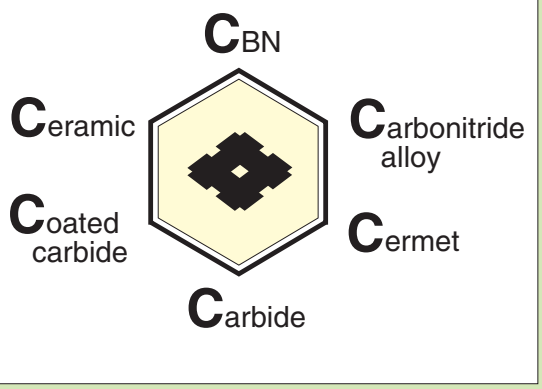
Grades

A

A1 ~ A25



Refer to page L1 ~ for SUMIBORON Products and M1 ~ for SUMIDIA Products.

Selection of Sumitomo Grades (Turning)

P Steel — General Steel (Carbon Steel, Alloy Steel) Structural Steel

Application	High Speed Machining	Finishing~Light		Medium	Roughing~Heavy	
ISO Classification	—	P01	P10	P20	P30	P40
COATED CARBIDE	AC700G		AC2000	AC3000		
COATED CERMET		T2000Z		T3000Z		
CERMET		T110A		T1200A		
CARBIDE			ST10P	ST20E	A30	
CERAMIC						
CBN						

K Cast Iron — Cast Iron

High Speed Machining	Finishing	Medium	
—	K01	K10	K20
	EH10Z		
New	AC410K		
			AC700G
	T110A		
		T1200A	
		G10E	
	NS260C·NS260		
	BNS800		
	BN700		
	BN500		

H Hardened Steel — Hardened Steel

Application	High Speed Machining	Finishing	Roughing
COATED CBN	BNC100	New (High Precision)	
	BNC80		
		BNC200	
		BNC300	
CBN	BNX10		
		BNX20	
		BN250	
		BNX25	
		BN350	
COATED CERAMIC		NB100C	

M Stainless Steel — Stainless Steel

Application	Finishing~Light Cut	Medium~Roughing
COATED CARBIDE	AC610M	
	EH 10Z	
		AC630M
		AC3000
CERMET	T1200A	

S Exotic Alloy — Exotic Alloy

Application	Finishing~Light Cut	Medium
COATED CARBIDE	EH510Z	
	EH520Z	
CARBIDE	EH510	
		EH520
COATED CERAMIC	WX120	
CBN	BN700	
		BNS800

N Non-Ferrous Metal — Non- Ferrous Metal

Application	Finishing~Light Cut	Medium
PCD	DA2200	
	DA150	
CARBIDE		H1

Sintered Materials

CBN	BN700	
		BN350
COATED CARBIDE		EH10Z

Selection of Sumitomo Grades (Milling)

P Steel

General Steel (Carbon Steel, Alloy Steel) Structural Steel

Application	High Speed Machining	Finishing~Light		Medium	Roughing~Heavy	
ISO Classification	—	P01	P10	P20	P30	P40
COATED CARBIDE		New ACP100				
		New ACP200				
			New ACP300			
CERMET		T250A				
CERAMIC						
CARBIDE				A30N		
CBN						

K Cast Iron

Cast Iron

High Speed Machining	Finishing	Medium	
—	K01	K10	K20
	New ACK200		
			New ACK300
	NS260		
		G10E	
BNS800			
BN700			
BN500			

H Hardened Steel

Hardened Steel

Application	Finishing
CBN	BN700
	BN350
CERAMIC	—

M Stainless Steel

Stainless Steel

Application	Finishing~Light Cut	Medium~Roughing
COATED CARBIDE	New ACP200	
		New ACP300
CARBIDE		A30N
CERMET	T250A	

S Exotic Alloy

Exotic Alloy

Application	Finishing~Light Cut	Medium
COATED CARBIDE	EH520Z	
	EH20Z	
		New ACK300
CARBIDE		EH520
		EH20

N Non-Ferrous Metal

Non- Ferrous Metal

Application	Finishing~Light Cut	Medium
PCD	DA2200	
COATED CARBIDE	DL1000	
CARBIDE		H1

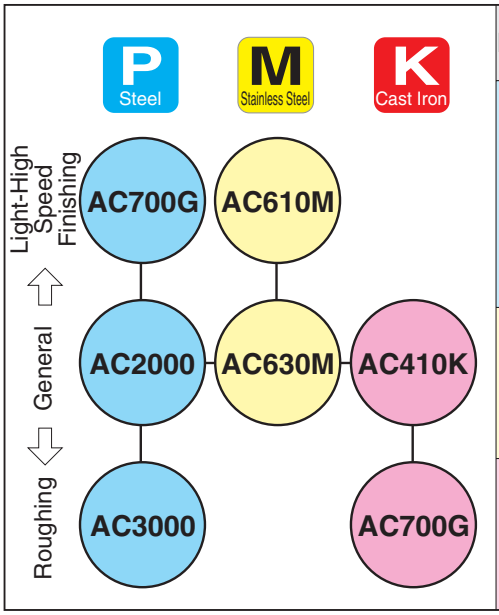
Coated Grade "ACE Coat Series"

Main Series Grades With Good Reliability For General Applications

■ General Features

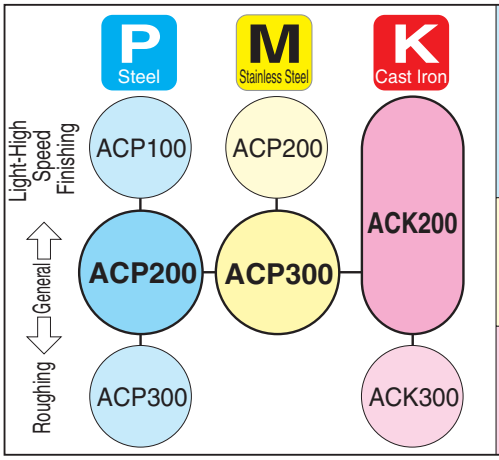
Sumitomo Electric Hardmetal's "ACE Coat Series" for turning, features a special substrate with an extra tough layer coated with super hard thin films. All these components enable the insert to have excellent wear resistance, toughness and high hot hardness properties. Consequently, steels and cast irons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

■ Turning Application



Material	Grade	Characteristic · Application
Steel	AC700G	· High wear resistance P10 grade. · High speed light cutting to medium cutting of steel.
	AC2000	· Excellent plastic deformation and fracture resistance. · Suitable for general steel machining.
	AC3000	· Excellent plastic deformation and fracture resistance. · Suitable for low to medium roughing and heavy interrupted machining of steel.
Stainless Steel	AC610M	· High wear resistant M10 grade. · High efficiency machining of stainless steel.
	AC630M	· M30 grade with good cutting performance and stability. · General purpose machining of stainless steel.
Cast Iron	**AC410K**	· K10 grade provides high wear resistance. · High speed machining of grey cast iron and ductile cast iron.
	AC700G	· High toughness substrate with high adhesive coating. · Suitable for grey cast iron and ductile cast iron machining.

