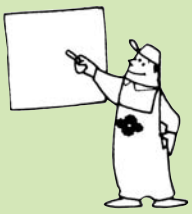
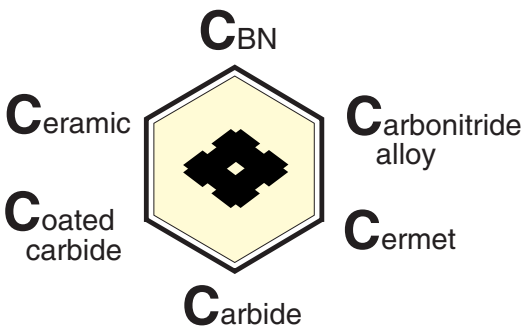
Grades

B

B1 ~ B24





Refer to page L1 ~ and M1 ~ for SumiBoron and SumiDia Products.

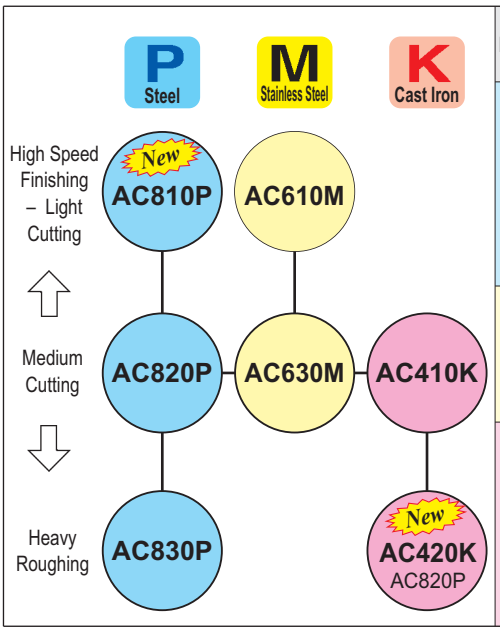
"ACE-Coat" Series

High Efficiency & High Reliability Grades

General Features

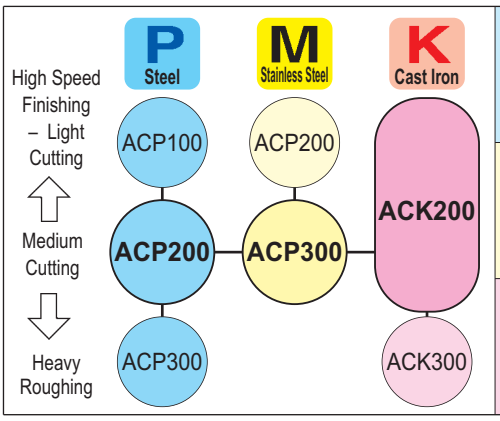
Sumitomo's "ACE-Coat" series for turning features a special substrate with an extra tough layer coated with super hard thin films. All these components enable the insert to have excellent wear resistance, toughness and hardness properties.
Consequently, steels and cast irons can be machined with higher efficiency.

Turning Application



Material	Grade	Characteristic · Application
Steel	New AC810P	• P10 grade provides high wear resistance. • Suitable for high performance machining of steel.
	AC820P	• Excellent plastic deformation and fracture resistance. • Main grade for general machining of steel.
	AC830P	• Very tough grade for strong interrupted cutting and rough machining of steel
Stainless Steel	AC610M	• M10 grade provides high wear resistance. • Suitable for high performance machining of stainless steel.
	AC630M	• Special substrate with high toughness and special wear resist CVD coating. • Main grade for stainless steel.
Cast Iron	AC410K	• K01 grade provides high wear resistance. • Grey cast iron and ductile cast iron high speed continuous machining.
	New AC420K	• High toughness substrate with high adhesive coating for roughing of grey and ductile cast iron.
	AC820P	• Extremely tough grade for hard roughing and heavy interrupted cut of ductile cast iron.

Milling Application

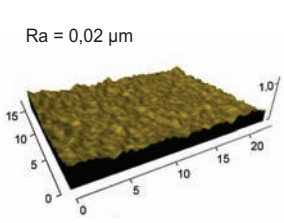


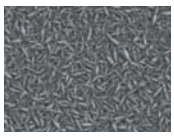
Steel	ACP100	• Excellent thermal cracking resistance and high wear resistance suitable for high speed wet machining of steel
	ACP200	• PVD Super ZX coating provides excellent wear resistance. • Medium to high speed milling of steel.
Stainless Steel	ACP200	• PVD Super ZX coating provides excellent wear resistance. • Medium to high speed milling of steel.
	ACP300	• Super tough substrate with PVD Super ZX-coating • For milling of stainless steel
Cast Iron	ACK200	• Tough fine grades substrate with CVD Super FF coating • For milling of cast iron
	ACK300	• PVD Super ZX coated insert has excellent notch wear resistance. • High speed, high feed milling of cast iron.

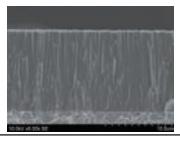
"Super FF"
CVD Coating

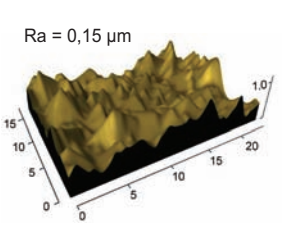
Feature of Coating

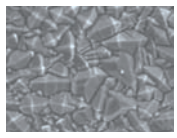
" Super FF"	Conventional coating
Surface roughness	Surface roughness
Ra = 0,02 µm	Ra = 0,15 µm

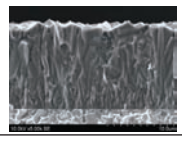






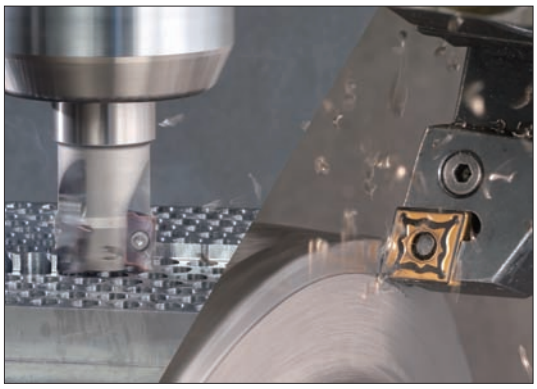






Coated Grade

"Super FF / ZX" Series



General Features

The "Super FF coat" is a smooth multi-layer thin film structure of titanium carbonitride and aluminum oxide which provides improved resistance to chip adhesion and wear. This is newly developed CVD coating which is suitable for higher speed turning and milling applications of Steel and Cast Iron.

The "Super ZX coat" is a newly developed PVD coating with super multi layer structure of TiAiN and AlCrN which provide excellent hardness and oxidation resistance by optimizing Titanium and Aluminum quantity and adding Chromium. This PVD coating is suitable for turning and milling of Steels, Stainless Steels and Non-ferrous metals to increase productivity and to extend tool life.

"Super FF"
CVD Coating

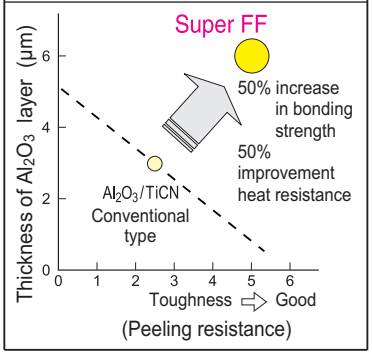
- Higher bonding strength and adhesion resistance by Flat surface of coating
- Higher hardness and strength by ultra Fine grain of MT-TiCN layer
- 1,5 times higher speed and efficiency machining is possible
- Double tool life compared to conventional grades

Application

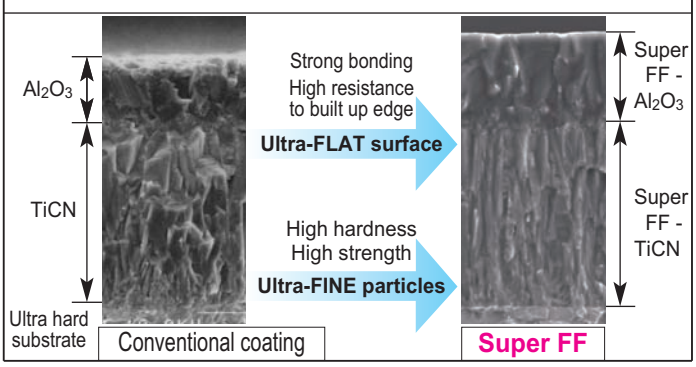
New AC810P, AC820P, AC830P	(For steel turning)
AC410K, AC420K New	(For cast iron turning)
AC610M, AC630M	(For stainless steel turning)
ACP100, ACK200	(For milling)

Characteristics / Performance

● Feature of Coating



● Structure



"Super ZX"
PVD Coating

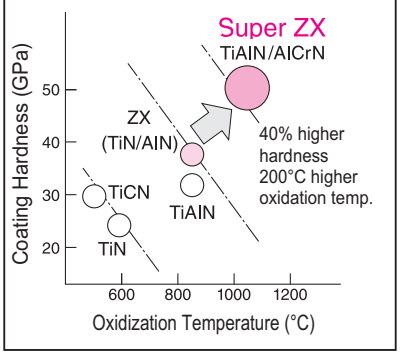
- Super multi layer structure from TiAlN and AlCrN, nano size of each layer
- 40% higher hardness, 200°C higher oxidation temperature
- 1,5 times higher speed and efficiency machining is possible
- Double tool life compared to conventional grades

Application

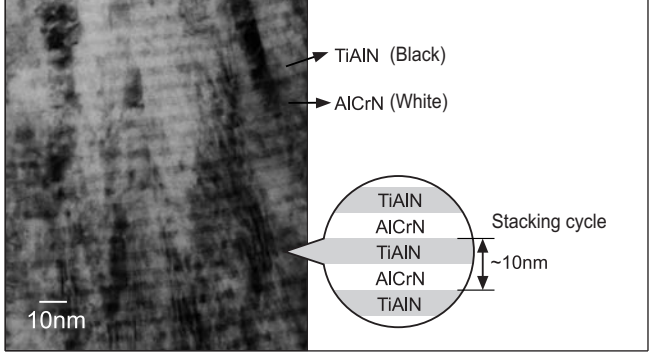
ACP200, ACP300, ACK300	(For milling)
AC510U, AC520U, AC530U	(For turning)

Characteristics / Performance

● New Coating

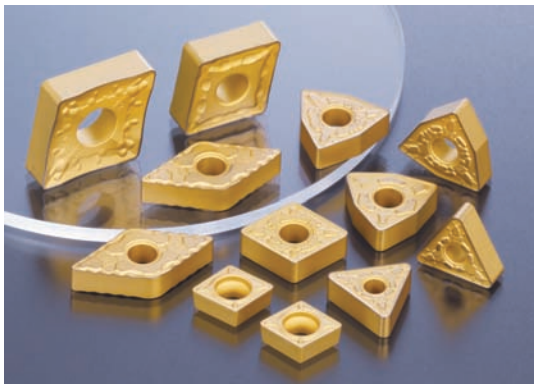


● Layer structure (TEM image)



AC810P / AC820P / AC830P

CVD Coated Grades for Steel

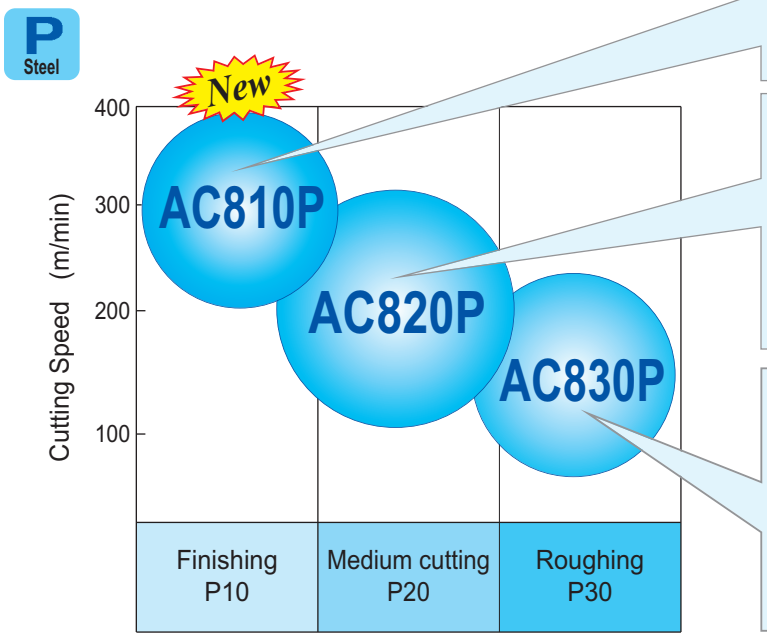


General Features

Super FF coat is a “steel turning technology breakthrough” as the ultra hard coating reduces tool wear even at higher cutting speeds, and the ultra smooth surface via heat reduction at the cutting edge improves surface finish, tool life, and size control. The strong cutting edge enables unfavourable turning applications including interrupted cuts, whilst ceramic layers improve thermal resistance necessary for higher cutting speeds and dry cutting applications.

AC810P/AC820P/AC830P efficiently turns steels across a wide application band and is suitable for low batch quantities and mass production. Increased feed rates improve productivity and increased tool life reduces monthly tooling bills.

Application Range



AC810P
Premium finishing grade at high speeds

The hardness of the cutting edge at high temperatures results in excellent wear resistance at high speeds.

