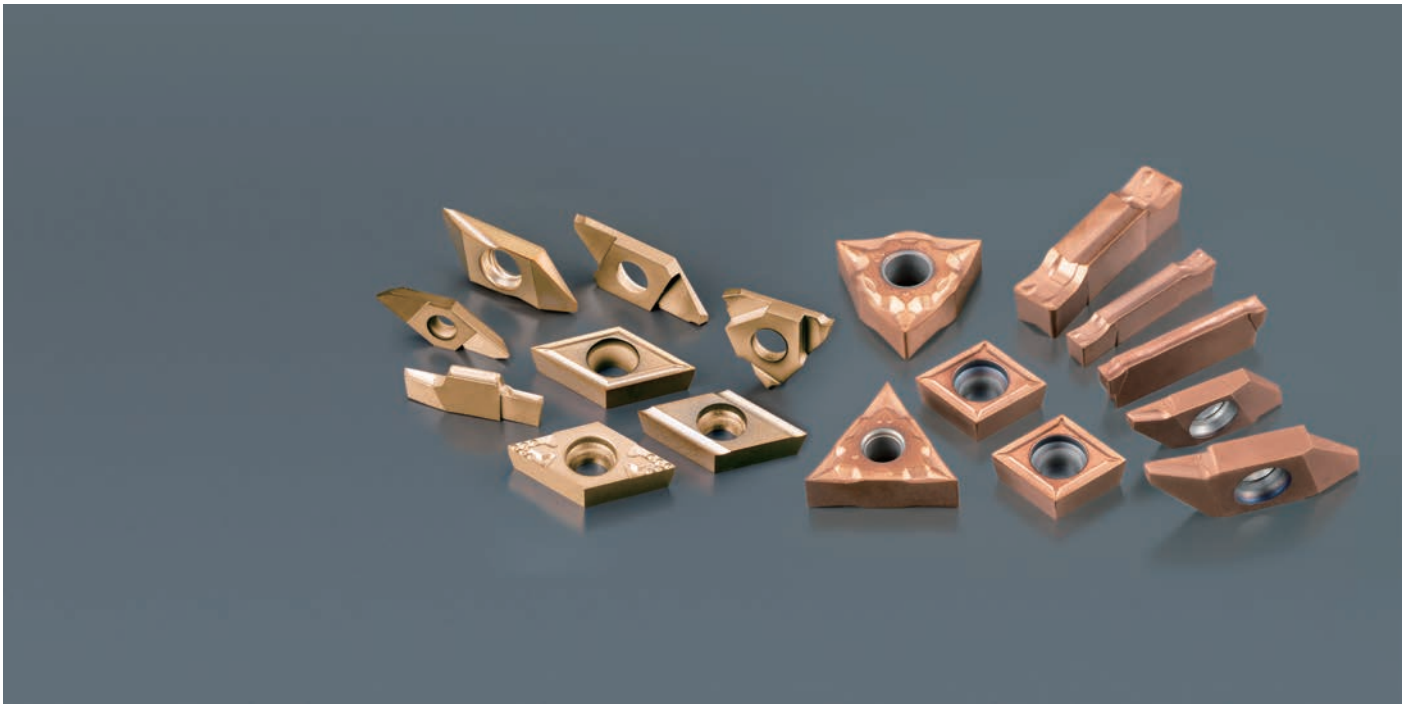
Case study automotive parts

TM4 achieved 1.9 times longer tool life than the competitor's product. Its superior wear resistance ensured long stable machining.

Work material	SUS304
Cutting speed	80m/min
Feed	0.02mm/rev
Depth of cut	-1.2mm
Coolant	WET







Machining difficult-to-cut materials | PVD-coated carbide

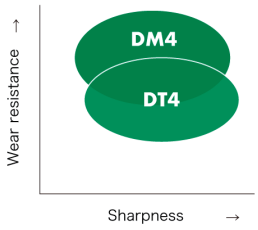
DT4 / DM4

Ideal for machining difficult-to-cut materials such as titanium and heat-resistant alloys

Stable machining even under conditions where cutting heat tends to concentrate on the cutting edge

Performance

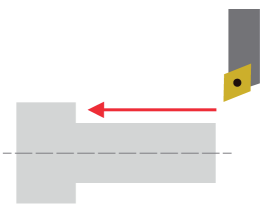
- Thick TiAlN coating reduces cutting tool damage due to machining heat.
- DT4 has a thin coating layer. A sharp cutting edge ideal for machining small diameter parts.
- DM4 has a thick coating layer. A combination of heat resistance and wear resistance makes it ideal for high load machining such as parting and grooving.