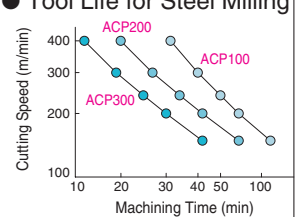
■ Milling Application



Material	Grade	Characteristic · Application
Steel	ACP100	· Excellent thermal cracking resistance and high wear resistance. · High speed machining of steel with wet cutting condition.
	ACP200	· Super ZX Coat provides excellent wear resistance. · General grade for steel and die steel.
	ACP300	· Utilizing a very tough substrate with Super ZX Coat. · Roughing of general steel.
Stainless Steel	ACP200	· Utilizing Super ZX Coat for excellent wear and thermal resistance. · Roughing of stainless steel.
	ACP300	· Utilizing a very tough substrate with Super ZX Coat. · General-purpose grade of stainless steel.
Cast Iron	**ACK200**	· Excellent in thermal crack resistance and wear resistance. · Medium to high speed milling of cast iron.
	ACK300	· Utilizing a very tough substrate with Super ZX Coat. · For milling of cast iron.

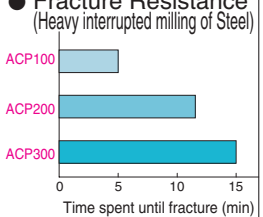
■ Performance

● Tool Life for Steel Milling



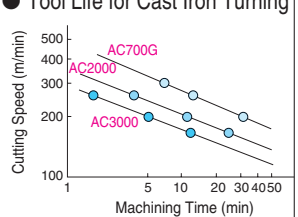
Work: SCM435 Block material (W100×L300mm)
Cutter: WGC4160R (φ160, 7 teeth)
Insert: SEET13T3AGSN-G
d=2mm, f=0.3mm/t, DRY
Criteria: VB=0.2mm

● Fracture Resistance (Heavy interrupted milling of Steel)



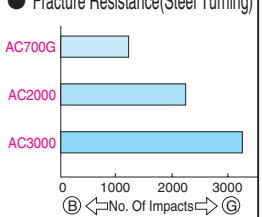
Work: S50C Drilled material (W155×L300mm, Hole of diameter 10×304)
Cutter: WGC4160R (φ160, 7 teeth)
Insert: SEET13T3AGSN-G
V=180m/min, f=0.45mm/t,
d=2mm, DRY

● Tool Life for Cast Iron Turning



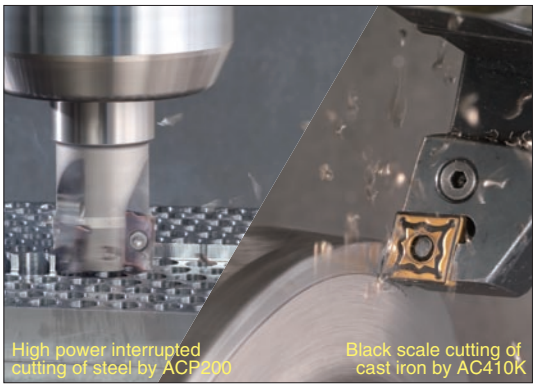
Material: SCM435 Holder: PCLNR2525-43
Insert: CNMG120408
d=2mm, f=0.35mm/rev, Wet
Criteria: VB=0.2mm

● Fracture Resistance(Steel Turning)



Work: SCM435-Grooved
Holder: PCLNR2525-43
Insert: CNMG120408
V=200m/min,
f=0.4mm/rev, d=2mm, Dry

Super ZX Coat/Super FF Coat



New

■ General Features

Super ZX Coat has succeeded in drastically improving the surface hardness and oxidization resistance of the coating, by optimizing metallic elements Titanium and Aluminum which are conventionally used as coating layers as well as the new addition of Chromium. Super FF Coat, through our unique development process [Super FF Coating Technology], has produced ultra-FLAT boundary faces between coating layers and super ultra-FINE coating particles to achieve higher reliability and longer tool life.

■ Super ZX Coat

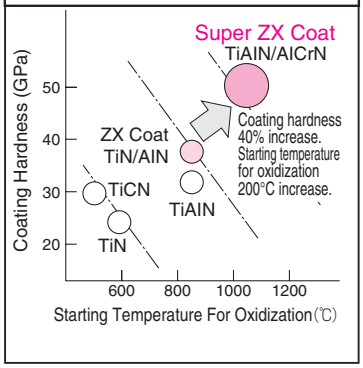
- Super-multi layered coating with ultra-thin (nanometer) layers of TiAlN and AlCrN, alternately stacked up to 1,000 layers.
- 40% increase in coating hardness and 200°C increase in oxidization temperature as compared with conventional grades.
- High speed, high efficiency machining of more than 1.5 times that of conventional grades is possible.
- Achieving more than double the tool life of conventional grades under conventional cutting conditions.

■ Application

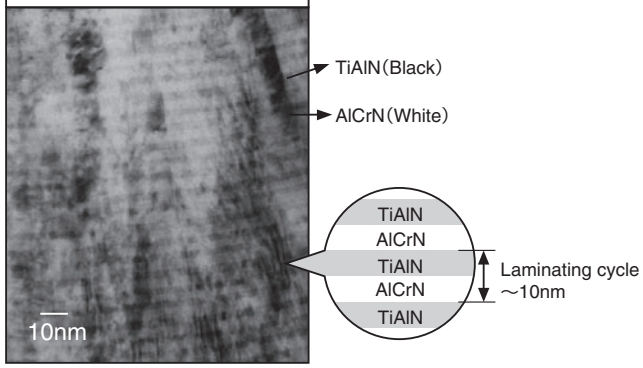
(For milling) ACP200, ACP300, ACK300
(For turning) AC530U

■ Characteristics/ Performance

● Coating Map



● Cross sectional TEM photo of coating



■ Super FF Coat

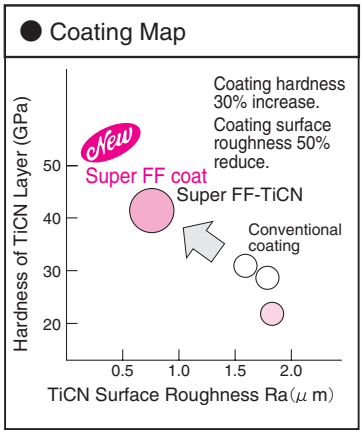
- High layer to layer and layer to substrate adhesion strength for excellent built-up-edge and chipping resistance.
- Harder than conventional coatings with huge improvements in wear resistance.
- High speed, high efficiency machining of more than 1.5 times that of conventional grades is possible.
- Achieving more than double the tool life of conventional grades under conventional cutting conditions.