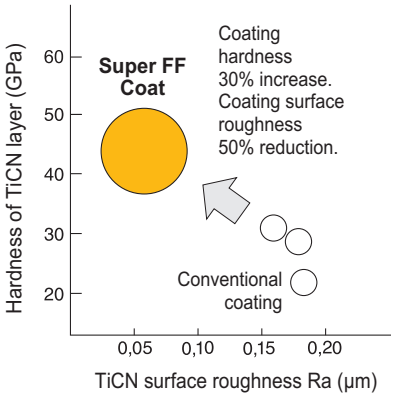
AC820P
General purpose grade

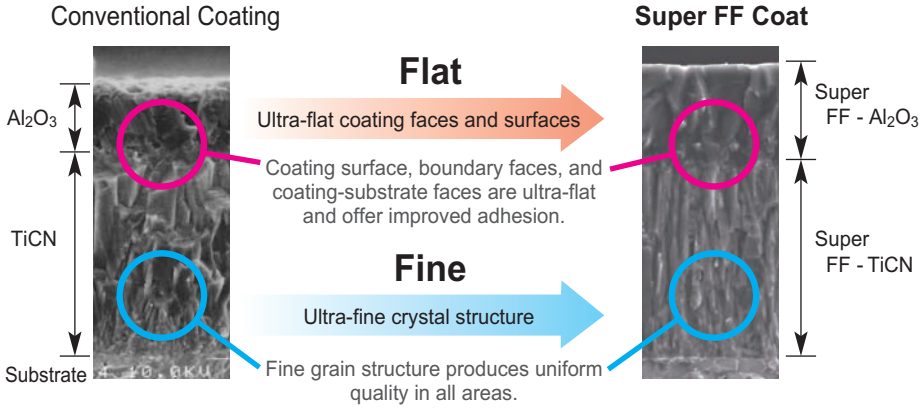
with wide application range eliminates the need to stock alternative grades.
Suitable for medium to light turning operations - removal of rough outer skin - light interrupted cuts and available with new NSE, NGE and NME style chipbreaker’s for optimised chip control at higher feed rates.

AC830P
Super tough grade for roughing

including interrupted cutting - removal of rough outer skin - unstable workholding conditions etc.
Outstanding edge security makes this grade a reliable workhorse in heavy roughing applications across a broad range of cutting speeds and offers increased productivity and significant increases in tool life.

Characteristics / Performance





- High bonding strength of coating layers prevents premature edge failure
- 30% increase on coating hardness and a 50% reduction in coating surface roughness
- 50% increase in feed rates possible for increased productivity

Increased feed rates – Increased tool life

Improved profitability

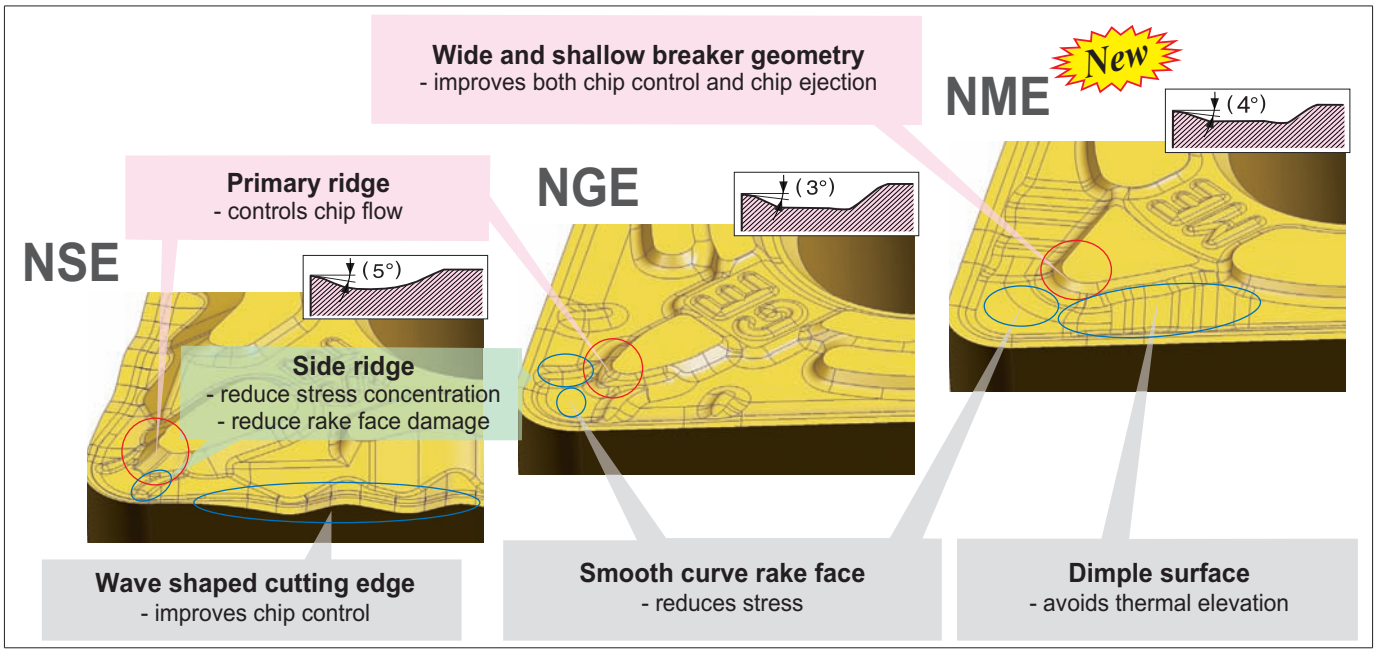
High Feed Chipbreakers

NSE / NGE / NME

The ability to control chip size and chip direction is vital for efficient production, unmanned machining and protection of the tool / workpiece.

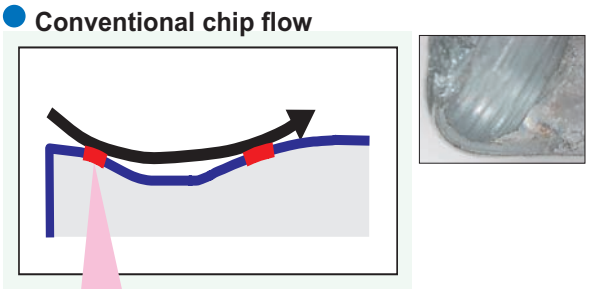
The unique design of three new chipbreakers **NSE** for finishing applications, **NGE** for general purpose turning and **NME** for roughing enables smooth chip flow across a wide range of feed rates even at elevated cutting speeds and increased depths of cut.

Features



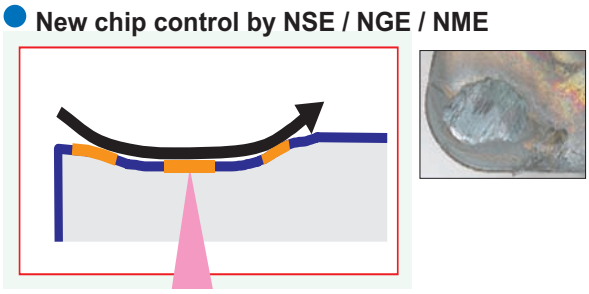
Chip Control

Conventional chip flow



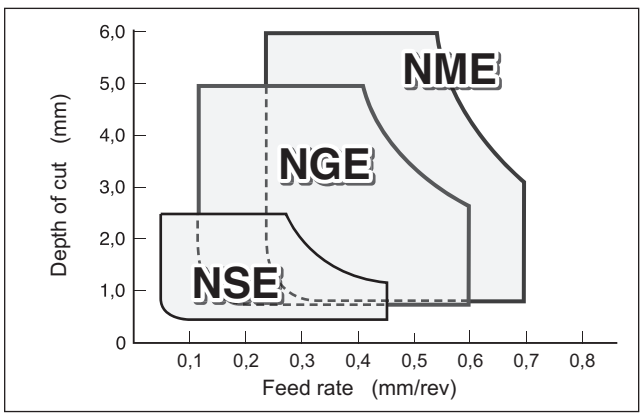
Limited chip contact area increases stress and causes insert damage

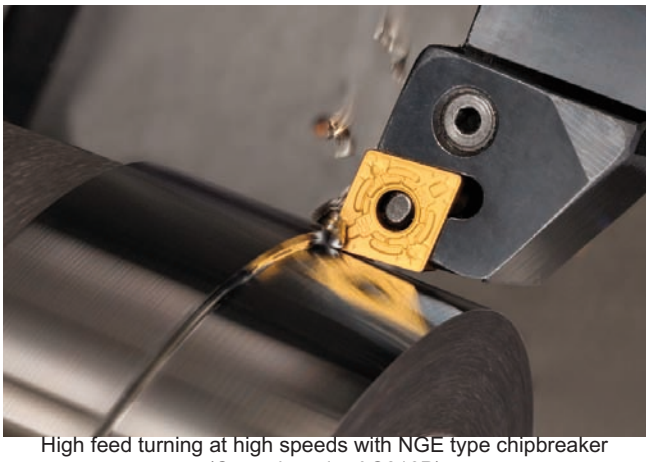
New chip control by NSE / NGE / NME



Smooth flow improves chip direction and shape.

Application Range



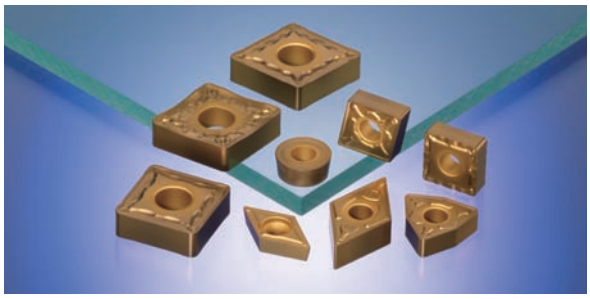


High feed turning at high speeds with NGE type chipbreaker
(Coated grade: AC810P)

ACE-Coat

AC810P / AC820P / AC830P

Recommended Cutting Conditions



■ Recommended Cutting Conditions

(Min.- **Optimum** - Max.)

● Low Carbon Steel (Below HB180)

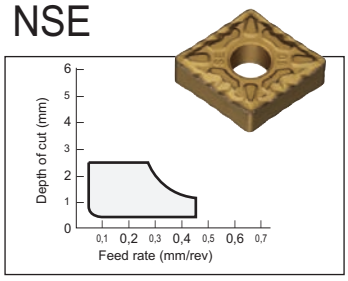
Insert Specification and Chipbreaker		Recommended Cutting Conditions				
		AC810P	AC820P	AC830P	f	d_{oc}
		Vc (m/min)			(mm/rev)	(mm)
CN□□12.. DN□□15.. SN□□12.. TN□□16.. WN□□08..	NLU NSU	**290** (170-430)	**250** (150-350)	**200** (120-300)	**0,2** (0,1-0,4)	**1,3** (0,5-2)
	NSE				**0,3** (0,1-0,45)	
	NGU NUX	**290** (170-430)	**230** (150-300)	**200** (120-300)	**0,3** (0,1-0,45)	**2,2** (0,8-5)
	NGE				**0,4** (0,1-0,6)	
	NMU	**260** (140-360)	**200** (130-280)	**180** (100-250)	**0,35** (0,2-0,6)	**3** (1,8-6)
	NME				**0,45** (0,2-0,7)	**3** (1-6)
	NMP NHG	**220** (140-290)	**180** (100-260)	**150** (100-200)	**0,4** (0,35-0,8)	**4,5** (3-8)
CN□□16.. SN□□15..	NGU NUX	**260** (140-360)	**200** (130-280)	**180** (100-250)	**0,3** (0,15-0,45)	**3,5** (0,8-5)
	NGE				**0,4** (0,1-0,6)	
	NMU	**220** (140-290)	**180** (100-260)	**150** (100-200)	**0,4** (0,2-0,6)	**4,5** (1,8-6)
	NME				**0,45** (0,2-0,7)	**4,5** (1,5-7)
	NMP NHG	**190** (120-260)	**160** (80-240)	**130** (80-180)	**0,6** (0,35-0,8)	**5** (3-8)
CN□□19.. DN□□19.. SN□□19.. TN□□22..	NMU	**220** (140-290)	**180** (100-260)	**150** (100-200)	**0,4** (0,2-0,6)	**5** (1,8-6)
	NME				**0,45** (0,2-0,7)	**4,5** (2-8)
	NMP NHG	**190** (120-260)	**160** (80-240)	**130** (80-180)	**0,4** (0,35-0,8)	**6,5** (3-9)

● Carbon and Alloy Steel (Above HB180)

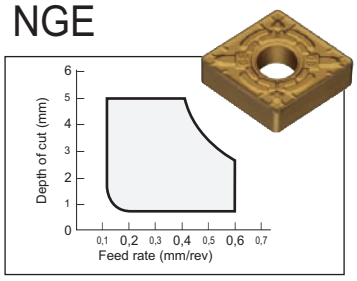
Insert Specification and Chipbreaker		Recommended Cutting Conditions				
		AC810P	AC820P	AC830P	f	d_{oc}
		Vc (m/min)			(mm/rev)	(mm)
CN□□12.. DN□□15.. SN□□12.. TN□□16.. WN□□08..	NLU NSU	**260** (170-360)	**210** (120-300)	**180** (120-250)	**0,2** (0,1-0,4)	**1,3** (0,5-2)
	NSE				**0,3** (0,1-0,45)	
	NGU NUX	**250** (150-350)	**180** (100-270)	**150** (100-200)	**0,3** (0,1-0,45)	**2,2** (0,8-5)
	NGE				**0,4** (0,1-0,6)	
	NMU	**230** (130-330)	**150** (80-230)	**130** (80-180)	**0,35** (0,2-0,6)	**3** (1,8-6)
	NME				**0,45** (0,2-0,7)	**3** (1-6)
	NMP NHG	**140** (100-230)	**130** (60-200)	**100** (70-160)	**0,4** (0,35-0,8)	**4,5** (3-8)
CN□□16.. SN□□15..	NGU NUX	**190** (130-250)	**160** (100-230)	**130** (90-170)	**0,3** (0,15-0,45)	**3,5** (0,8-5)
	NGE				**0,4** (0,1-0,6)	
	NMU	**160** (100-220)	**140** (80-210)	**110** (70-150)	**0,4** (0,2-0,6)	**4,5** (1,8-6)
	NME				**0,45** (0,2-0,7)	**4,5** (1,5-7)
	NMP NHG	**140** (90-200)	**120** (70-180)	**100** (60-140)	**0,6** (0,35-0,8)	**5** (3-8)
CN□□19.. DN□□19.. SN□□19.. TN□□22..	NMU	**160** (100-220)	**140** (80-210)	**110** (70-150)	**0,4** (0,2-0,6)	**5** (1,8-6)
	NME				**0,45** (0,2-0,7)	**4,5** (2-8)
	NMP NHG	**140** (90-200)	**120** (70-180)	**100** (60-140)	**0,4** (0,35-0,8)	**6,5** (3-9)