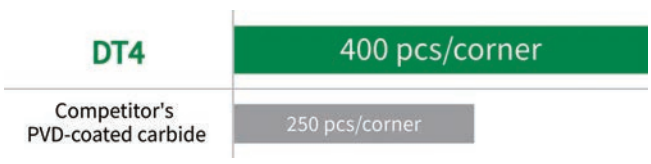


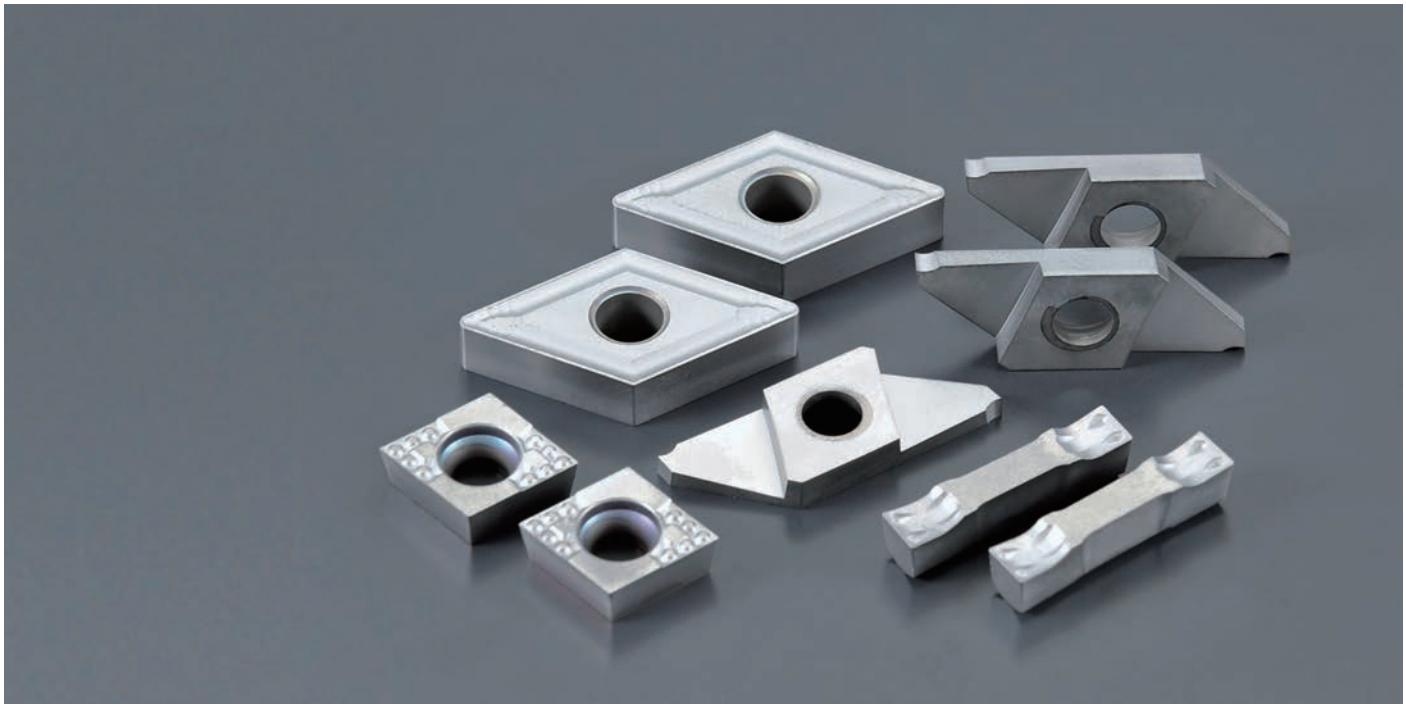
Case study medical screw

DM4 achieved approximately 1.6 times longer tool life than the competitor's product.

Work material	Titanium alloy
Cutting speed	60m/min
Feed	0.02mm/rev
Depth of cut	0.5mm
Coolant	WET







Carbon and alloy steel machining | PVD coated carbide

QM3

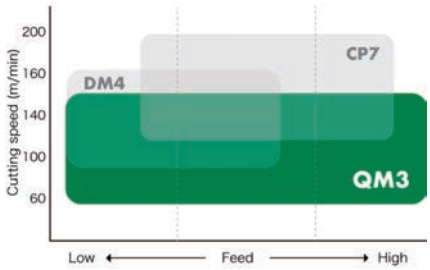
Longer tool life and stable machining of carbon and alloy steels such as S45C and SCM materials

Excellent wear resistance ensures stable machining and extended tool life

Performance

- Combination of tough carbide material and TiCN coating provides excellent chipping resistance.
- Excellent wear resistance, especially in the low speed range.
- Stable machining even in heavy interruptions.