■ Application

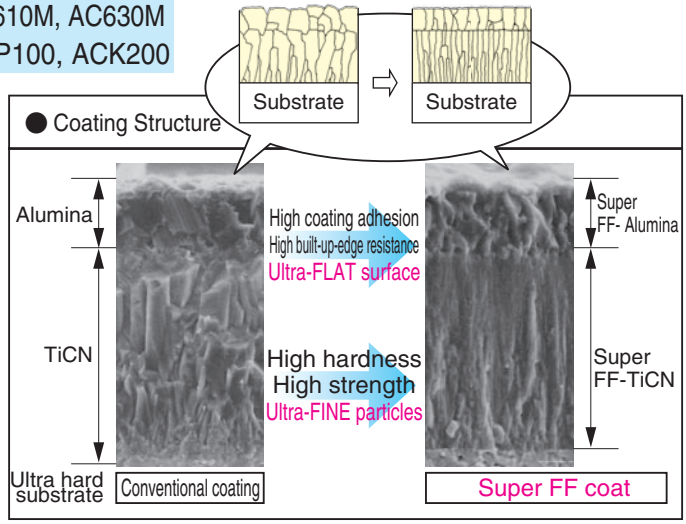
(For Cast Iron turning) AC410K
(For Stainless Steel turning) AC610M, AC630M
(For milling) ACP100, ACK200

■ Characteristics/ Performance

● Coating Map



● Coating Structure



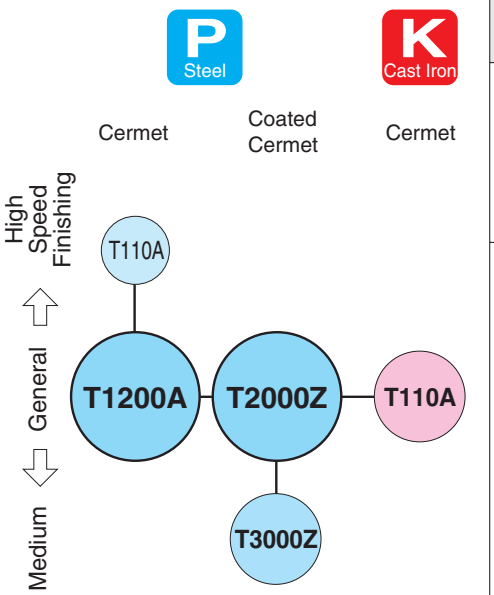
Cermet / Coated Cermet

Achieving High Precision Machining With Beautiful Finish

■ General Features

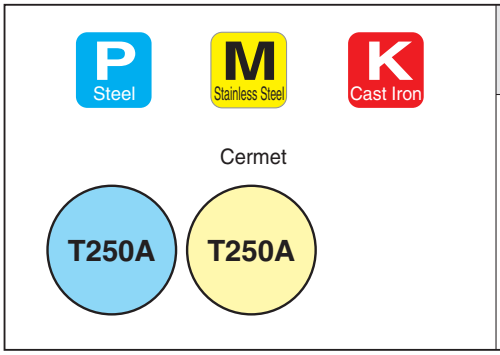
Cermets are used to produce excellent surface finish and high precision machining because of their low adhesion with steels. The most versatile cermets developed by Sumitomo Electric are the latest T1200A for turning and T250A for milling. In addition, ZX Coat cermets also widen the range of applications.

■ Turning Application



Type	Grade	Characteristic · Application
Coated Cermet	**T2000Z**	· ZX Coat improves adhesion resistance. · High speed machining of steel.
	T3000Z	· ZX Coat with good adhesion strength. · Medium to finish interrupted machining of steel
Cermet	T110A	· High wear resistance and toughness. · For finishing of steels and cast iron.
	T1200A	· Excellent high wear resistance with good toughness. · Finishing to medium speed machining of steel.

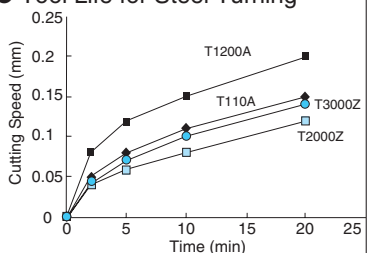
■ Milling Application



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

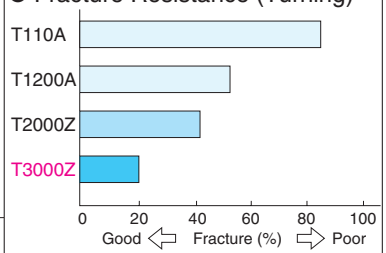
■ Performance

● Tool Life for Steel Turning



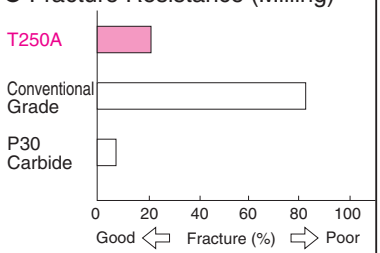
Work: SCM435(260HB)
Holder: PTGNR2525-33 Insert: TNMG160408
Conditions: V=230m/min, f=0.2mm/rev.
d=1.5mm, Wet

● Fracture Resistance (Turning)



Work: SCM435(260HB) Grooved material
Holder: PTGNR2525-33 Insert: TNMG160408
Conditions: V=100m/min, f=0.15～0.55mm/rev,
d=1.5mm, Dry, 30secs

● Fracture Resistance (Milling)



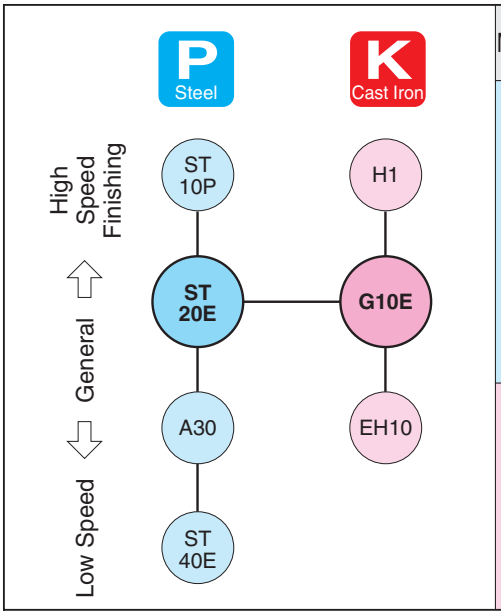
Work: SCM435(260HB)
Cutter: FPG4160R Insert: SDKN42MT
Conditions: V=216m/min, f=0.27～0.45mm/t,
d=2.0mm, 8 passes, Dry