■ High feed chipbreakers improve productivity

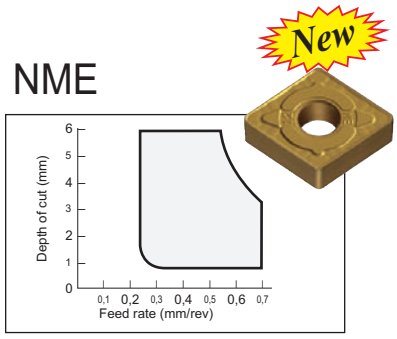
NSE



NGE



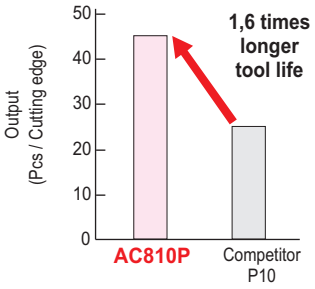
NME



AC810P

Ring / 100Cr6

Insert: CNMG 1606016 NMU
Conditions: v_c=280m/min, f=0,35mm/rev, d_{oc}=1,0mm, Wet

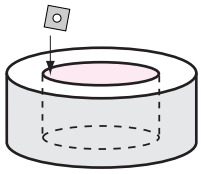


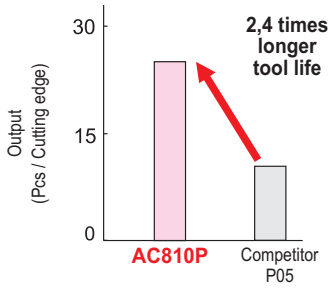
Longer tool life due to high wear resistance

Under exacting test conditions AC810P showed outstanding flank wear resistance and increased tool life by 60% when compared with a leading competitors brand.

Coupling / Ck45

Insert: SNMG 150616 NMU
Conditions: v_c=175m/min, f=0,66mm/rev, d_{oc}=2,6mm, Wet





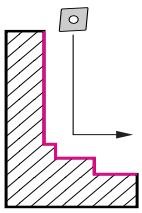
Higher productivity - Improved tool life

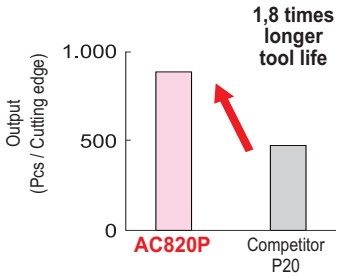
Using AC810P at high feed machining against a competitors P05 grade - tool life improved by 140% due to improved resistance to wear.

AC820P

Turbine Hub / 15CrMo5

Insert: CNMG 120408 NGU
Conditions: v_c=200m/min, f=0,25mm/rev, d_{oc}=2,0mm, Wet



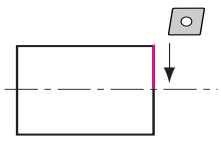


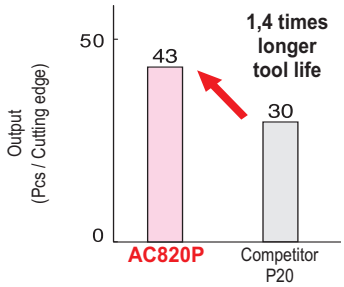
Excellent surface finish on low alloy steel

Using the same cutting data as a competitors P20 grade, we increased tool life by 80%.

Transmission parts / Ck50

Insert: CNMG 120408 NSE
Conditions: v_c=220m/min, f=0,3mm/rev, d_{oc}=0,2mm, Dry





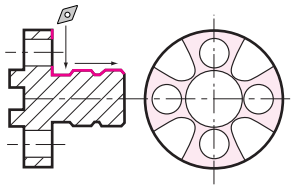
Good chip control and increase tool life

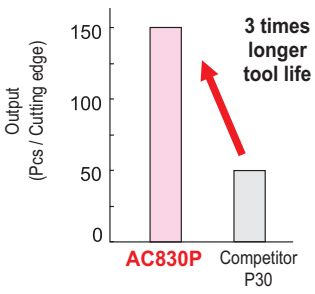
When rake face damage diminished using AC820P against a competitors P20 grade - tool life improved by 40%.

AC830P

Hub / Ck55

Insert: DNMG 150412 NUX
Conditions: v_c=150m/min, f=0,25mm/rev, d_{oc}=1,0mm, Wet



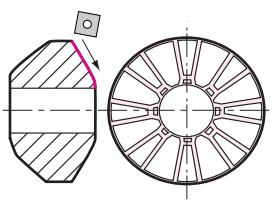


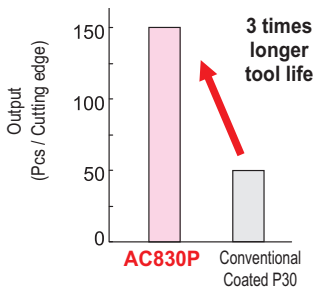
Continuous cutting with heavy interruptions

When machining a component with continuous and interruptions cuts AC830P compared with a P30 competitor's grade increased tool life by 200%.

Pinion Gear / 20Cr4

Insert: SNMG 120412 NUX
Conditions: v_c=170m/min, f=0,35mm/rev, d_{oc}=1,5mm, Wet





Tool life increase on heavy interrupted cuts

It is reasonable to assume some edge condition failure on heavily interrupted cuts but against a competitor's tool at the same cutting speeds the tool life of AC830P increased by 200%.

ACE-Coat

AC410K / AC420K

CVD Coated Grades for Cast Iron

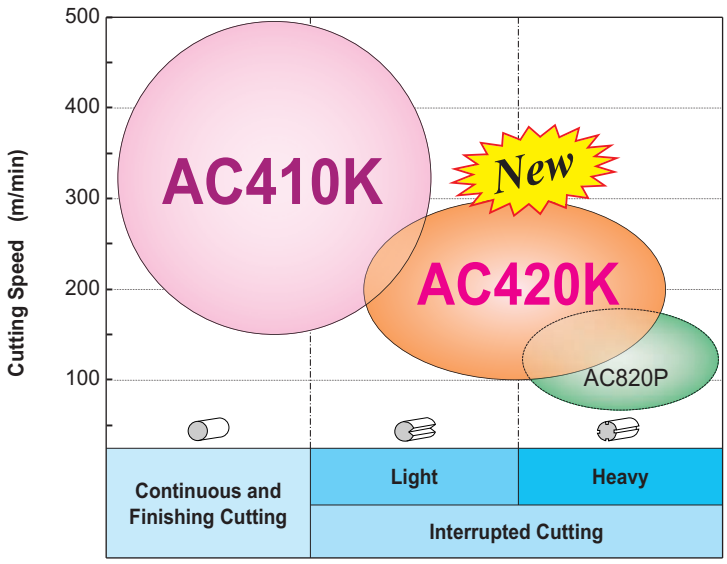
General Features

Developed for Turning FC (Grey Cast Iron) and FCD (Ductile Cast Iron) our premium grades AC410K and AC420K feature a newly developed Super FF coating which is 30% harder and 150% more resistant to chipping and peeling.
AC410K a general purpose grade suitable for continuous cut operations is complimented by AC420K a grade where new stress control technology strengthens the coating for heavy roughing, interrupted cutting and efficient removal of mill scale.

AC410K General purpose grade for continuous and light interrupted cuts.
AC420K Tough grade for roughing operations heavily interrupted cuts and removal of mill scale.

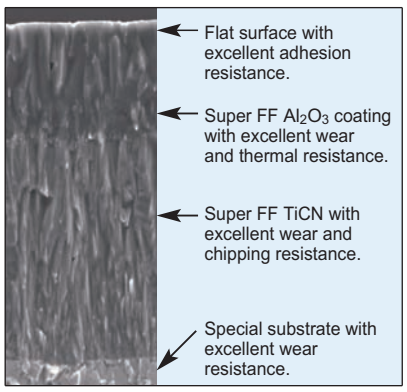
Application Range

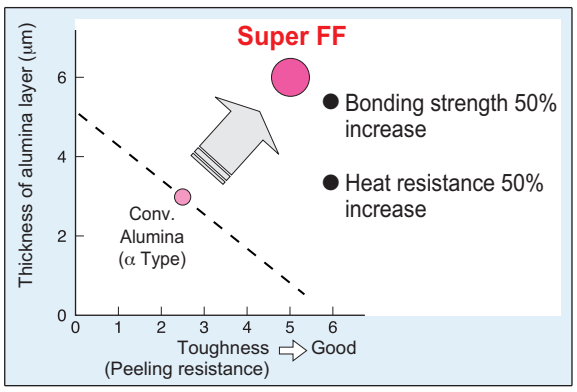
K Cast Iron



AC410K Features

- The newly developed tough Super FF Al_2O_3 film at high temperatures is 30% harder and 150% more resistant to chipping and peeling.
- Compared with a competitors grade the tool life was double.
- The cutting efficiency is improved by 50% substantially improving productivity.
- Suitable for dry machining.





Recommended Cutting Condition

Grey Cast Iron (GG)

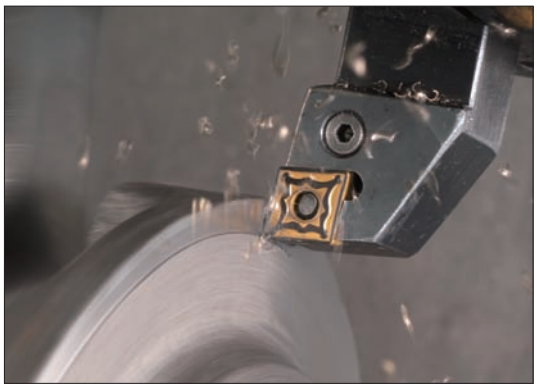
Application	Recommended Grade	Chipbreaker	Cutting Speed (m/min) / Feed (mm/rev)
Light and Continuous Cutting	AC410K	NUZ	200 – 500 / 0,1 – 0,4
Medium ~ Rough Cutting	AC410K	NGZ	150 – 400 / 0,1 – 0,5
Interrupted Cutting	AC420K	NGZ	100 – 300 / 0,1 – 0,5
Heavy Duty Cutting	AC420K	–	100 – 250 / 0,1 – 0,6

Ductile Cast Iron (GGG)

Application	Recommended Grade	Chipbreaker	Cutting Speed (m/min) / Feed (mm/rev)
Light and Continuous Cutting	AC410K	NGZ	150 – 450 / 0,1 – 0,4
Medium ~ Rough Cutting	AC410K	NGZ	150 – 350 / 0,1 – 0,5
Interrupted Cutting	AC420K	NGZ	80 – 220 / 0,1 – 0,5
Heavy Duty Cutting	AC820P	NUX	80 – 180 / 0,1 – 0,5

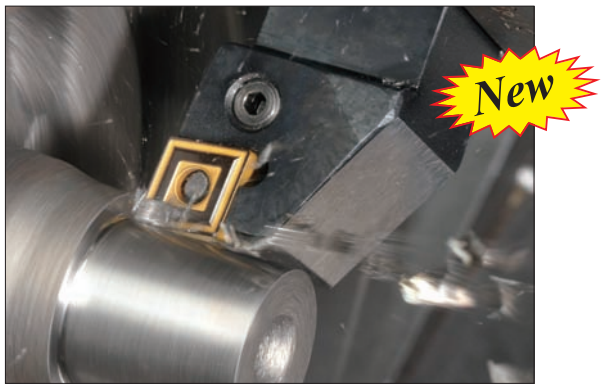
ACE-Coat

AC410K / AC420K



AC410K

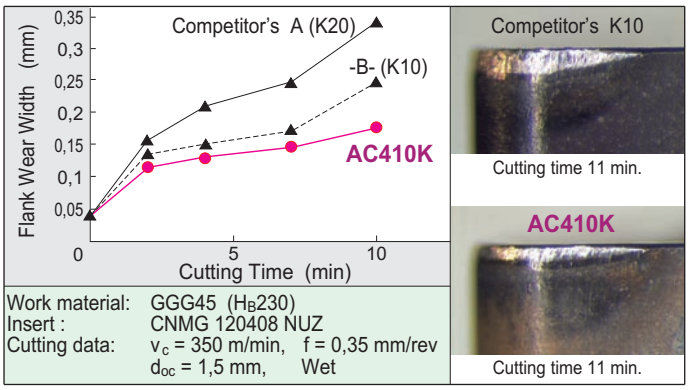
The Super FF coat on grade AC410K is a smooth multilayer thin film structure of titanium carbonitride and aluminium oxide which provides improved resistance to chip adhesion and wear.This newly developed CVD grade is suitable for higher speed turning of ductile cast Iron and grey cast iron in the light to medium rough, continuous cutting application range.