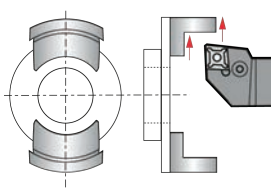
Application area

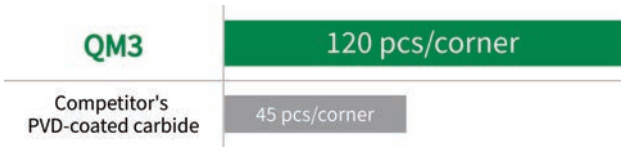


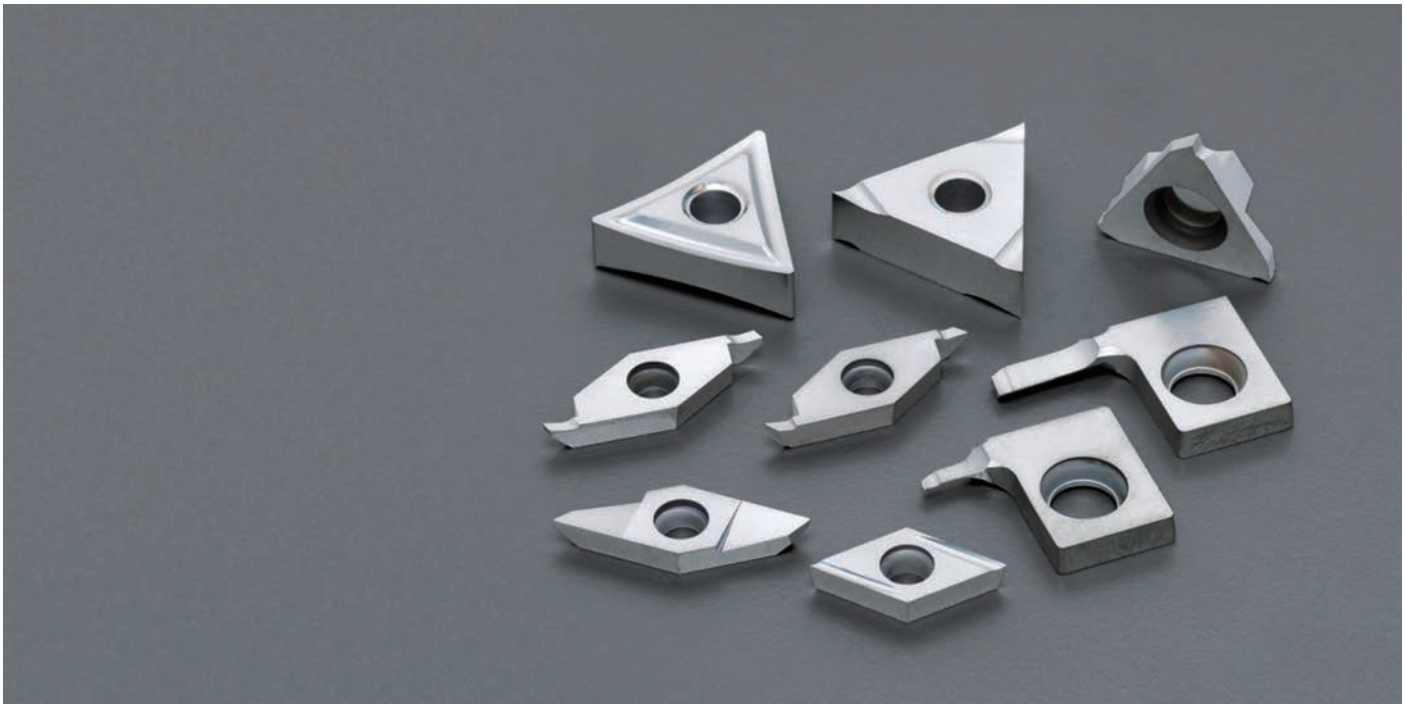
Case study

The combination of QM3 and Z5 chipbreaker extends the tool life by more than 2.5 times, while the competitor's tool experienced unstable tool life.

Work material	S50C
Cutting speed	156m/min
Feed	0.33mm/rev
Depth of cut	1.5mm
Coolant	WET







Free-cutting steel machining | PVD-coated carbide

VM1

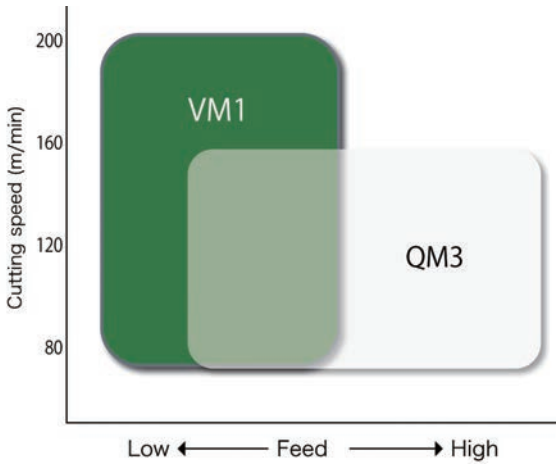
Ideal for machining free-cutting steel (SUM)

Long-tool life machining is achieved by reducing the built up edge on the cutting edge.

Performance

- Thin-layer TiCN coating provides both outstanding sharpness and wear resistance.
- Achieves long tool life and high-precision machining even at high speeds.

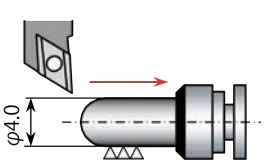
Application area

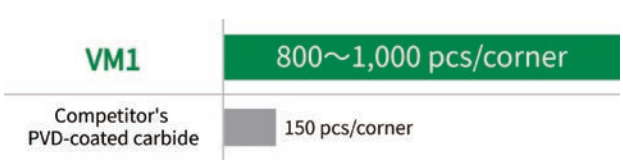


Case study

VM1 is stable in both dimensions and surface finish and has 5 times longer tool life than the competitor's product.

Work material	SUM24L
Cutting speed	140m/min
Feed	0.015mm/rev
Depth of cut	0.1mm
Coolant	WET





High-speed machining of carbon and alloy steel | CVD coated carbide

CP7

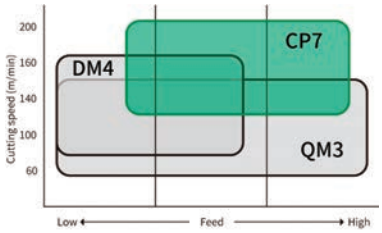
Ideal for high-speed machining of alloy steel and carbon steel

CVD multilayer coating for outstanding performance machining steel

Performance

The CVD multi-layer coating and high strength base material provides excellent wear resistance and toughness that can be used in a wide range of applications.