"Igetalloy" Carbides

■ General Features

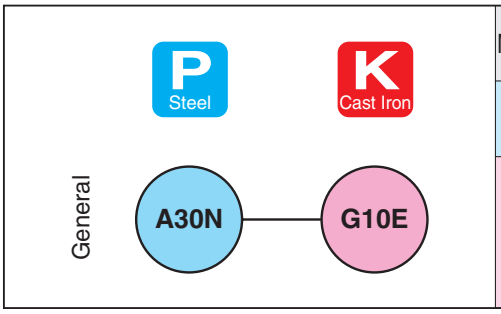
Sumitomo Electric has been developing carbide grades for the past 70 years. Since then many grades have been developed, improved as well as terminated, all with respect to the ever changing industrial needs. With this vast experience, the development of the high toughness A30 for steel machining, EH10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

■ Turning Application



Material	Grade	Characteristic · Application
Steel	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.
Cast Iron	H1	· High speed finishing of non-ferrous metals.
	EH10	· General machining of cast irons.
	G10E	· Machining of cast iron and aluminium.

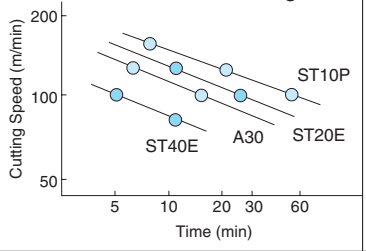
■ Milling Application



Material	Grade	Characteristic · Application
Steel	**A30N**	· General machining of steels
Cast Iron	**G10E**	· Milling of cast iron

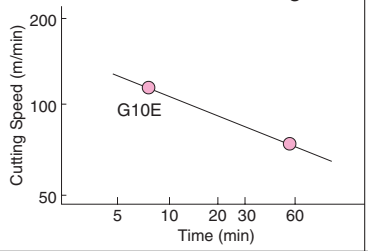
■ Performance

● Tool Life for Steel Turning



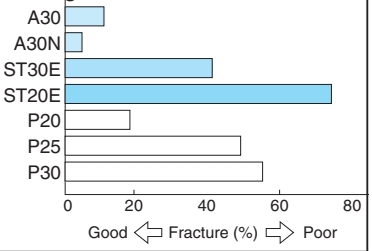
Material: SCM435(38HS) Holder: FN12R-44A
Insert: SNGN120408
Conditions: f=0.36mm/rev, d=2mm, Dry
Criteria: V_B=0.3mm

● Tool Life for Steel Turning



Material: FC250(35HS)
Holder : FN12R44 Insert: SNGN120408
Conditions: f=0.26mm/rev, d=2mm, Dry
Criteria: V_B=0.3mm

● Toughness



Material: SCM440
Cutter: MC100R (single tooth)
Conditions: V=86~31m/min, f=0.33~0.63mm/rev, (N=4 cycles)

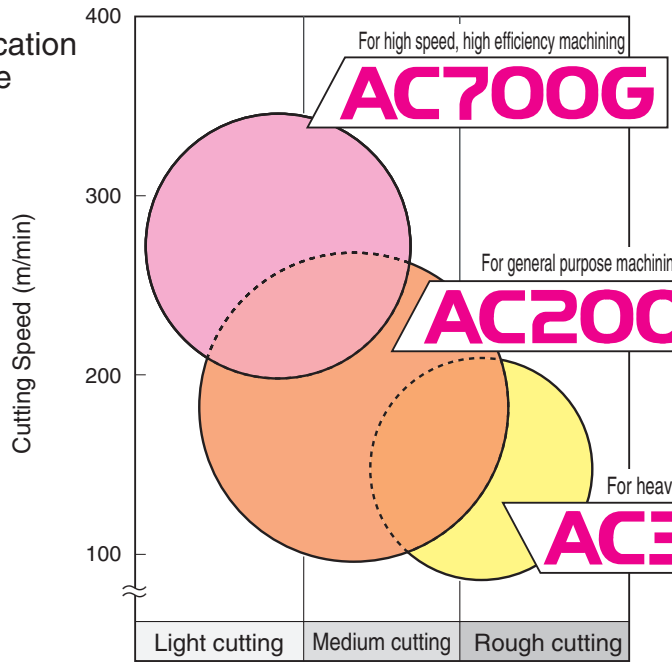
ACE-Coat
AC700G/AC2000/AC3000

From High Speed to Interrupted Machining,
The Steel Turning Trio For All Applications !

■ General Features

ACE-Coat AC700G with its tough Alumina coating, is suitable of both high speed machining of steel and roughing of cast iron.
The new ACE-Coat AC2000 is an improved version with better coating strength and higher reliability. Along with the extra tough ACE-Coat AC3000, this highly efficient series exhibits longer tool life from high speed to heavy interrupted turning of steel.

■ Application Range



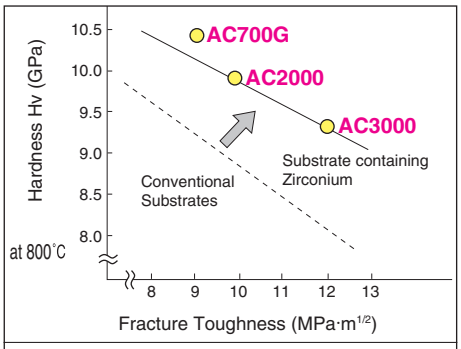
- For high speed to general purpose machining with double the tool life of competitor's.
- Excellent for dry machining due to high resistance to plastic deformation, even at high temperatures.

- Improved grade with excellent wear and chipping resistance.
- Applicable for a wide range of processes from light to interrupted cut.

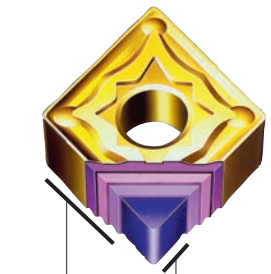
- Tough grade with excellent fracture resistance.

■ Characteristics

● Grade Map



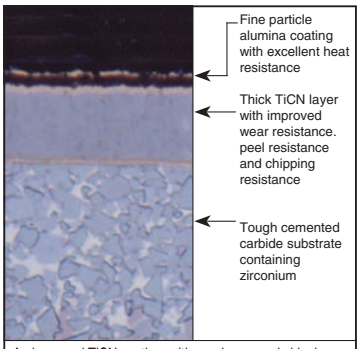
Tough carbide grade with Zirconium content has greatly improved the wear and fracture resistance.