AC420K

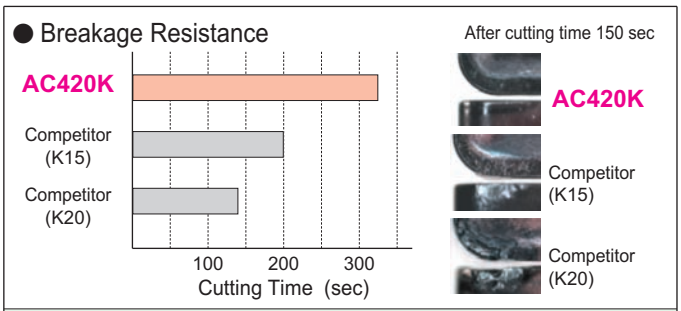
The new AC410K and AC420K offer reliable edge security under extreme conditions, and can be used on roughing and medium to heavy interrupted cut applications.
AC420K compliments heavy roughing grades AC820P for ductile dast iron.

■ AC410K Performance (Continuous Cutting)



Work material: GGG45 (H_B230)
Insert : CNMG 120408 NUZ
Cutting data: v_c = 350 m/min, f = 0,35 mm/rev
d_{oc} = 1,5 mm, Wet

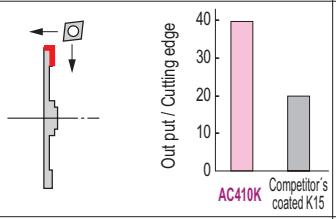
■ AC700G Performance (Interrupted Cutting)



Work material: GGG45
Insert : CNMG 120408
Cutting data: v_c = 350 m/min, f = 0,25 mm/rev , d_{oc} = 1,5 mm, Wet

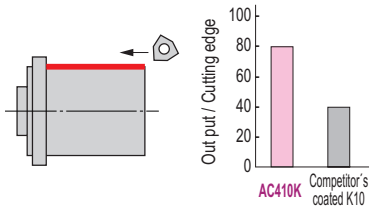
■ Application eg. of AC410K

● GGG60 Wheel



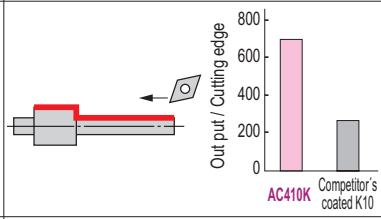
Insert: CNMG 120408 NUX
Cutting data: v_c = 300 m/min
f = 0,2 mm/rev, d_{oc} = 2,0~3,0 mm, Dry

● GGG45 Hub



Insert: WNMG 080408 NUX
Cutting data: v_c = 200 m/min
f = 0,25~ 0,3 mm/rev, d_{oc} = 1,2 mm, Wet

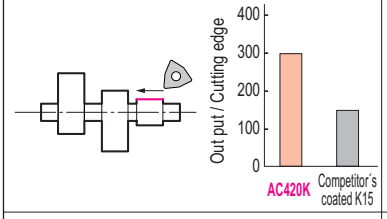
● GGG60 Shaft



Insert: DNMG 150608 NUX
Cutting data: v_c = 130~200 m/min
f = 0,3 mm/rev, d_{oc} = 0,5 mm, Wet

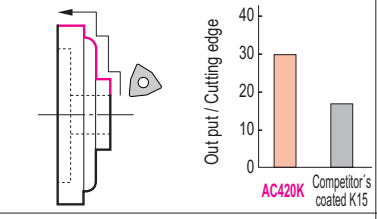
■ Application eg. of AC420K

● GGG70 Crankshaft



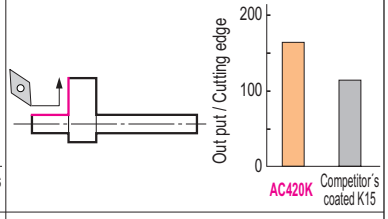
Insert: WNMA 080408
Cutting data: v_c = 100~250 m/min
f = 0,15~0,3 mm/rev, d_{oc} = 1,0 mm, Wet

● GGG45 Drive Sprocket



Insert: WNMA 080408
Cutting data: v_c = 200 m/min
f = 0,32 mm/rev, d_{oc} = 3,0 mm, Wet

● GGG50 Shaft



Insert: DNMG 150412 NGZ
Cutting data: v_c = 100~270 m/min
f = 0,15~0,4 mm/rev, d_{oc} = 1,5 mm, Wet

ACE-Coat

AC610M / AC630M

CVD Coated Grades for Stainless Steel

General Features

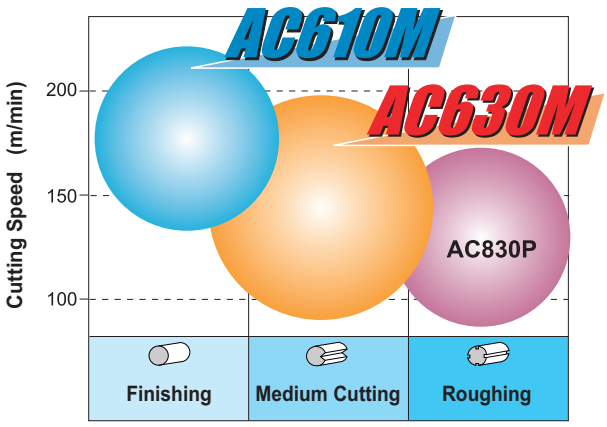
AC610M and AC630M are special "Super FF" coated grades for the machining of stainless steel.
Due to improved welding resistance and notch wear resistance resulting from the latest coating technology, improved notch wear resistance leads to a more stable and long tool life.

Advantages

M Stainless Steel

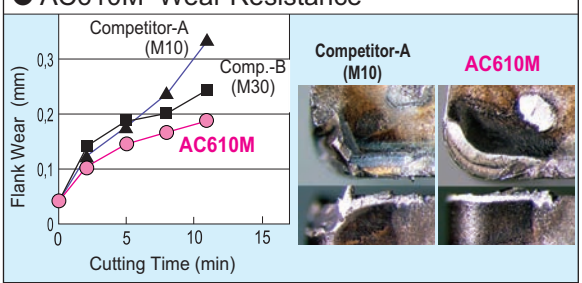
- Fine grain TiCN layer provides high peeling resistance to special carbide substrate and excellent wear resistance
- Newly developed fine grain α-Al_2O_3 coating with high hardness and high adhesion resistance
- **AC610M** : High wear resistance grade for high performance machining of stainless steel
- **AC630M** : Main grade with special tough substrate provides smooth and reliable machining of stainless steel

Application Range



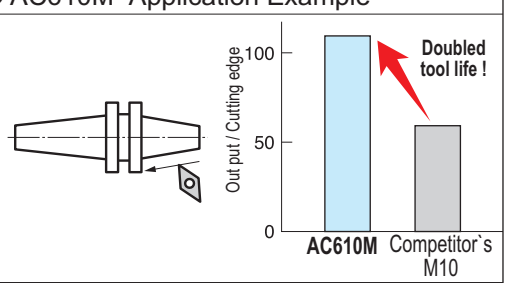
Efficiency of AC610M

AC610M Wear Resistance



Work material: X5 CrNiMo 17122 (1.4401)
Insert: CNMG 120408 NGU
Cutting data: v_c = 200 m/min, f = 0,25 mm/rev
d_{oc} = 1,5 mm, Wet

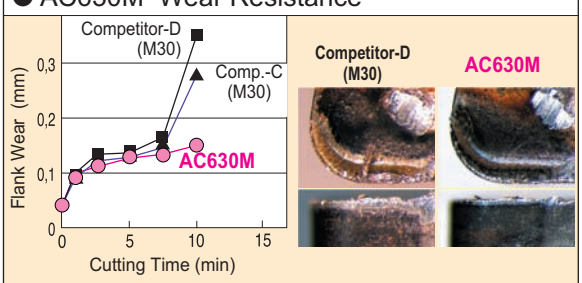
AC610M Application Example



Work material: X5 CrNi 1810 (1.4301)
Insert: DNMG 150608 NEX
Cutting data: v_c = 210 m/min, f = 0,3 mm/rev
d_{oc} = 2,0 mm, Wet

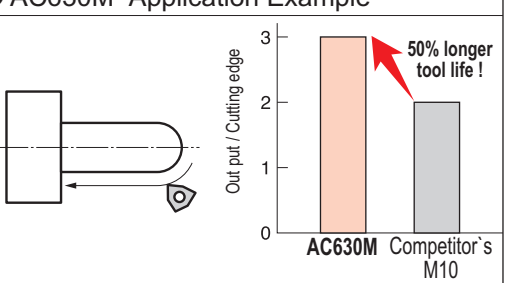
Efficiency of AC630M

AC630M Wear Resistance



Work material: X5 CrNiMo 17122 (1.4401)
Insert: CNMG 120408 NGU
Cutting data: v_c = 150 m/min, f = 0,25 mm/rev
d_{oc} = 1,5 mm, Wet

AC630M Application Example



Work material: X5 CrNi 1810 (1.4301)
Insert: DNMG 150608 NEX
Cutting data: v_c = 210 m/min, f = 0,3 mm/rev
d_{oc} = 2,0 mm, Wet

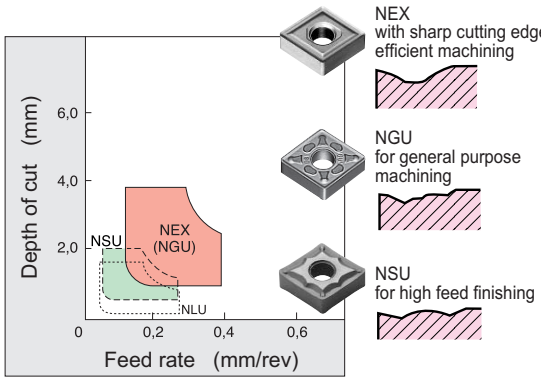
ACE-Coat

AC610M / AC630M

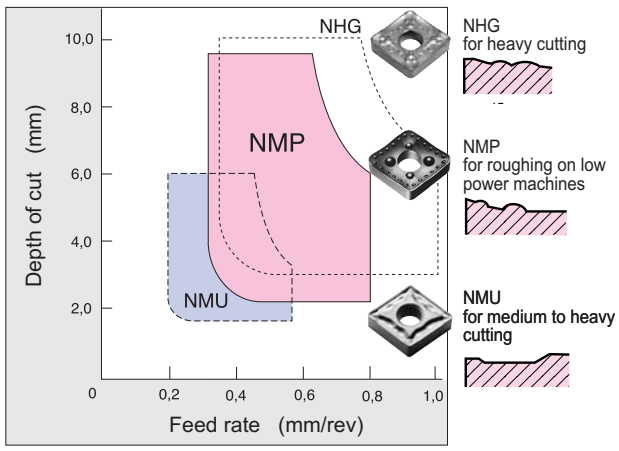
Chipbreakers

For finishing and light cut operations

M Stainless Steel



● For roughing operations



Recommended Cutting Conditions

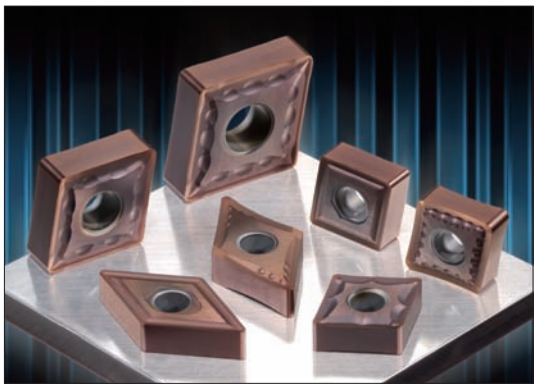
Feed rate: f (mm/rev)
Cutting speed: v_c (m/min)

	Work material	W-No.	DIN EN	JIS (UNS)	AISI	AC610M			AC630M		
						f = 0,2	f = 0,4	f = 0,6	f = 0,2	f = 0,4	f = 0,6
						v_c	v_c	v_c	v_c	v_c	v_c
1	Free-machining stainless steels Ferritic stainless steels Martensitic stainless steels Easy to machine	1.4305	X8 CrNiS 18 9	SUS303	303	300	235	195	235	180	155
		1.4005	X12 CrS 13	SUS416	416						
		1.4029	X29 CrS 13	SUS420F	420F						
				SUS440F							
		1.4002	X6 CrAl 13	SUS405	405						
		1.4105	X6 CrMoS 17	SUS430F	430F						
2	Ferritic stainless steels Martensitic stainless steels Good machinability			SUS403	403	265	205	170	210	160	140
		1.4006	X12 Cr 13	SUS410	410						
		1.4021	X20 Cr 13	SUS420J1	420						
		1.4028	X30 Cr 13	SUS420J2	420						
		1.4016	X6 Cr 17	SUS430	430						
		1.4057	X19 CrNi 17 2	SUS431	431						
		1.4308	X6 CrNi 18 9	SCS13							
3	Martensitic stainless steels Austenitic stainless steels Difficult to machine	1.4301	X5 CrNi 18 10	SUS304	304	230	180	150	180	140	120
		1.4307	X2 CrNi 19 11	SUS304L	304L						
		1.4311	X2 CrNiN 18 10	SUS304LN	304LN						
		1.4401	X4 CrNiMo 17 12 2	SUS316	316						
		1.4404	X2 CrNiMo 17 12 2	SUS316L	316L						
		1.4571	X6 CrNiMoTi 17 12 2	SUS316Ti	(S31635)						
			X5 CrNiMo 17 13	SUS317	317						
		1.4541	X6 CrNiTi 18 10	SUS321	321						
		1.4109	X70 CrMo 15	SUS440A	440A						
				SUS440B	440B						
		1.4125	X105 CrMo 17	SUS440C	440C						
		1,4408	X6 CrNiMo 18 10	SCS1_							
4	Austenitic stainless steels Very difficult to machine	1.4319	X5 CrNi 17 7	SUS301	301	185	145	120	145	110	95
				SUS302	302						
		1.4306	X2 CrNi 18 9	SUS304N1	304N						
				SUS304N2	(S30452)						
				SUS309S	309S						
			X6 CrNi 25 20	SUS310S	310S						
		1.4406	X2 CrNiMoN 17 12 2	SUS316LN	316LN						
		1.4550	X6 CrNiNb 18 10	SUS347	347						
5	Austenitic-Martenstic (Duplex) stainless steels Precipitation hardening stainless steels Extremly difficult to machine			SUS316J1		140	110	90	110	85	70
				SUS316J1L							
		1.4542	X5 CrNiCuNb 16 4	SUS630	S17400						
		1.4568	X7 Cr NiAl 17 7	SUS631	S17700						
			X4 CrNiMo 27 5 2	SUS329J1							
		1.4462	X2 CrNiMoN 22 5 3	SUS329J3L	31803						
		1.4507	X2 CrNiMoCuN 25 6 3	SUS329J4L	32250						
		1.45742	X5 CrNiCuNb 17 4	SCS24	S17400						

ACE-Coat

AC510U / AC520U

High Performance "Super ZX" Coated Grades for Heat Resistant Alloy



General Features

AC510U and AC520U are special grades for the machining of exotic metals such as Heat Resisting Steels and Titanium Alloys.
With better wear and notch-wear resistance, these grades exhibit a more stable tool life as compared to conventional grades.