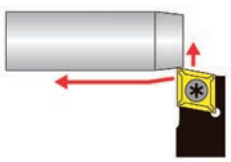
Application area

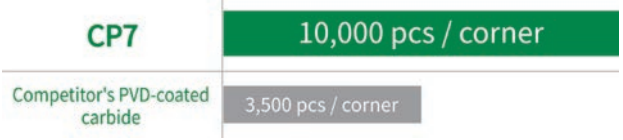


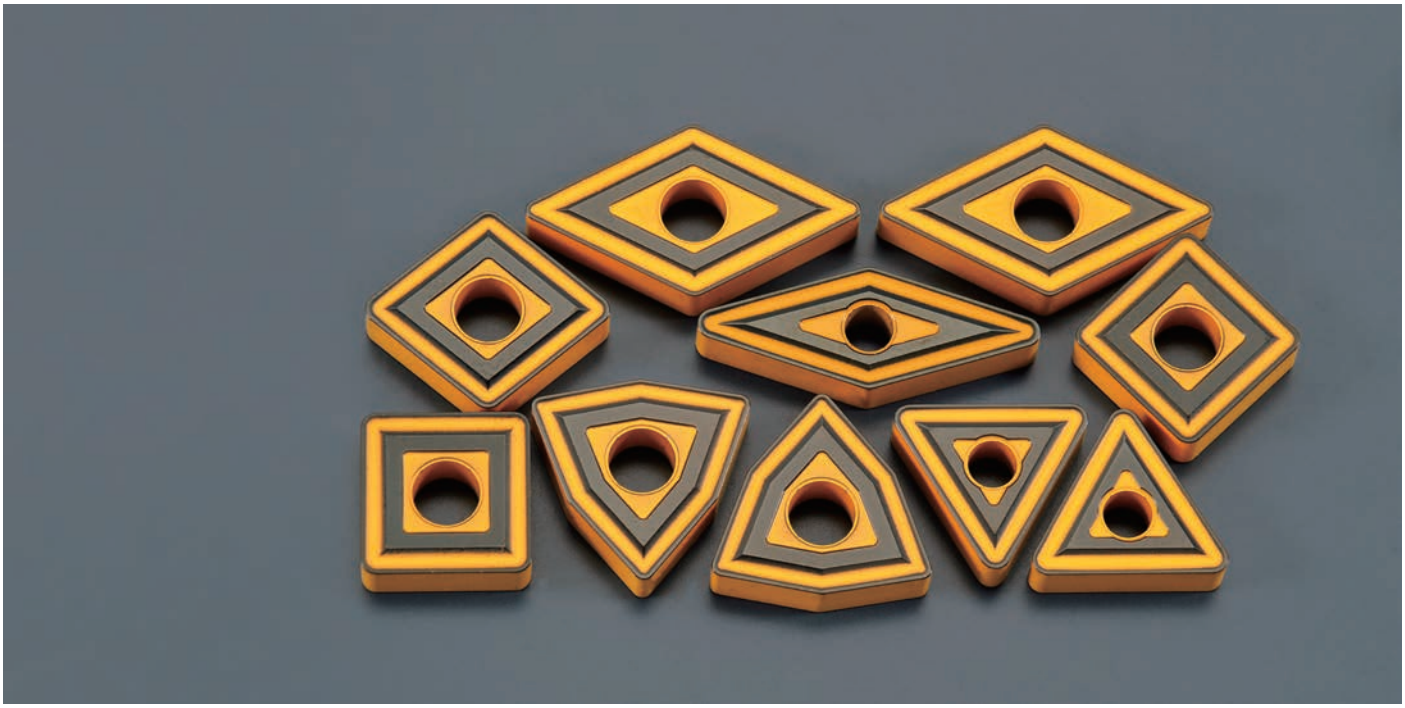
Case study

Achieves approximately 3 times the tool life of the competitor's coated carbide.
Wide range of applications are possible.

Work material	SUJ2
Cutting speed	90m/min
Feed	0.15mm/rev
Depth of cut	0.5mm
Coolant	WET







Grey cast iron and ductile cast iron with scale machining | CVD coated carbide

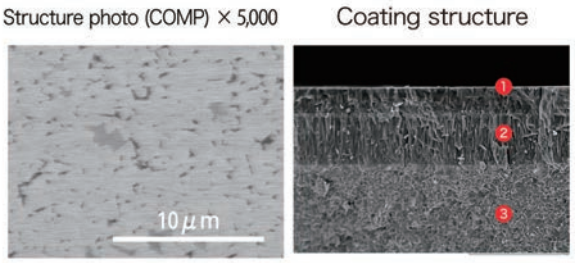
CP1

Achieves high efficiency and stable machining even under conditions where cutting speed cannot be increased

Outstanding wear resistance at Vc=~300m/min

Performance

- Specializing in scale machining of grey and ductile cast iron.
- Excellent wear resistance and stable machining are achieved with a thick TiCN layer and an Al2O3 layer in the coating.
- Unique rake face surface smoothing process provides superior performance in adhesion resistance.



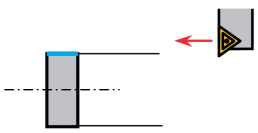
Equivalent to HRA 91.3
Young's modulus: 640GPa