Advanced coating technology

World's first carbide substrate with Zirconium

● Coating Structure



An improved TiCN coating, with good wear and chipping resistance, is combined with a heat resistant, micro-grained Alumina coating resulting in improved wear resistance.

■ Recommended Conditions

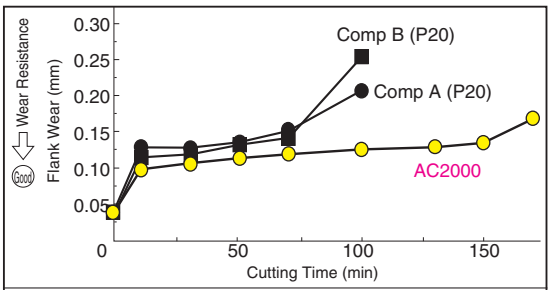
Material	AC700G	AC2000	AC3000
General Steel Alloy Steel	150 – 300 m/min 0.15 – 0.5 mm/rev	100 – 250 m/min 0.15 – 0.5 mm/rev	80 – 200 m/min 0.15 – 0.5 mm/rev
Low Carbon Steel	200 – 400 m/min 0.15 – 0.5 mm/rev	150 – 350 m/min 0.15 – 0.5 mm/rev	120 – 300 m/min 0.15 – 0.5 mm/rev

Cutting Speed (m/min)
Feedrate (mm/rev)
Depth of cut: 1~5mm

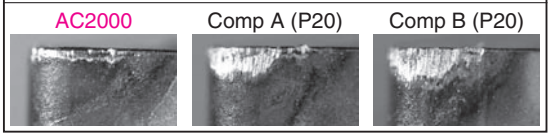
Reference to using CNMG120408 insert

■ Performance

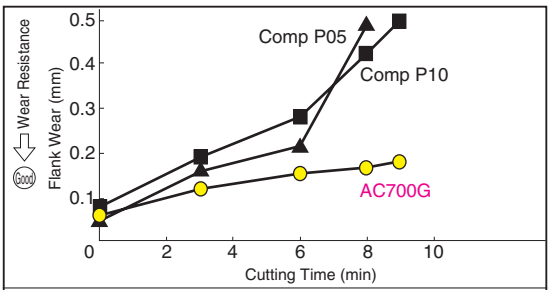
● Wear Resistance of AC2000



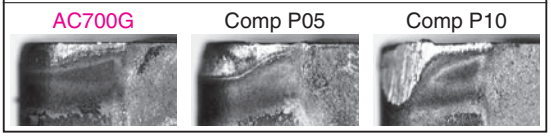
Work : SCM415 Insert: CNMG120408
Conditions : V=220m/min, f=0.30mm/rev, d=1.5mm, Wet



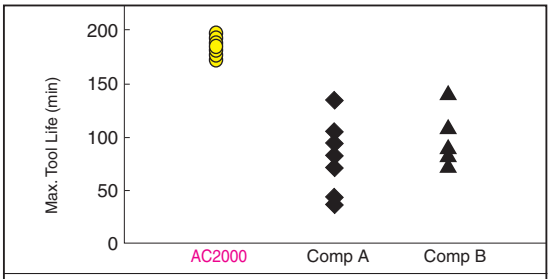
● Wear Resistance of AC700G



Work : SCM435 Insert: CNMG120408
Conditions : V=250m/min, f=0.40mm/rev, d=2.0mm, Dry

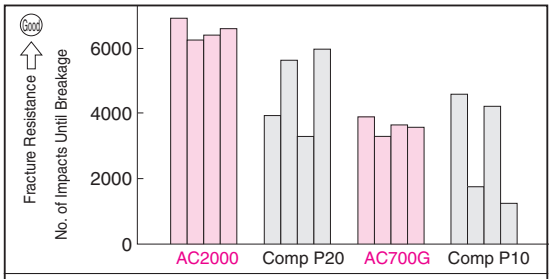


● Tool Life Stability of AC2000



Work : SCM415 Insert: CNMG120408
Conditions : V=220m/min, f=0.30mm/rev, d=1.5mm, Wet
Standard tool life is based on flank wear of 0.2mm

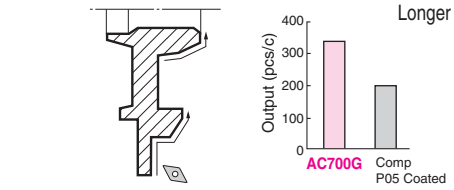
● Fracture Resistance of AC2000



Work : SCM435 Insert: CNMG120408
Conditions : V=220m/min, f=0.25mm/rev, d=1.5mm, Wet