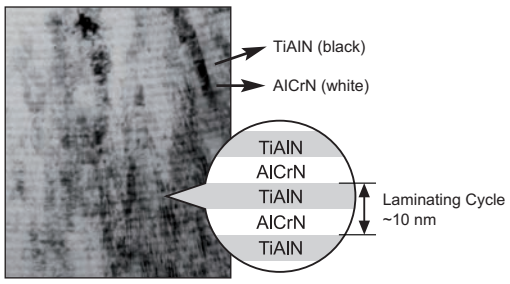
Advantages

S Exotic Metal

- For super alloys with Fe, Ni or Co base and Titanium alloys
- Super ZX Coat shows superior wear and thermal resistance
- Twice or more longer tool life

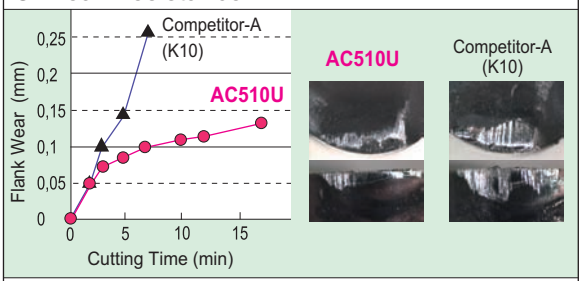
- **AC510U**: For continuous cutting
- **AC520U**: For roughing, interrupted cutting

● **"Super ZX"** 1000x TiAlN/AlCrN layers



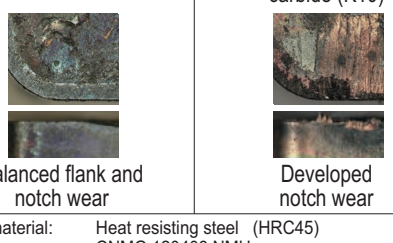
Efficiency of AC510U

● Wear Resistance



Work material: Inconel 718 (HRC45)
Insert: CNMG 120408 NEX
Cutting data: v_c = 80 m/min, f = 0,12 mm/rev
d_{oc} = 0,8 mm, Wet

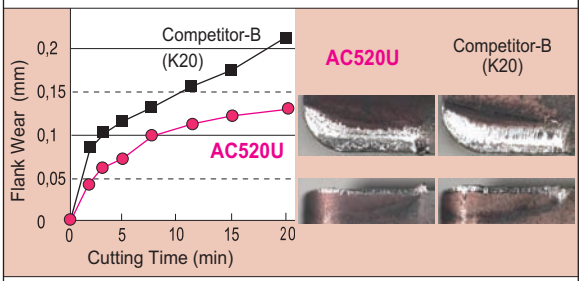
● Edge Wear Comparison



Work material: Heat resisting steel (HRC45)
Insert: CNMG 120408 NMU
Cutting data: v_c = 30 m/min, f = 0,35 mm/rev
d_{oc} = 4,0 mm, Dry

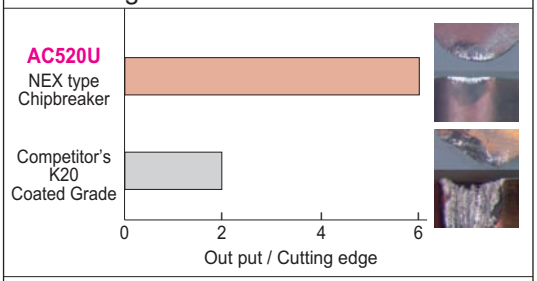
Efficiency of AC520U

● Wear Resistance



Work material: Heat resisting steel (Fe base)
Insert: CNMG 120408 NMU
Cutting data: v_c = 40 m/min, f = 0,2 mm/rev
d_{oc} = 2,0 mm, Wet

● Breakage Resistance



Work material: Inconel 718 (HRC43)
Insert: CNMG 120408 NEX
Cutting data: v_c = 60 m/min, f = 0,25 mm/rev
d_{oc} = 0,5 mm, Wet

Recommended Conditions

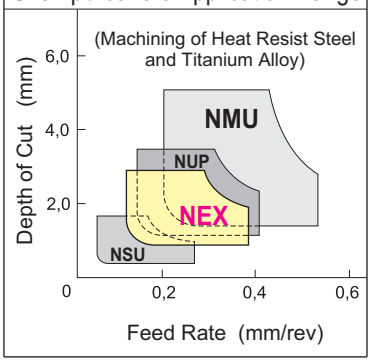
● Application Field

Finishing ~ Light Cutting	Medium ~ Interrupted Cutting
AC510U	
	AC520U

● Recommended Conditions

Work material	v_c (m/min) / f (mm/rev)
Ni - based alloys (Inconel718/x750, Waspalloy)	30 – 80 / 0,1 – 0,3
Fe - based alloys (A286, Incoloy800/801)	30 – 70 / 0,1 – 0,3
Co - based alloys (Stellite, S816, HS30)	30 – 60 / 0,1 – 0,3
Ti - based alloys (Ti-6Al-4V)	30 – 70 / 0,1 – 0,3

● Chipbreakers Application Range

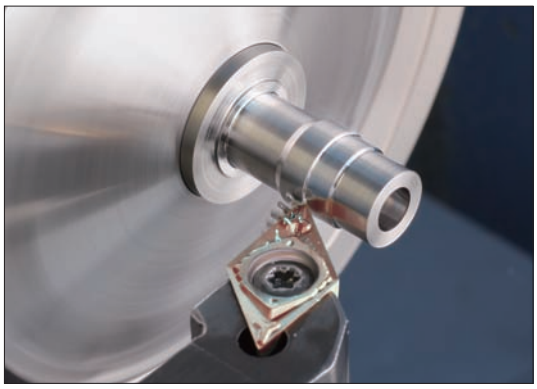


Superb "Super ZX" Coated Grade

for High Precision Small Parts Turning

ACE-Coat

AC530U



Ultra hard "Super ZX" coated grade with extra tough substrate

Excellent grade for

- High performance turning of small precision components
- Suitable for most steels
- Ideal for grooving applications

Advantages

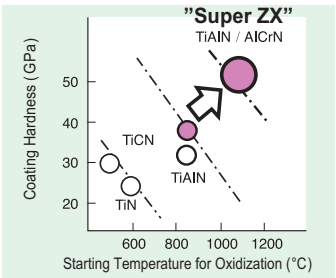
P Steel M Stainless Steel

- The ultra hard Super ZX coat doubles tool life.
- The ultra smooth Super ZX coat prevents chip adhesion and increases productivity.
- The newly developed chip breaker efficiently clears swarf from the cutting area.
- Improves productivity - machines more parts per hour than a competitors grade

Performance

- Increased feed rates from high shear cutting action and efficient chip evacuation
- 40% increase in coating hardness and 200% increase in oxidation resistance

Oxidation Temperature

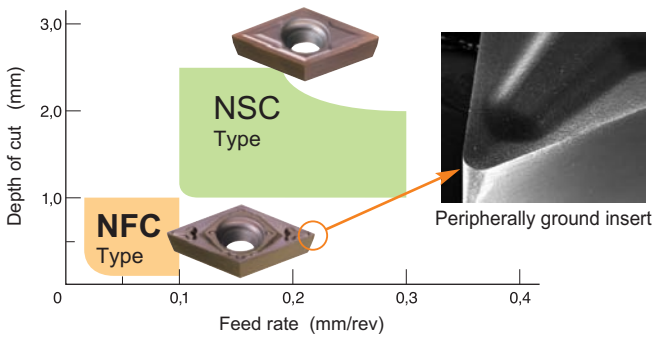


Recommended Cutting Conditions

Work material	v_c (m/min) f (mm/rev)
Free-cutting steel	50 — 200 0,02 — 0,15
Carbon steel Alloy steel	50 — 200 0,02 — 0,1
Stainless steel	50 — 200 0,02 — 0,1

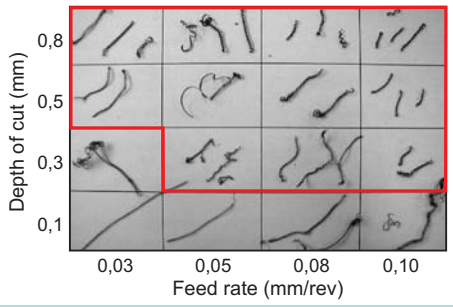
New NFC Type Chip Breaker

● Application Range



Excellent Chip Control

New higher speed cutting breaker for efficient and reliable chip removal



Work material: X6Cr17 (1.4016)

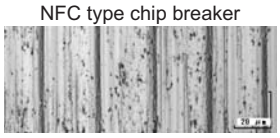
Insert: DCGT11T302NFC
Grade: AC530U

Cutting conditions: v_c = 100 m/min wet (oil)

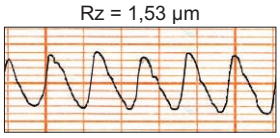
Excellent Surface Finish

The precision ground sharp cutting edge greatly improves surface finish

NFC type chip breaker



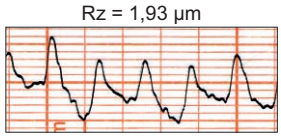
Rz = 1,53 µm



Work material: X6Cr17 (1.4016)
Cutting conditions: v_c = 100 m/min, f = 0,03 mm/rev, d_{oc} = 0,2 mm, wet (oil)

Competitor's chip breaker

Rz = 1,93 µm

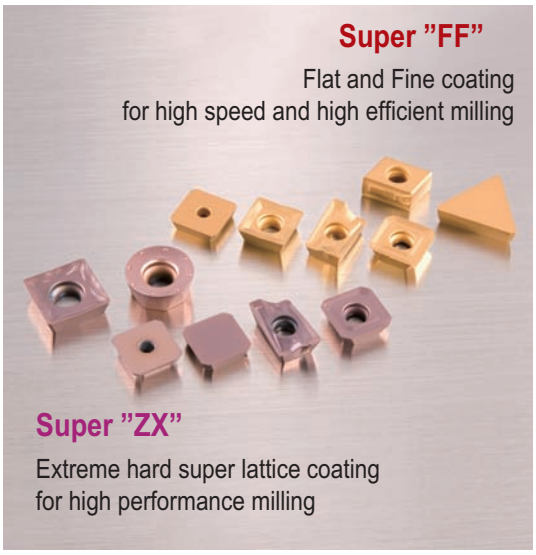


Work material: X6Cr17 (1.4016)
Cutting conditions: v_c = 100 m/min, f = 0,03 mm/rev, d_{oc} = 0,2 mm, wet (oil)

ACE-Coat

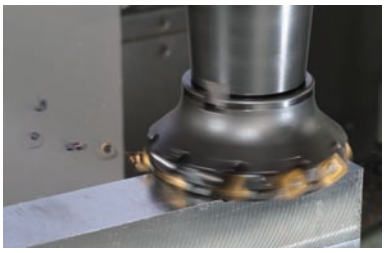
ACP100•200•300 / ACK200•300

Super FF/ZX Coated Grades for Milling



General Features

Introducing 5 new "ACE-Coat" grades which utilize the latest in CVD coating "Super FF" and PVD coating "Super ZX", for high cutting edge reliability during high speed and high efficiency milling operations.
Achieving stability and longer tool life with "ACE-Coat" ACP100, ACP200 and ACP300 for general steel, die steel and stainless steel, and "ACE-Coat" ACK200 and ACK300 for cast iron and ductile cast iron.



Characteristics

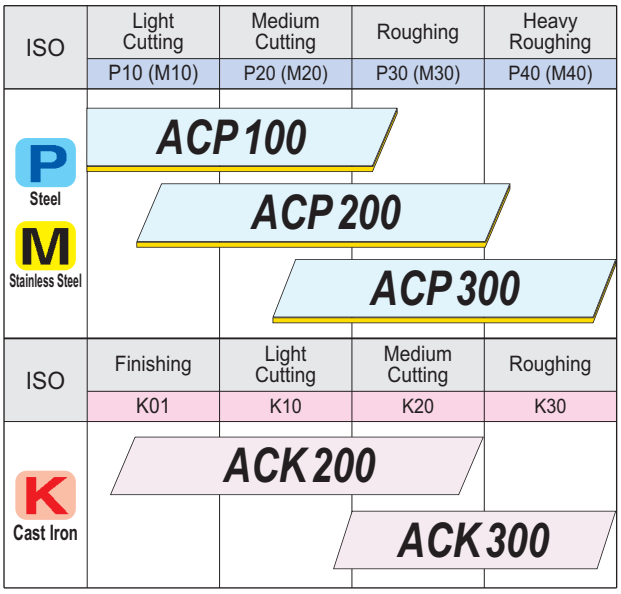
Coated Grades for General Steel, Die Steel and Stainless Steel

Grade	Coating	Applications	Characteristics
ACP100	"Super FF" (Flat and Fine)	General ~ High speed machining and wet cutting	Excellent wear and thermal crack resistance with new Ti-based CVD "Super FF (Flat and Fine) Coating"
ACP200	"Super ZX"	General machining of general steel and die steel	Excellent balance of wear and chipping resistance by Cr added new PVD "Super ZX Coating" and tough carbide substrate.
ACP300	"Super ZX"	General to heavy duty machining of steel and stainless steel	Excellent toughness by Cr added new PVD "Super ZX Coating" and extremely tough carbide substrate.