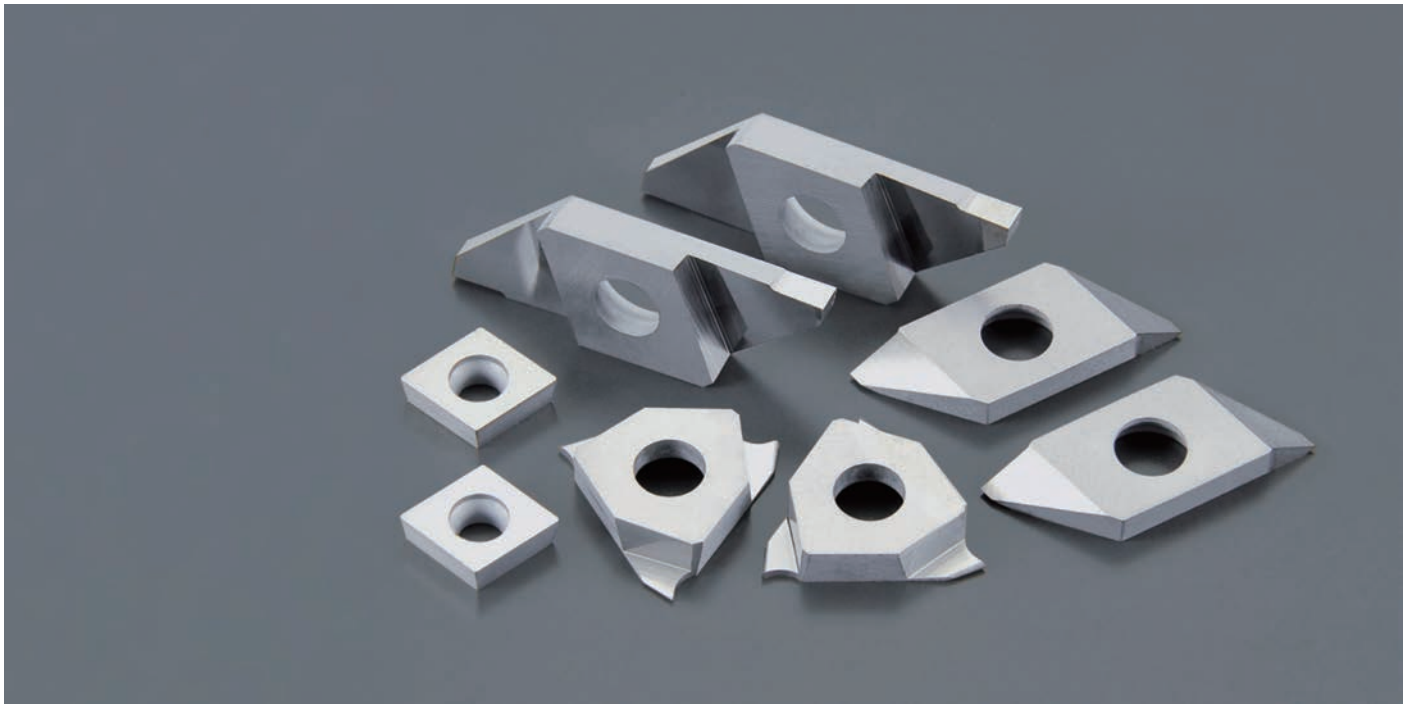
① A very smooth layer of fine grain Al2O3
② Fine column shaped grain TiCN layer
③ Ultra - hard carbide base material

Case study

CP1 achieves higher machining efficiency than competitor's tools.

Work material	FCD450
Cutting speed	200m/min
Feed	0.12mm/rev
Depth of cut	1.0m
Coolant	WET





Nonferrous metal machining, cost effective | Uncoated carbide

KM1

Ideal for machining non-ferrous metals such as aluminum, brass, and resin

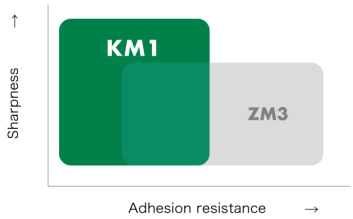
Excellent machined surfaces are achieved by reducing the occurrence of built up edge

Outstanding sharpness solves the problem of a rough machined surface

Performance

- Uncoated fine-grained carbide with excellent sharpness.
- Mirror polished surface reduces built up edge.
- Stable machining dimensions and excellent surface finishes.

KM1 comparison chart



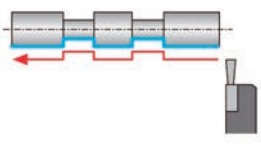
Up sharp edges and mirror finish

Case study

The competitor's product machined 3 roughing passes and a finishing pass. The chips often scratched the workpiece. The cycle time was more than 3 minutes.

The KM1 machined in a single pass, reducing the cycle time to 1 minute and 50 seconds.

Work material	A5056
Cutting speed	90~170m/min
Feed	0.04mm/rev
Depth of cut	0.5~5.0mm
Coolant	WET



End mill tools | PVD coated carbide

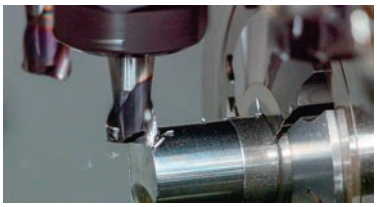
AC3

Developed for solid carbide end milling

Ideal for end milling of small-diameter workpieces that are prone to chattering, or applications that have problems with burrs forming

Performance

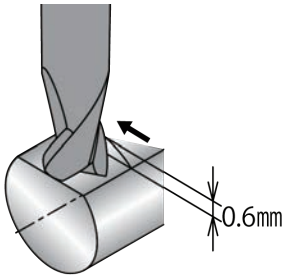
- TiAlN-TiAlCrN coated + fine grain carbide
- Grade with both excellent sharpness and wear resistance required for end milling on CNC type automatic lathes

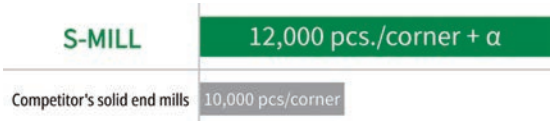


Case study

The current tool created a cloudy machined surface when it reached the end of its tool life. The S-Mill achieved good surface finish and an extended tool life.