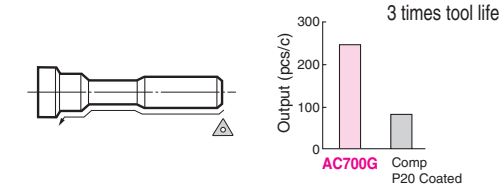
■ Application Example of AC700G

● S45C / Hub



Insert : DNMG150412N-MU
Conditions : V=210m/min, f=0.35mm/rev, d=2.0mm, Wet

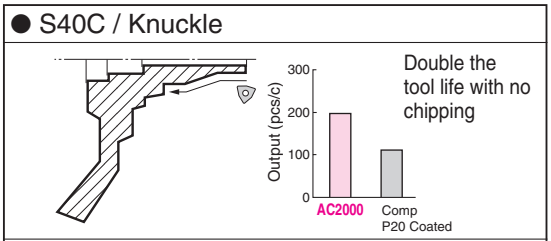
● S30C / Propeller Shaft



Insert : TNMG220412N-SX
Conditions : V=180m/min, f=0.35mm/rev, d=1.5mm, Dry

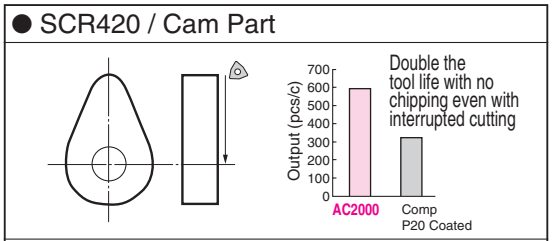
■ Application Example of AC2000

● S40C / Knuckle



Insert : WNMG080412N-MU
Conditions : V=130m/min, f=0.4mm/rev, d=2.0mm, Wet

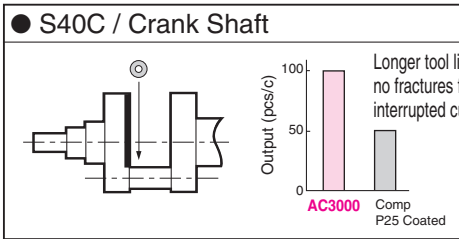
● SCR420 / Cam Part



Insert : WNMG080408N-GU
Conditions : V=250m/min, f=0.25mm/rev, d=1.5mm, Wet

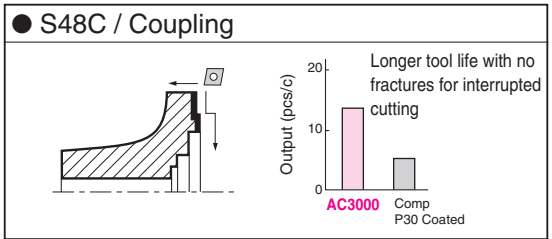
■ Application Example of AC3000

● S40C / Crank Shaft



Insert : RCMX1204MON-RP
Conditions : V=200m/min, f=0.4mm/rev, d=3～4mm, Dry

● S48C / Coupling



Insert : CNMG120408N-MU
Conditions : V=160m/min, f=0.25mm/rev, d=2.0mm, Wet

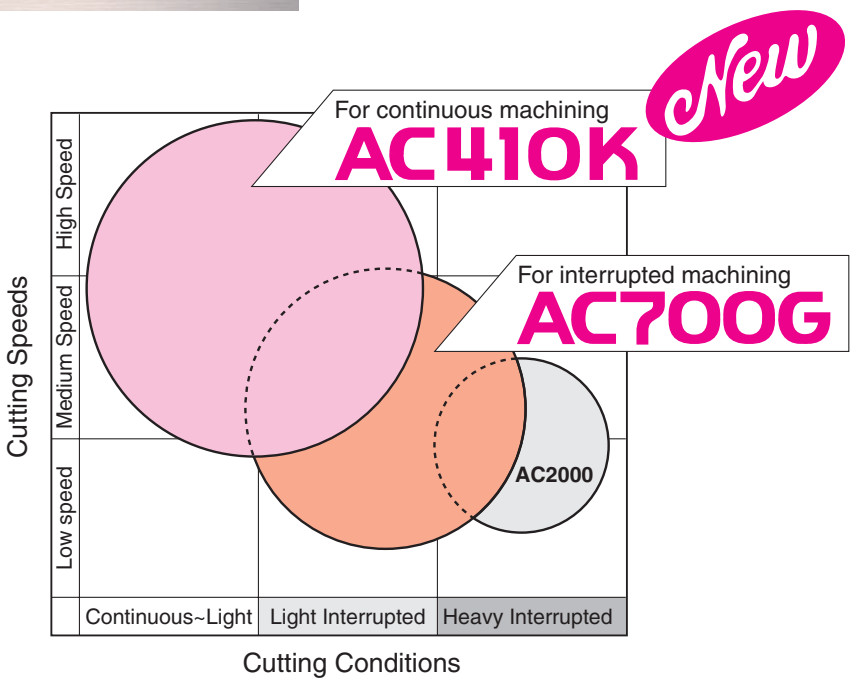
ACE-Coat
AC410K/AC700G

Introducing The New Cast Iron Turning Grade AC410K

■ General Features

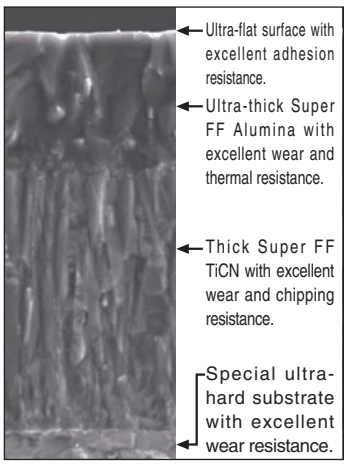
ACE-Coat AC410K, utilizing the ultra-thick Super FF Coat, is the new grade for high speed and high efficiency machining of Ductile Cast Iron and Grey Cast Iron. Along with ACE-Coat AC700G, the grades can cover a whole range of Cast Iron machining applications.

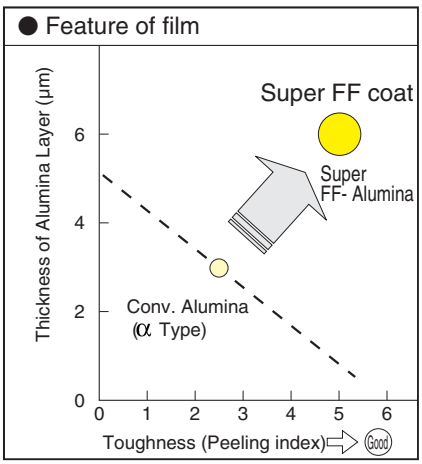
■ Application Range



■ AC410K Characteristics

- Achieving more than double the wear resistance of conventional grades with the new Super FF Coat.
- With an ultra-thick and high strength Alumina layer, high speed and high efficiency machining of 1.5 times better then conventional grades can be achieved.
- Drastic improvements on stability with smooth surface treatment.

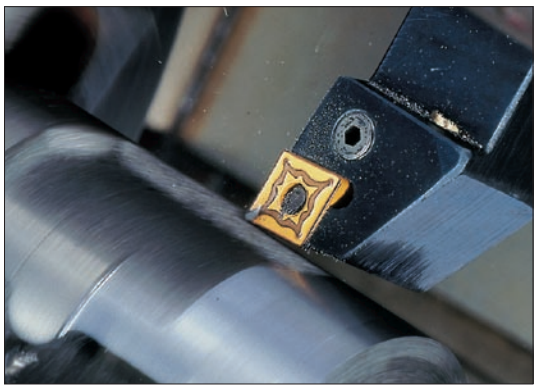




■ Recommended Conditions

Cutting Type	FCD (Ductile Cast Iron) Grade	Breaker	Conditions: C/Speed (m/min) / Feedrate (mm/rev)	FC (Grey Cast Iron) Grade	Breaker	Conditions: C/Speed (m/min) / Feedrate (mm/rev)
Continuous~Light cut	AC410K	UZ	150–350 / 0.1–0.5	AC410K	UZ	100–400 / 0.1–0.6
Roughing~Light Interrupted	AC410K	UX	100–250 / 0.1–0.4	AC410K	UX (UZ)	100–350 / 0.1–0.8
Heavy Interrupted	AC700G	UX (UZ)	80–200 / 0.1–0.4	AC700G	UX (UZ)	100–300 / 0.1–0.6
Heavy cut	AC2000	UX (MU)	80–200 / 0.1–0.4	AC700G	No Breaker (UX)	100–250 / 0.1–0.6