Coated Grades for Cast Iron

Grade	Coating	Applications	Characteristics
ACK200	"Super FF" (Flat and Fine)	General machining of cast iron and ductile cast iron	Excellent wear resistance and tough CVD "Super FF (Flat and Fine) Coating" with Ti-based Al_2O_3 layer.
ACK300	"Super ZX"	General to heavy cut machining of cast iron and ductile cast iron	Excellent toughness with fine grain carbide substrate. Cr added new PVD **"Super ZX Coating"** could improve hardness and oxidation resistance.

Application Field



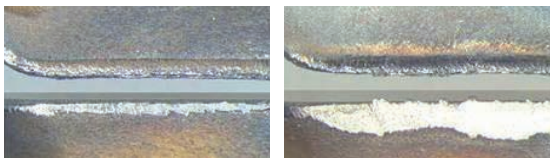
Recommended Cutting Condition

ISO	Work Material	Cutting speed: v_c (m/min) / Feed rate: f_t (mm/tooth)
P Steel	Carbon Steel / Alloy Steel	80 – 300 / 0,1 – 0,4
P Steel	Die Steel (~ HRC30)	80 – 230 / 0,1 – 0,3
P Steel	Die Steel (HRC30~60)	80 – 200 / 0,1 – 0,3
M Stainless Steel	Stainless Steel	80 – 250 / 0,1 – 0,3
K Cast Iron	GG Grey Cast Iron	80 – 250 / 0,1 – 0,3
K Cast Iron	GGG Ductile Cast Iron	80 – 230 / 0,1 – 0,3

■ Application Example of ACP100

(Edge Wear Comparison)

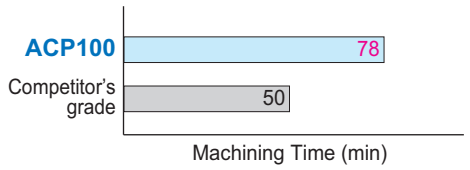
Work material: X155CrVMo12-1 (Alloy tool steel, raw material)
Cutter: WGC4100RS, Insert: SEMT13T3AGSN-G
Cutting data: v_c = 150 m/min, f_t = 0,15 mm/teeth
d_{oc} = 2,0 mm, w_{oc} = 50 mm, Dry



ACP100 Competitor's grade

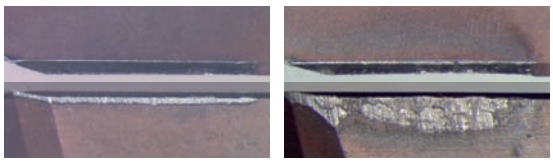
(Tool Life or Output Comparison)

Work material: C50
Cutter: GC4100RS, Insert: SEMT13T3AGSN-H
Cutting data: v_c = 150 m/min, f_t = 0,32 mm/teeth
d_{oc} = 2,0 mm, w_{oc} = 50 mm, Dry



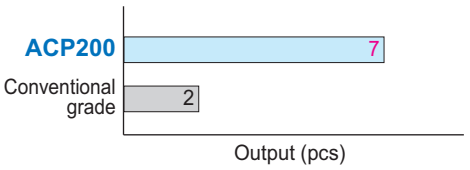
■ Application Example of ACP200

Work material: X40CrVMo5-1 (Alloy tool steel, raw material)
Cutter: FPG4160RS, Insert: SDKN42MT
Cutting data: v_c = 180 m/min, f_t = 0,2 mm/teeth
d_{oc} = 2,0 mm, Dry



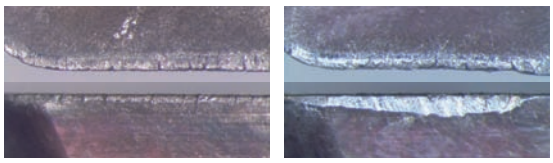
ACP200 Conventional Grade

Work material: 42CrMo4
Cutter: WGC4080RS, Insert: SEET13T3AGSN-G
Cutting data: v_c = 254 m/min, f_t = 0,2 mm/teeth
d_{oc} = 2,0 mm, Dry



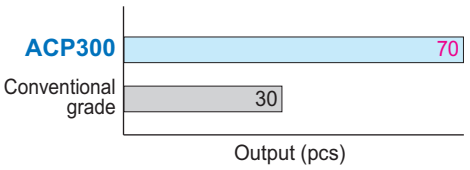
■ Application Example of ACP300

Work material: X10CrNiS189
Cutter: UFO4160RS, Insert: SFKN12T3AZTN
Cutting data: v_c = 200 m/min, f_t = 0,15 mm/teeth
d_{oc} = 2,0 mm, Dry



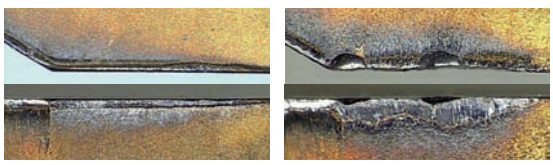
ACP300 Conventional grade

Work material: XCrNiMo17122
Cutter: FPG4160RS, Insert: SDKN42MT
Cutting data: v_c = 63 m/min, f_t = 0,2 mm/teeth
d_{oc} = 1,5 mm, Wet



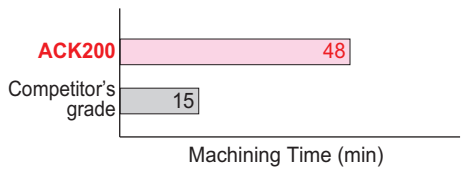
■ Application Example of ACK200

Work material: GG25
Cutter: DPG 4200RS, Insert: SPCH42R
Cutting data: v_c = 150 m/min, f_t = 0,15 mm/teeth
d_{oc} = 3,0 mm, Dry



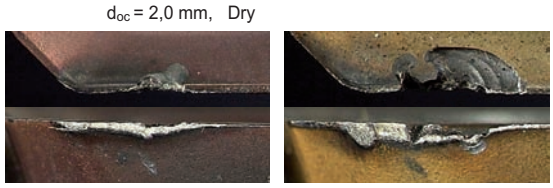
ACK200 Conventional grade

Work material: GG25
Cutter: WGC4160RS, Insert: SEMT13T3AGSN-G
Cutting data: v_c = 250 m/min, f_t = 0,2 mm/teeth
d_{oc} = 2,0 mm, Dry



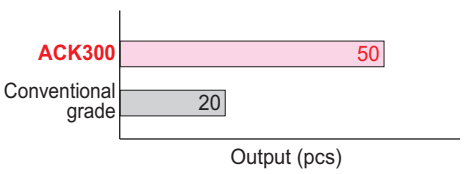
■ Application Example of ACK300

Work material: GGG40.3
Cutter: WGC4100RS, Insert: SEMT13T3AGSN-G
Cutting data: v_c = 200 m/min, f_t = 0,12 mm/teeth
d_{oc} = 2,0 mm, Dry

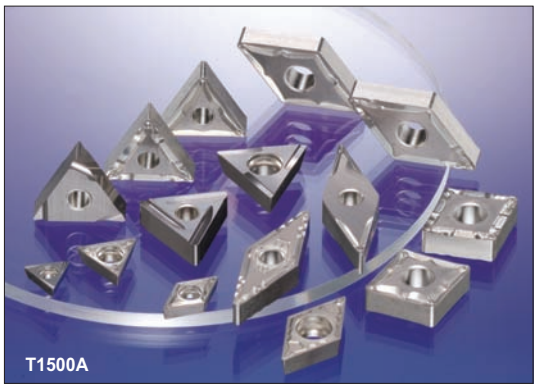


ACK300 Competitor's grade

Work material: GGG40.3
Cutter: UFO4100RS, Insert: SFKN12T3AZTN
Cutting data: v_c = 230 m/min, f_t = 0,3 mm/teeth
d_{oc} = 3,0 mm, Dry



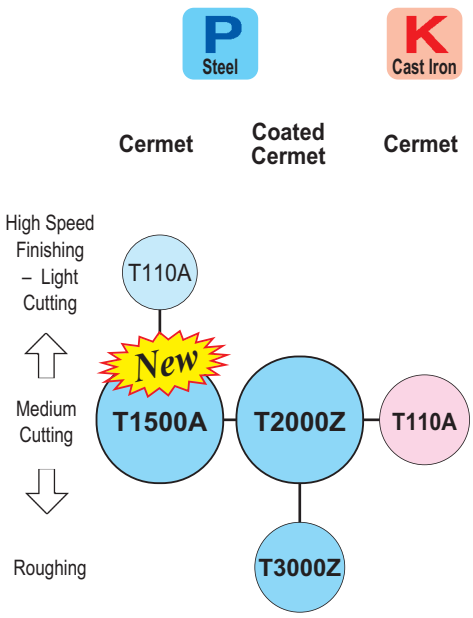
Cermet / Coated Cermet



General Features

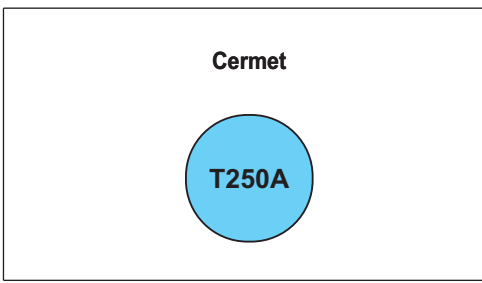
Cermets are used to produce excellent surface finish and high precision machining because of their low adhesion with steels. The most versatile cermets developed by Sumitomo are the latest T1500A for turning and T250A for milling.
In addition, PVD coated cermet grades also widen the range of applications.

Turning Application



Type	Grade	Characteristic · Application
Cermet	T110A	• High wear resistance and toughness. • For finishing of steels and cast iron.
	New T1500A	• Excellent high wear resistance with good toughness. • Finishing to medium speed machining of steel.
		
Coated Cermet	T2000Z	• ZX-Coating improves adhesion resistance. • High speed machining of steel.
	T3000Z	• ZX-Coating with good adhesion strength. • Medium to finish interrupted machining of steel

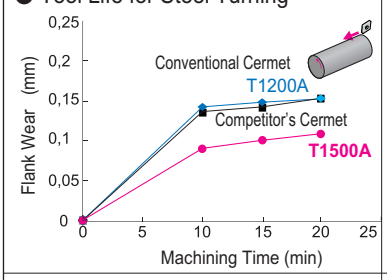
Milling Application



Type	Grade	Characteristic · Application
Cermet	T250A	• Strong cutting edge enhances chipping resistance. • General steel and stainless steel.

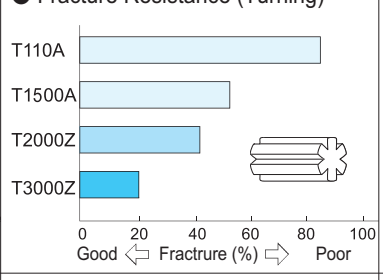
Performance

● Tool Life for Steel Turning



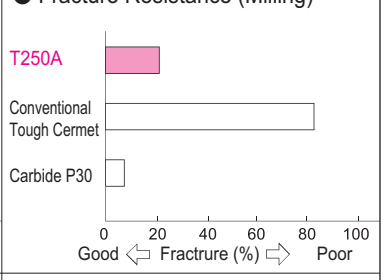
Material: 34CrMo4 (HB260)
Insert: CNMG 120408 NSU
Conditions: v_c=230 m/min, f=0,2 mm/rev, d_{oc}=1,0 mm, Wet

● Fracture Resistance (Turning)



Material: 34CrMo4 (HB260), grooved bar
Insert: TNMG 160408
Conditions: v_c=100 m/min, f=0,15~0,55 mm/rev, d_{oc}=1,5 mm, Dry, (duration: 30sec.)

● Fracture Resistance (Milling)

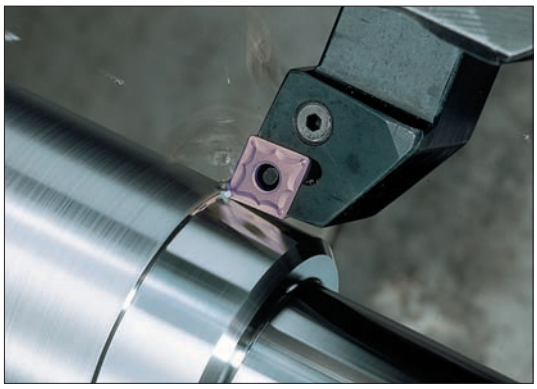


Material: 34CrMo4 (HB260)
Insert: SDKN42MT
Conditions: v_c=216 m/min, f_t=0,27~0,45 mm/tooth, d_{oc}=2,0 mm, Dry (8 passes)

Coated Cermets

T2000Z / T3000Z

ZX-Coated Grade for Turning of Steels



General Features

ZX-Coated new cermet grades are suitable for light to medium turning of alloy steels, carbon steels, and soft steels at depths of cut up to 3mm.
T2000Z makes holding size more reliable, increases tool life, gives excellent surface finish, and can be used wet or dry.
T3000Z is a new tough grade for roughing and interrupted cuts.