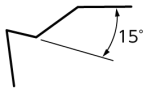
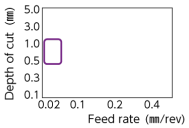
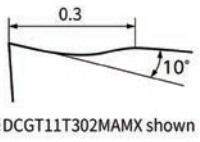
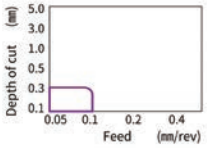
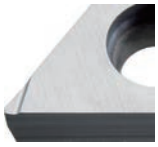
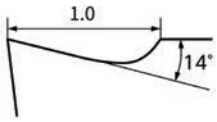
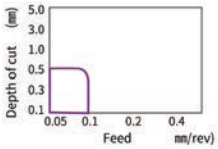
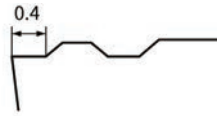
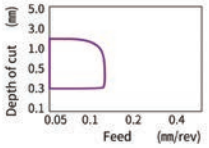
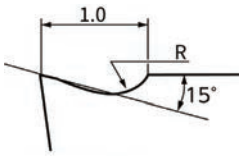
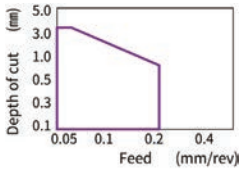
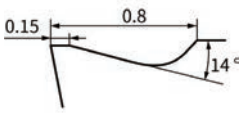
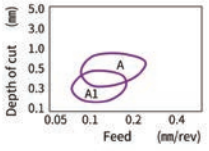
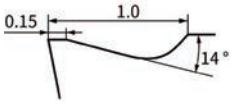
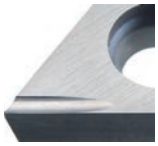
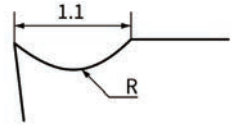
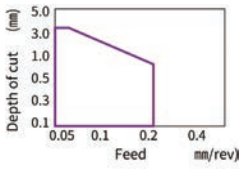
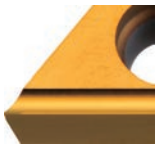
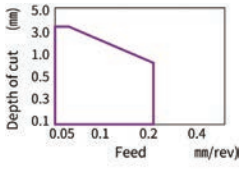
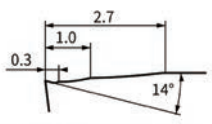
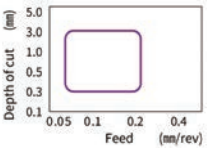
Work material	SUS416F
Cutting speed	3,200rev/min
Feed	140mm/min
Depth of cut	0.6mm
Coolant	WET



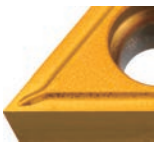
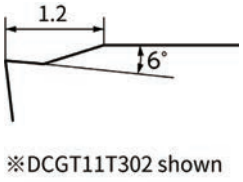
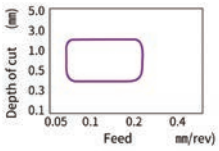
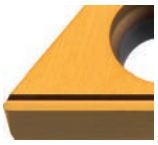
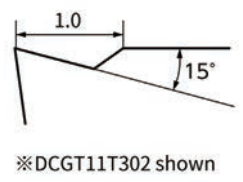
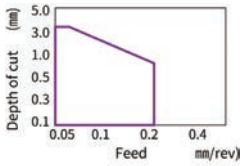
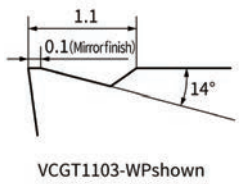
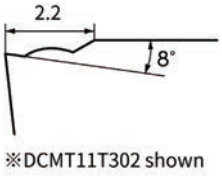
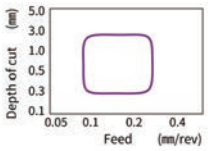
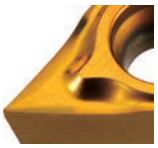
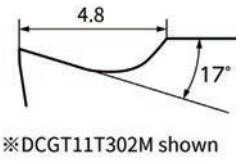
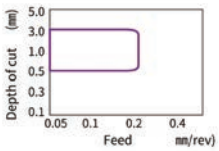
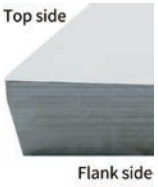
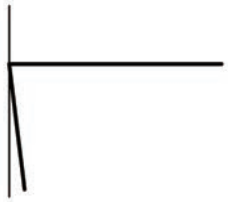


Chipbreaker for turning

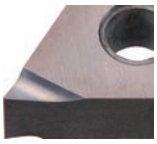
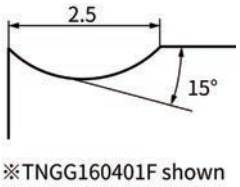
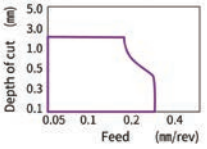
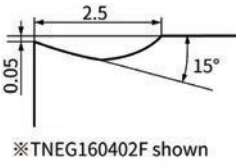
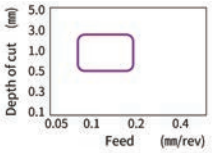
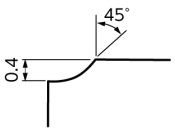
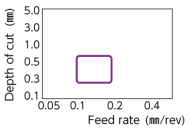
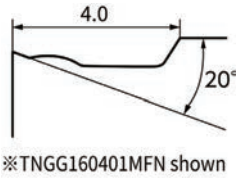
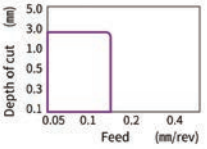
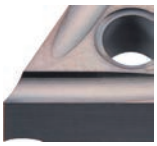
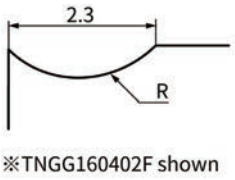
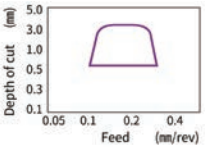
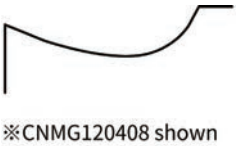
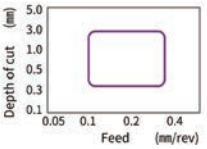
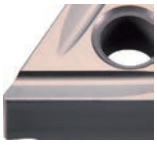
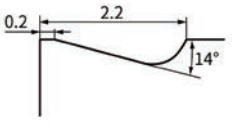
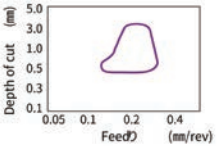
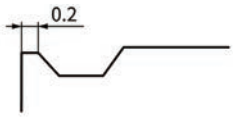
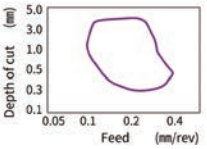
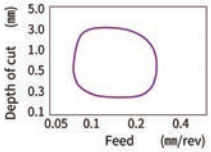
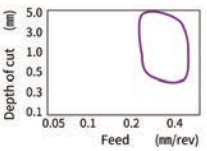
OD turning positive inserts