New



ACE-Coat AC410K

ACE-Coat AC700G

■ Characteristics and Application

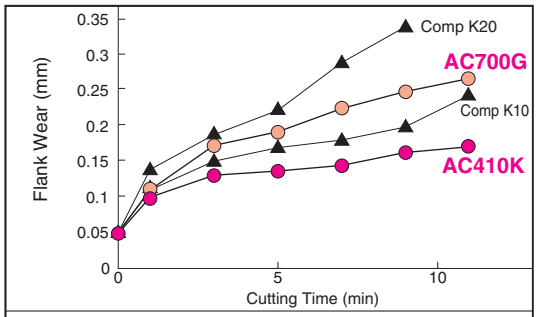
Special ultra-hard carbide substrate coupled with the ultra-thick Super FF Coat for excellent wear resistance. For continuous to light interrupted machining of ductile cast iron and grey cast iron.

■ Characteristics and Application

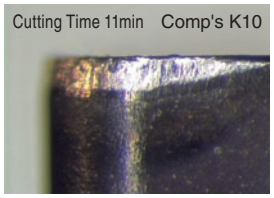
A reliable grade that combines a special tough substrate with a peeling resistant coating. For roughing and interrupted machining of ductile cast iron and grey cast iron.
(Also suited for high speed machining of steel)

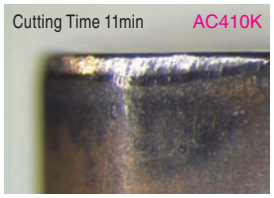
■ Performance

● Wear Resistance

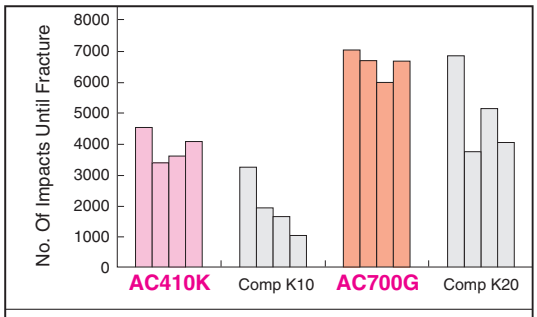


Work: FCD450 (240HB)
Insert: CNMG120408 Holder: PCLNL2525-43
Conditions: V=350m/min f=0.35mm/rev. d=1.5mm, Wet



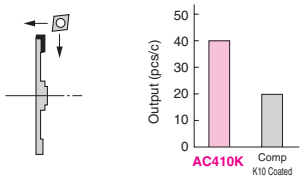
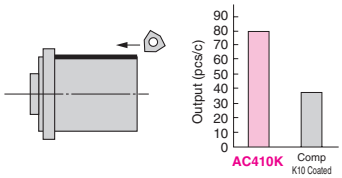
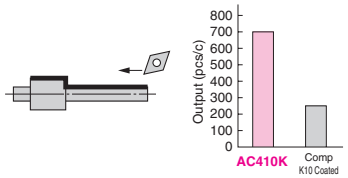


● Fracture Resistance

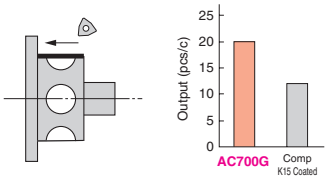
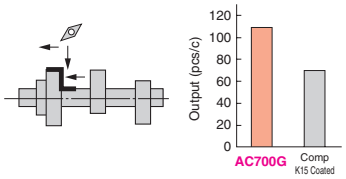
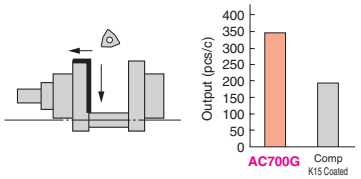


Work: FCD700 Interrupted material (270HB)
Insert: CNMG120408 Holder: PCLNL2525-43
Conditions: V=160m/min f=0.35mm/rev. d=1.5mm, Dry

■ Application Example of AC410K

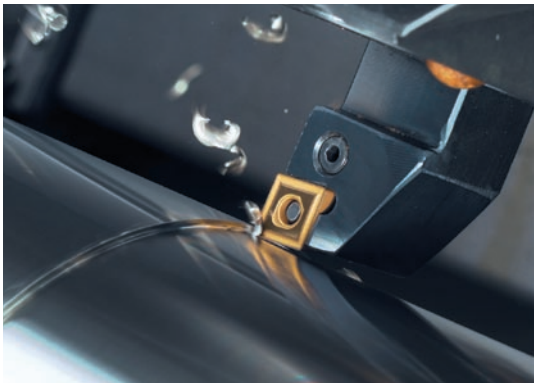
● FCD600 / Flywheel	● FCD450 / Hub	● FCD600 / Shaft
		
Insert : CNMG120408N-UX Conditions : V=300m/min f=0.2mm/rev d=2.0~3.0mm, Dry	Insert : WNMG080408N-UZ Conditions : V=200m/min f=0.25~0.3mm/rev d=1.2mm, Wet	Insert : DNMG150412N-UZ Conditions : V=130~200m/min f=0.3mm/rev d=0.5mm, Wet

■ Application Example of AC700G

● FCD450 / Case	● FCD450 / Cam Shaft	● FCD600 / Crank Shaft
		
Insert : WNMG080412N-UX Conditons : V=250m/min f=0.24mm/rev d=2.2mm, Wet	Insert : VNMG160412N-UX Conditions : V=190m/min f=0.3mm/rev d=3.0mm, Wet	Insert : WNMG080408N-UZ Conditions : V=200m/min f=0.15mm/rev d=1mm, Wet

ACE-Coat
AC610M/AC630M

Coated Grades For Stainless Steel Turning



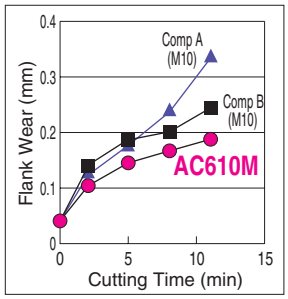
■ General Features

ACE-Coat AC610M/AC630M for Stainless Steel turning, utilizes the Super FF Coat for superior resistance to notch wear which typically occurs during the machining of Stainless Steel, to achieve a stable and long tool life.