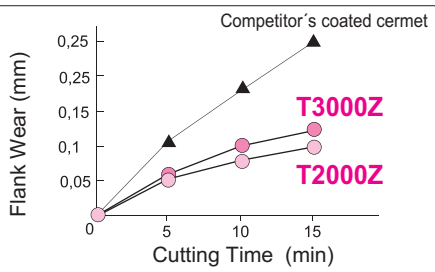
Advantages

P Steel

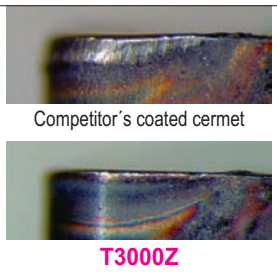
- New high hardness ZX-coating doubles the tool life as compared to conventional cermets.
- Improvements on the density and smoothness of the coating results in consistent beautiful finishing.
- **T2000Z**: For continuous machining, from high speed cutting to medium cutting.
- **T3000Z**: Special tough cermet substrate for medium to interrupted cutting

Performance

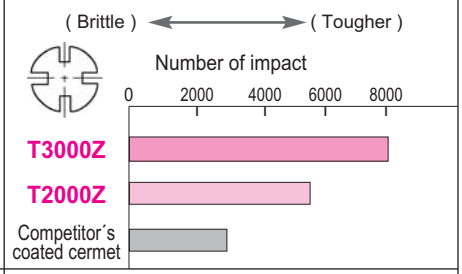
● Wear Resistance



● Edge Comparison



● Breakage Resistance



Insert:	CNMG 120408 (HB260)
Work material:	34CrMo4
Cutting data:	v_c = 200 m/min, f = 0,30 mm/rev, d_{oc} = 1,5 mm, Wet

Insert:	CNMG 120408
Work material:	34CrMo4
Cutting data:	v_c = 200 m/min f = 0,25 mm/rev d_{oc} = 1,5 mm, Wet

Application Range

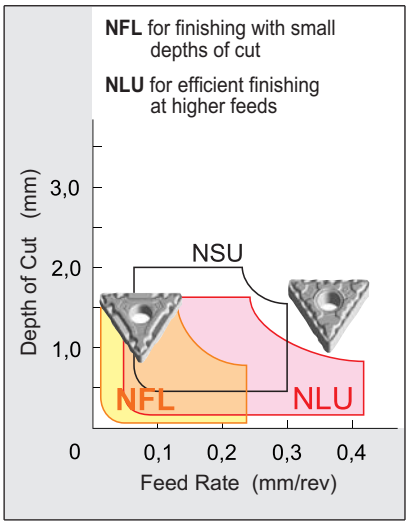
High Speed Cutting	Finishing	Medium Cutting	Interrupted Cutting

T2000Z
T3000Z
T110A
T1500A

Recommended Cutting Condition

Work Material		Cutting Speed v_c (m/min) Feed Rate f (mm/rev)
Low Carbon Steel	<HB150	100 – 400 0,1 – 0,3
Carbon Steel	<HB280	100 – 300 0,1 – 0,3
Alloy Steel	HB280 ~350	50 – 250 0,1 – 0,2

New Chip Breakers



Grades

For Steel Turning

T1500A

■ General Features

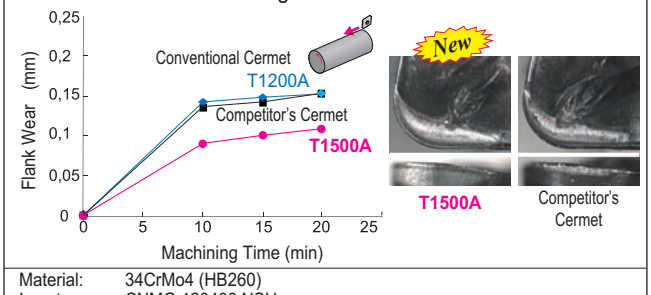
T1500A was developed for a wide application range from finishing to rough machining.
With its improved wear and fracture resistance, high speed machining of steel is also possible.
Furthermore, with good thermal cracking resistance, wet cutting can be performed.

■ Advantages

- High efficiency high speed machining with improved wear resistance.
- Sharp cutting edge that produces excellent surface finish.
- Wet cut possible with good thermal cracking resistance.
- Stable tool life with good fracture resistance
- Available in a variety of chipbreakers.

■ Performance

● Tool Life for Steel Turning



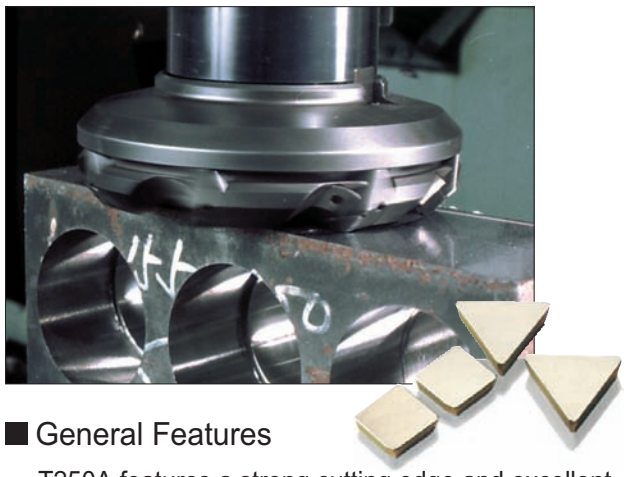
Material: 34CrMo4 (HB260)
Insert: CNMG 120408 NSU
Conditions: v_c=230 m/min, f=0,2 mm/rev, d_{oc}=1,0 mm, Wet

■ Recommended conditions

● Application Range					● Recommended conditions	
ISO	P05	P10	P20	P30	Cutting speed (m/min) Feed (mm/rev)	
Grade		T1500A			Soft Steel (Below HB150)	100 – 300 0,1 – 0,3
					Carbon Steel Alloy Steel (Below HB280)	100 – 250 0,1 – 0,3
		T110A			Carbon Steel Alloy Steel (Above HB280)	50 – 200 0,1 – 0,2

For Steel Milling

T250A



■ General Features

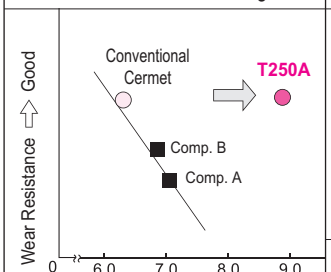
T250A features a strong cutting edge and excellent wear resistance with a tool life 2 to 3 times that of conventional cermets. With its high toughness properties, high effciency and excellent tool life can be expected in the milling of Alloy steel, Carbon steel, Stainless steel, Die steel as well as some special materials.

■ Advantages

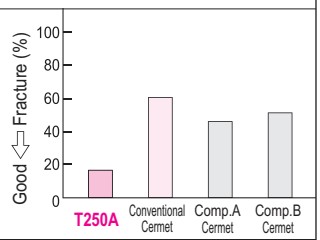
- 30% higher K_{1C} value, as compared to conventional cermets, improves edge toughness and tool life.
- High toughness and hardness improve wear resistance.
- Stable milling of general steel, stainless steel and die steel etc.

■ Performance

● Wear Resistance vs Toughness



● Fracture Resistance



Work: 34CrMo4 (HB260), 3 Goooves
Insert: SDKN42MT
Conditions: v_c=216m / min, f_t =0,27-0,45 mm/ tooth
d_{oc}=2,0mm, Dry

■ Recommended conditions

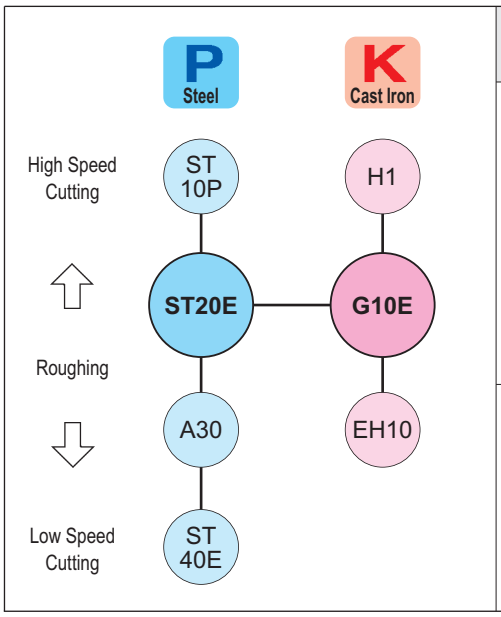
● Application Range					● Recommended conditions	
ISO	P05	P10	P20	P30	Cutting speed (m/min) Feed (mm/tooth)	
Grade		T250A			Carbon Steel Alloy Steel	120 – 250 0,1 – 0,3
					Soft Steel	150 – 300 0,1 – 0,3
					Stainless Steel	80 – 230 0,1 – 0,2
					Die Steel	60 – 180 0,1 – 0,2

"Igetalloy" Carbides

General Features

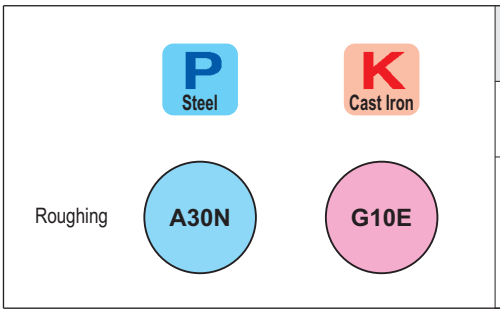
Sumitomo has been developing carbide grades for the past 70 years. Since then many grades have been developed, improved as well as terminated, all with respect to the ever changing industrial needs.
With this vast experience, the development of the high toughness A30 for steel machining, EH10 and EH20 for hard-to-cut materials are just some examples of our achievements.

Turning Application



Class	Grade	Characteristic · Application
P Class	ST10P	• Medium to high speed finishing of steels.
	ST20E	• General machining of steels.
	A30	• Low to medium speed roughing of steels.
	ST40E	• Low speed, roughing of steels.
K Class	H1	• High speed finishing of non-ferrous metals.
	EH10	• General machining of cast irons.
	G10E	• Machining of cast iron and aluminium.

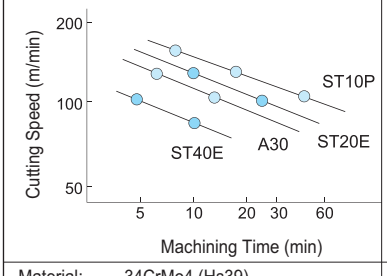
Milling Application



Class	Grade	Characteristic · Application
P Class	**A30N**	• General machining of steels
K Class	**G10E**	• Milling of cast iron

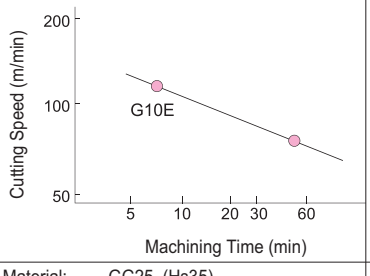
Performance

● Tool Life for Steel Turning



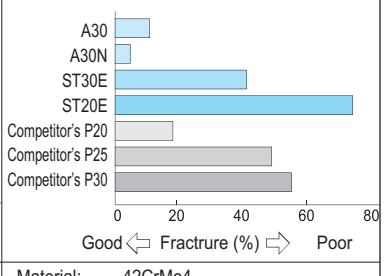
Material: 34CrMo4 (Hs39)
Insert: TNMG 220408 (NL)
Conditions: d_{oc}=2,0 mm, f=0,36 mm/rev, Dry
Criteria: V_B=0,3mm

● Tool Life for Cast Iron Turning



Material: GG25 (Hs35)
Insert: SNMN 120408
Conditions: d_{oc}=2,0 mm, f=0,26 mm/rev, Dry
Criteria: V_B=0,3mm

● Fracture Resistance



Material: 42CrMo4
Cutter: MC100R (single tooth)
Conditions: v_c=86~31m/min, f_t=0,33~0,62 mm/t, (N=4 cycles)

DLC (Diamond Like Carbon)

Aurora Coat Series

DLC-Coated Grade for Aluminium

Features

Sumitomo's "AURORA" COAT is a high hardness, low coefficient layer of "Diamond Like Carbon" (DLC).

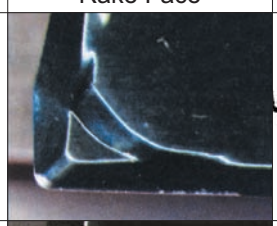
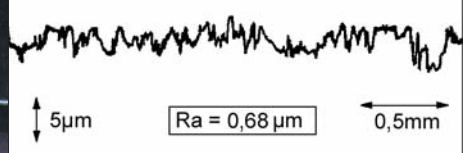
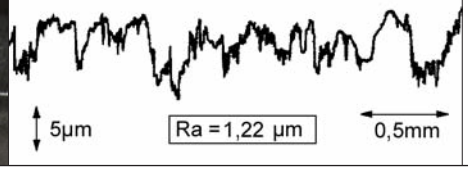
Other than producing excellent surface finish for machining of Aluminium and non-ferrous metals, DLC coat can be used for dry cutting and is environmental friendly.

Advantages and Applications

- **Super smooth surface and low coefficient of friction**
  Achieving beautiful finishing on Aluminium and non-ferrous metalls with its high resistance to build-up edge.
- **High coating strength withstand tough cutting conditions**
  Special DLC coating technique that improves coating adhesion.
  It is the world's first application of DLC coat on cutting tools.
- **Wide application possibilities**
- **A Spectrum of colours**
  Glittering colours are result of the special coating technique.

There are 7 interfacing colours in the AURORA COAT but have no effects on cutting performance.