	Name	Chipbreaker geometry		Features	Chip control range
Finishing	TMV			• Chipbreaker for Vibration Cutting • Reliably long tool life and stable chip evacuation during vibration cutting	
	AMX		 ※DCGT11T302MAMX shown	• Designed for very light depth of cut	
	KHG		 ※DCET11T302 shown	• Excellent chip control on finishing cuts • For super high-precision machining • Precision tolerance in corner radius: ±0.01	
	AZ7		 ※DCGT11T302MFN shown	• Excellent chip control at light feed and light depth of cut	
	AT		 ※DCGT11T302 shown	• Excellent adhesion resistance with dimensional stability • Best for small diameter parts and for machining low carbon steels	
For light cut	A1		 ※CPGH040102 shown	• Tough cutting edge and good chip control • General-purpose ID chipbreaker	
	A		 ※CPGH080202 shown		
	UHG		 ※DCET11T3008R shown	• Excellent chip control on finishing cuts • Precision tolerance in corner radius: ±0.01	
	U U1		 ※DCGT11T302 shown	• Sharp cutting edge prevents materials from work hardening [chipbreaker width] U →1.1mm U1→1.6mm	
	YL		 ※DCGT11T302MYL shown	• Great combination of sharpness and toughness • Excellent chip control	

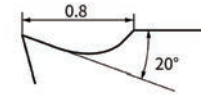
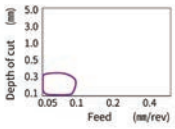
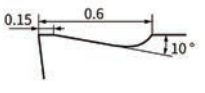
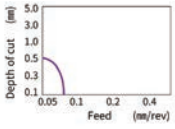
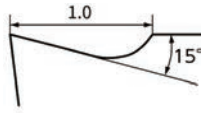
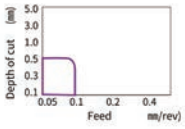
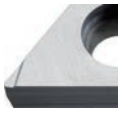
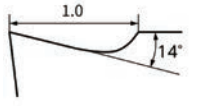
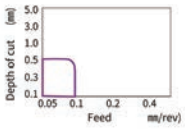
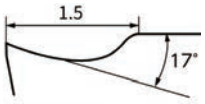
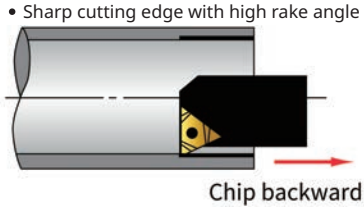
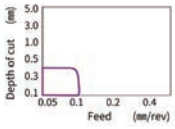
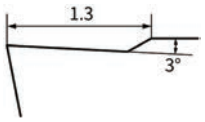
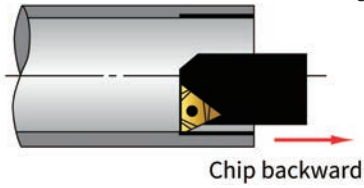
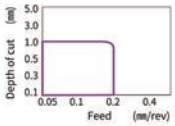
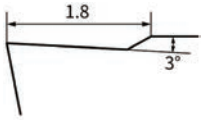
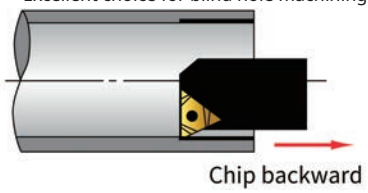
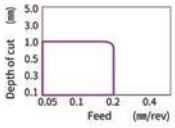
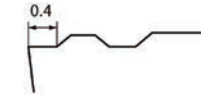
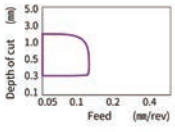
OD turning positive inserts

	Name	Chipbreaker geometry		Features	Chip control range
For Middle Cut	AM3			• All purpose chipbreaker • Sharp edge with toughness	
	S			• Standard ground chipbreaker with wide cutting condition coverage • Sharp cutting edge with excellent chip control	
	SX				
	AZ8			• Superior cutting quality and versatile breaker with CVD coating	
	CL			• Sharpest molded chipbreaker • Excellent chip control • Less tool pressure	
For non-ferrous	V P H			• Very up-sharp edge with mirror finish • V: Mirror finish on Top and Flank side with R0 nose radius • P: Mirror finish on Top and Flank side • H: Mirror finish on Top side	–

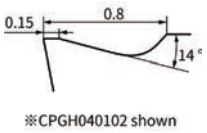
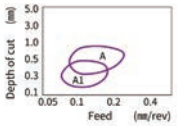
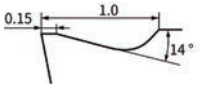
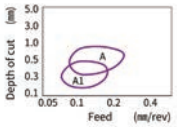
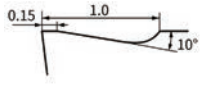
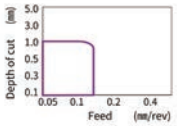
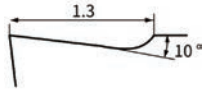
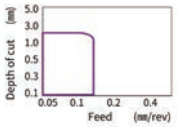
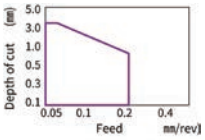
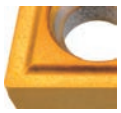
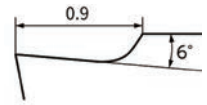
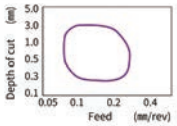
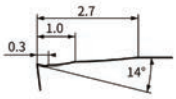
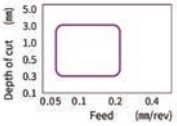
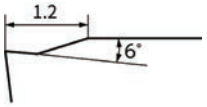
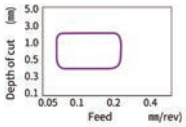
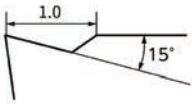
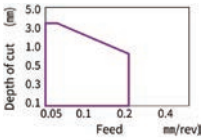
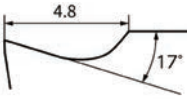
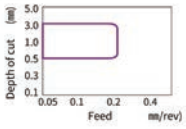
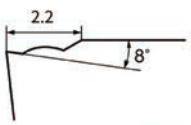
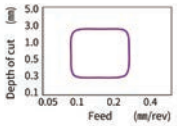
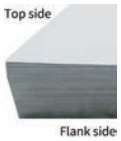
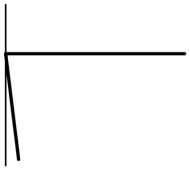
OD turning negative inserts

	Name	Chipbreaker geometry		Features	Chip control range
Finishing	DA		 ※TNGG160401F shown	• Excellent chip control and sharp cutting edge	
	D1		 ※TNEG160402F shown	• Excellent chip control and sharp cutting edge	
	AG			• Resolve chip entanglement, which is likely to occur during machining of low-hardness layer	
For light cut	UL		 ※TNGG160401MFN shown	• Negative insert with a positive insert's chipbreaker • Reduced burr • Improved microfinish • Superb advantage in cost per corner over positive inserts	
For Middle Cut	U2		 ※TNGG160402F shown	• Reduced burr and work hardening due to high rake design	
	ZP		 ※CNMG120408 shown	• Double-positive rake and sharp cutting edge • Low tool pressure even at heavy depth of cut	
	C		 ※TNGG160402F shown	• General-purpose chipbreaker with excellent toughness and chip control	
For Rough Cut	Z5		 ※CNMG120408ENB shown	• Very tough insert • Designed for machining with heavy interruption	
	AM1		 ※VNMG160404 shown	• Tough chipbreaker for roughing with exceptional stability	
	G		 ※CNMG120408 shown	• Tough chipbreaker for roughing with exceptional stability	

ID turning positive inserts

	Name	Chipbreaker geometry		Features	Chip control range
Finishing	A2		 ※ERGHT30102F shown	• Control chips at light feed and light depth of cut • Sharp cutting edge due to large rake angle	
	B1		 ※TCGH060102FV shown	• Stable cutting thanks to sharp and tough cutting edge	
	K		 ※TPGH090202FL shown	• Superb chip control on finishing applications • Sharp cutting edge with the high rake angle	
	KHG		 ※DCET11T302 shown	• For super high-precision machining • Precision tolerance in corner radius: ±0.01	
	FG		 ※TPGH110304 shown	• Evacuates chips BACKWARD at light depth of cut • Sharp cutting edge with high rake angle 	
	F05		 ※TPGH060102F shown	• Evacuates chips BACKWARD • Excellent choice for blind hole machining 	
	F1		 ※TPGH110302F shown	• Evacuates chips BACKWARD • Excellent choice for blind hole machining 	
	AZ7		 ※DCGT11T302MFN shown	• Excellent chip control at light feed and light depth of cut	

ID turning positive inserts

	Name	Chipbreaker geometry		Features	Chip control range
For light cut	A1		 ※CPGH040102 shown	• Tough cutting edge and good chip control • General-purpose ID chipbreaker	
	A		 ※CPGH080202 shown	• Tough cutting edge and good chip control • General-purpose ID chipbreaker	
	B2		 ※TPGH090202FV shown	• Stable cutting thanks to sharp and tough cutting edge	
	B3		 ※TPGH090202F shown	• Stable cutting thanks to sharp and tough cutting edge	
	U U1		 ※DCGT11T302 shown	• Sharp cutting edge prevents materials from work hardening [chipbreaker width] U →1.1mm U1→1.6mm	
	AM5		 ※CPGH060202FN shown	• Provides both good cutting performance and chip control	
	YL		 ※DCGT11T302MYL shown	• Great combination of sharpness and toughness • Covers extremely wide range • Excellent chip control	
For Middle Cut	AM3		 ※DCGT11T302 shown	• All purpose chipbreaker • Sharp edge with toughness	
	S		 ※DCGT11T302 shown	• Standard ground chipbreaker with wide cutting condition coverage	
	CL		 ※DCGT11T302M shown	• Sharpest molded chipbreaker • Less tool pressure	
	AZ8		 ※DCMT11T302 shown	• CVD coated chip breaker with excellent sharpness and high versatility.	
For non-ferrous	V P H			• Very up-sharp edge with mirror finish • V: Mirror finish on Top and Flank side with R0 nose radius • P: Mirror finish on Top and Flank side • H: Mirror finish on Top side	–