Performance of DLC coating

Grade	Rake Face	Surface Roughness	Conditions
Aurora Coated DL1000			Work material: ADC12 Tool: WEM3032E Cutting data: v_c = 300 m/min f_t = 0,15 mm/tooth d_{oc} = 5 mm w_{oc} = 5 mm Cutting length: 36 m Dry
Uncoated Carbide			

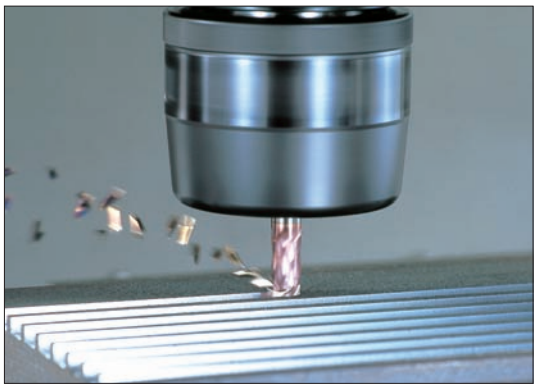
Applicable Products

● WaveMill Insert
(DL1000)

● Aurora Coated Endmills
(ASM2000/4000DL, SNB2000DL)

● Aurora Coated Drills
(DLH Type)

ZX-Coating Series



Features

ZX is the worlds first 2000 layer TiN/AlN ultra hard coating, available on a wide range of milling and drilling tools developed specifically for high feed machining a broad range of workpiece materials including steels, stainless steels, high temperature alloys and irons.

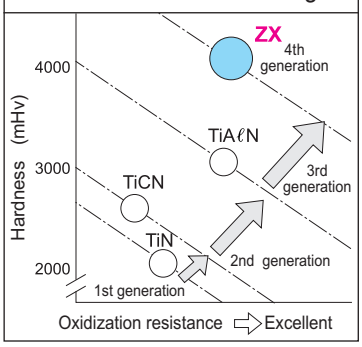
The super lattice ZX-Coating is only 2,5 microns thick (1,25 nano-metres x 2000) and at Hv4000 has a hardness approaching that of CBN. In addition the ZX-Coating has a smooth surface which improves the finish on machined workpieces. Its resistance to high temperatures results in high feed rates and greatly extended tool life.

Advantages

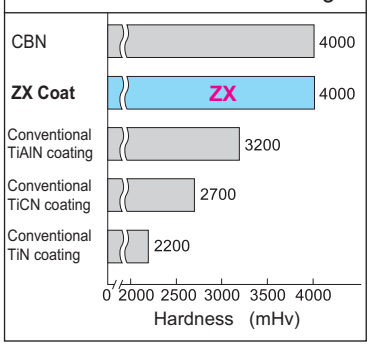
- Almost as hard as CBN
- Greatly extended tool life due to extreme hardness of ZX-Coating (Hv4000) compared to TiCN (Hv2700) and Ti/AlN (Hv3200)
- Smooth coating surface generates improved finish on workpiece.
- Available on a wide range of milling and drilling tools

Performance

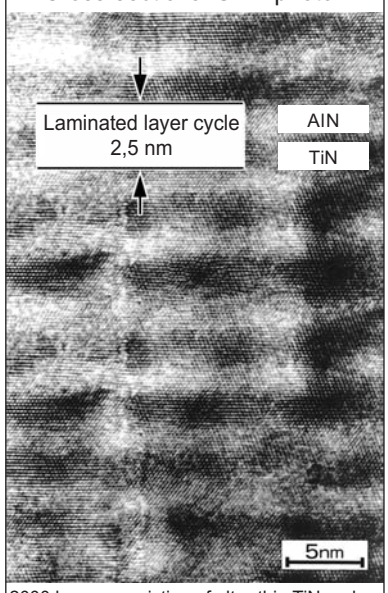
● Position of the ZX-Coating



● Hardness of the ZX-Coating



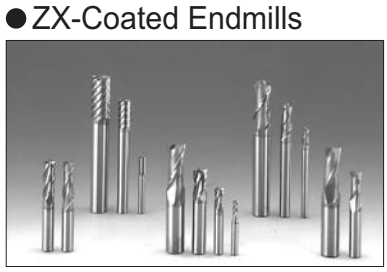
● Cross-sectional SEM photo



2000 layers consisting of ultra-thin TiN and AlN layers alternately laminated

● Super Multi-Drills HK Type

● ZX-Coated Endmills



RECOMMENDED

Cutting Conditions

Remarks:
- Mentioned cutting conditions are considered for an approach angle of 90°~95° and usage coolant.
- The conditions should be adjusted in accordance to the machine stability and workpiece conditions.

■ Recommended Cutting Conditions for Main Grade

ISO	Material	Hardness Brinell (HB)	Coated Carbide					
			AC410K	AC420K	AC810P	AC820P	AC830P	AC530U
			Feed Rate f (mm/rev)					
			0,2 - **0,4** - 0,6	0,2 - **0,4** - 0,6	0,2 - **0,4** - 0,6	0,2 - **0,4** - 0,6	0,2 - **0,4** - 0,6	0,2 - **0,4** - 0,6
			Cutting Speed v_c (m/min)					
P Steel	unalloyed steel, <0,15%C, annealed	125			380	320	270	230
	" , <0,45%C, annealed	190			330	270	230	200
	" , <0,45%C, tempered	250			280	210	205	180
	low alloyed steel,annealed	180			300	250	210	200
	" ,tempered	275			260	200	160	120
	" ,tempered	300			220	160	120	–
	" ,tempered	350			200	120	90	–
	high alloyed and tool steel, annealed	200			220	170	150	–
	" , tempered	325			130	90	70	–
M Stainless Steel	stainless steel, ferritic/martensitic, annealed	200						160
	martensitic, tempered	240						120
	austenitic, plunged	180						140
K Cast Iron	lamellar cast iron, pearlitic	180	350	300				160
	" , pearlitic(martensitic)	260	275	230				120
	nodular cast iron, ferritic	160	310	250				160
	nodular cast iron, perlitic	250	240	180				100
	malleable cast iron, ferritic	130	310	250				180
	malleable cast iron, perlitic	230	240	190				120
S Exotic Metal	heat resistant alloys, Fe basis	200						
	heat resistant alloys, Ni or Co basis	250						
	heat resistant alloys, Ni or Co basis	350						
	pure Titanium	400						
	Titanium alloys	950						

■ Recommended Cutting Conditions for Main Grade

ISO	Material	Hardness Brinell (HB)	Coated Carbide				Coated Cermet	
			AC610M	AC630M	AC510U	AC520U	T2000Z	T3000Z
			Feed Rate f (mm/rev)					
			0,2 - **0,4** - 0,6	0,2 - **0,4** - 0,6	0,2 - **0,4** - 0,6	0,2 - **0,4** - 0,6	0,2 - **0,4** - 0,6	0,2 - **0,4** - 0,6
			Cutting Speed v_c (m/min)					
P Steel	unalloyed steel, <0,15%C, annealed	125					350	300
	" , <0,45%C, annealed	190					300	250
	" , <0,45%C, tempered	250					250	200
	low alloyed steel,annealed	180					300	230
	" ,tempered	275					260	200
	" ,tempered	300					220	170
	" ,tempered	350						
	high alloyed and tool steel, annealed	200						
	" , tempered	325						
M Stainless Steel	stainless steel, ferritic/martensitic, annealed	200	205	160				
	martensitic, tempered	240	145	110				
	austenitic, plunged	180	180	140				
K Cast Iron	lamellar cast iron, pearlitic	180						
	" , pearlitic(martensitic)	260						
	nodular cast iron, ferritic	160						
	nodular cast iron, perlitic	250						
	malleable cast iron, ferritic	130						
	malleable cast iron, perlitic	230						
S Exotic Metal	heat resistant alloys, Fe basis	200			100	60		
	heat resistant alloys, Ni or Co basis	250			60	40		
	heat resistant alloys, Ni or Co basis	350			40	25		
	pure Titanium	400						
	Titanium alloys	950			70	50		

Grade Properties Chart

Coated Carbide Grades

Class	Grade	Hardness (HRA)	T.R.S. (GPa)	Coating Type	Layer Compositions	Coating Thickness (μm)
P Steel	**AC810P**	91,0	2,2	CVD	Super FF, Al_2O_3 + TiCN	18
	AC700G	91,0	2,2	CVD	Al_2O_3 + TiCN	12
	AC900G	90,1	2,2	CVD	Al_2O_3 + TiCN	12
	AC820P	90,1	2,2	CVD	Super FF, Al_2O_3 + TiCN	14
	AC2000	90,1	2,2	CVD	Al_2O_3 + TiCN	10
	AC830P	89,4	2,6	CVD	Super FF, Al_2O_3 + TiCN	8
	AC3000	89,4	2,6	CVD	Al_2O_3 + TiCN	10
	ACP100	89,3	3,1	CVD	Super FF, Al_2O_3 + TiCN	6
	ACP200	89,5	3,2	PVD	Super ZX, AlCrN / TiAlN	3
	ACP300	89,3	3,1	PVD	Super ZX, AlCrN / TiAlN	3
M Stainless Steel	**AC610M**	91,0	2,2	CVD	Super FF, Al_2O_3 + TiCN	5
	AC630M	89,5	2,7	CVD	Super FF, Al_2O_3 + TiCN	5
	AC530U	91,4	3,3	PVD	Super ZX, AlCrN / TiAlN	3
K Cast Iron	**AC410K**	92,0	2,4	CVD	Super FF, Al_2O_3 + TiCN	18
	AC420K	91,1	2,2	CVD	Super FF, Al_2O_3 + TiCN	12
	AC700G	91,0	2,2	CVD	Al_2O_3 + TiCN	12
	ACK200	91,7	2,5	CVD	Super FF, Al_2O_3 + TiCN	6
	ACK300	91,4	3,3	PVD	Super ZX, AlCrN / TiAlN	3
S Exotic Metal	**AC510U**	92,6	2,6	PVD	Super ZX, AlCrN / TiAlN	3
	AC520U	91,7	3,0	PVD	Super ZX, AlCrN / TiAlN	3
N Non-ferrous Metal	**DL1000**	92,9	2,1	PVD	DLC (Diamond Like Carbon)	0,5

Uncoated Carbide Grades

Class	Grade	Hardness (HRA)	T.R.S. (GPa)	Young's Modulus (GPa)	Thermal Conductivity Coefficient (W/m· °C)	Compressive Strength (GPa)	Linear Expansion Coefficient (x 10^{-6}/°C)
P Steel	**ST10P**	92,1	1,9	470	25	4,9	6,2
	ST20E	91,8	1,9	550	42	4,9	5,2
	A30	91,3	2,1	520	—	—	5,2
	A30N	91,2	2,2	520	—	—	—
	ST40E	90,4	2,6	—	75	—	—
M Stainless Steel	**U10E**	92,4	1,8	460	—	5,9	—
	U2	91,5	2,2	—	88	—	—
	A30	91,3	2,1	520	—	—	5,2
K Cast Iron	**BL130**	94,3	2,9	—	—	—	—
	H2	93,2	1,8	600	105	6,1	4,4
	H1	92,9	2,1	650	109	6,1	4,7
	EH10	92,4	3,4	640	105	—	4,5
	H10E	92,3	2,0	—	67	—	—
	EH20	91,3	3,5	620	105	—	4,5
	G10E	91,1	2,2	620	105	5,7	—
	KH03	91,4	3,3	—	—	—	—
Ultra Fine Grained	**AF1**	92,5	4,4	570	—	5,7	5,7
	F0	93,6	2,0	650	—	—	—
	F1	92,9	2,4	590	—	—	—
	A1	91,4	3,2	550	—	—	—

Grade Properties Chart

■ Cermet Grades

Class	Grade	Hardness (HRA)	T.R.S. (GPa)	Coating Type	Layer Compositions	Coating Thickness (μm)
Coated	**T2000Z**	92,0	2,3	PVD	TiN/AlN Multi-Layer	3
	T3000Z	91,3	2,4	PVD	TiN/AlN Multi-Layer	3
Uncoated	**T110A**	92,7	1,6	–	–	–
	T1200A	92,0	2,2	–	–	–
	T1500A	92,0	2,2	–	–	–
	T250A	91,4	2,1	–	–	–

■ Ceramic Grades

Coated	**NB100C**	95,0	1,0	PVD	TiN/AlN Multi-Layer	2
Uncoated	**NS260**	92,7	1,3	–	–	–

■ Properties of Basic Materials

Material		Specific Gravity	Micro Vickers Hardness (GPa)	Young's Modulus (GPa)	Thermal Conductivity Coefficient (W/m· °C)	Linear-Thermal Expansion Coefficient (x 10^{-6}/°C)	Melting Point (°C)
Tungsten Carbide	**WC**	15,6	21	690	126	5,1	2.900
Titanium Carbide	**TiC**	4,94	31	450	17	7,6	3.200
Tantalum Carbide	**TaC**	14,5	18	280	21	6,6	3.800
Niobium Carbide	**NbC**	8,2	20	340	17	6,8	3.500
Titanium Nitrate	**TiN**	5,43	20	260	29	9,2	2.900
Aluminium Oxide	**Al_2O_3**	3,98	29	410	29	8,5	2.050
Silicon Nitride	**Si_3N_4**	3,17	25	310	29	3,0	>1.900 (Disintegrate)
Cubic Boron Nitride	**CBN**	3,48	44	700	1.300	4,7	–
Carbon	**C**	3,52	>90	970	2.100	3,1	–
Cobalt	**Co**	8,9	–	100~180	69	12,3	1.495
Nickel	**Ni**	8,9	–	200	92	13,3	1.495
Carbide	**WC- 5% Co**	15,0	18	630	79	5,0	–
	WC-10 Co	14,6	14	580	75	5,0	–
	WC-20% Co	13,5	10	530	67	6,0	–
High Speed Steel		8,7	8	210	17	11,0	–