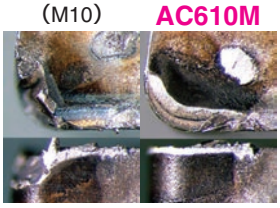
■ Characteristics

- Utilizes a micro-grained Ti-compound coating (Super FF TiCN) with improved coating strength and wear resistance.
- Utilizes a micro-grained α Alumina coating (Super FF Alumina) with improved hardness and adhesion resistance.
- AC610M: High hardness substrate for high efficiency maching with excellent wear resistance.
- AC630M: High toughness substrate for superior cutting edge sharpness and stability.

■ Performance of AC610M(Stainless Steel)



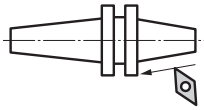
Comp A (M10) AC610M

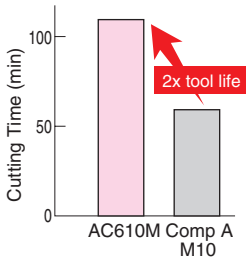


Work : SUS316
Insert : CNMG120408N-GU Holder : PCLNR2525-43
Conditions : V=200m/min, f=0.25mm/rev, d=1.5mm、Wet

■ Application Example of AC610M(Stainless Steel)

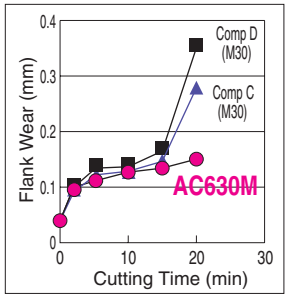
Machine Component (SUS304)



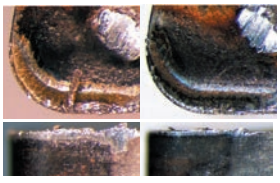


Insert : DNMG150408N-EX
Conditions : V=210m/min、f=0.3mm/rev、d=2.0mm、Wet

■ Performance of AC630M(Stainless Steel)



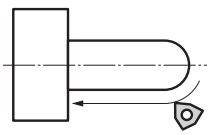
Comp D (M30) AC630M

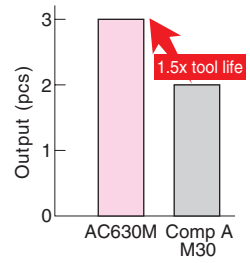


Work : SUS316
Insert : CNMG120408N-GU Holder : PCLNR2525-43
Conditions : V=150m/min、f=0.25mm/rev、d=1.5mm、Wet

■ Application Example of AC630M(Stainless Steel)

Machine Component (SUS304)





Insert : WNMG080408N-EX
Conditions : V=130m/min、f=0.4mm/rev、d=0.5mm、Wet

■ Recommended Conditions (Stainless Steel)

	Work Material Characteristics	JIS name	C/Speed V(m/min) AC610M f(mm/rev) 0.2	0.4	0.6	AC630M 0.2	0.4	0.6
1	Stainless Steel with good machinability Ferritic Structures Martensitic Structures	SUS303 SUS416 SUS420F SUS440F SUS405 SUS430F	300	235	195	235	180	155
2	Stainless Steel with average machinability Ferritic Structures Martensitic Structures	SUS403 SUS410 SUS420J1 SUS420J2 SUS430 SUS431 SCS13	265	205	170	210	160	140
3	Stainless Steel with low machinability Martensitic Structures Austenitic Structures	SUS304 SUS304L SUS304LN SUS316 SUS316L SUS316Ti SUS317 SUS321 SUS440A SUS440B SUS440C SCS14	230	180	150	180	140	120

	Work Material Characteristics	JIS name	C/Speed V(m/min) AC610M f(mm/rev) 0.2	0.4	0.6	AC630M 0.2	0.4	0.6
4	Stainless Steel with bad machinability Austenitic Structures	SUS301 SUS302 SUS304N1 SUS304N2 SUS309S SUS310S SUS316LN SUS347	185	145	120	145	110	95
5	Hard-to-cut Stainless Steel 2 Phase Structures (Duplex) Deposition Hardened Structures	SUS316J1 SUS316J1L SUS630 SUS631 SUS329J1 SUS329J3L SUS329J4L SCS24	140	110	90	110	85	70

ACE-Coat AC630M

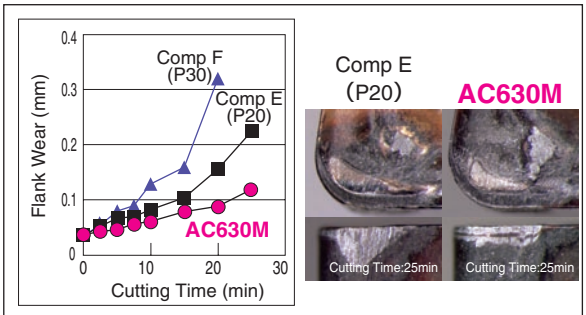
■ General Features

Other than Stainless Steel, ACE-Coat AC630M is also suitable for the turning of General Steels such as Carbon Steel and Alloyed Steel. The combination of a tough and reliable grade coupled with a sharp cutting edge, is excellent for applications which used to be difficult for conventional P20~P30 grades.

■ Characteristics

- Machining of small diameter or thin walled parts that are likely to cause chattering and deformation.
- In light interrupted turning, where the insert tool life is unstable.
- In finishing, where the tool life (surface roughness) of Cermet is unstable.

■ Performance of AC630M(General Steel)

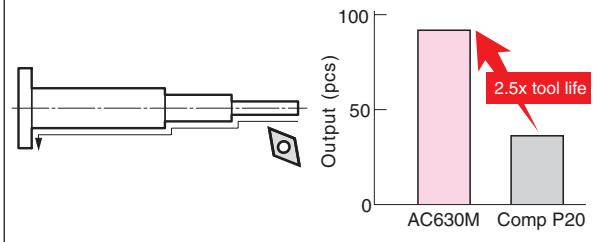


Work : SCM415 Insert : CNMG120408 Holder : PCLNR2525-43
Conditions : V=220m/min f=0.3mm/rev d=1.5mm Wet

AC630M is able to withstand coating peel-off damage caused by work adhesion and is good for turning of low carbon steel.

■ Application Example of AC630M (General Steel)

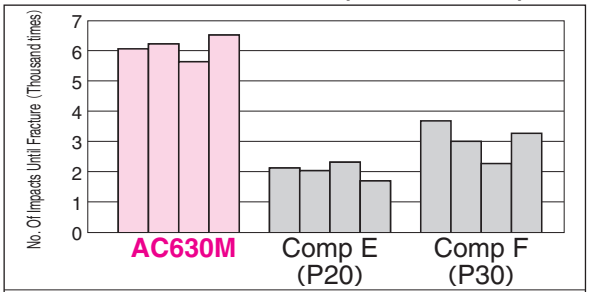
Shaft(SNCM439)



Insert : DNMG150404N-EX
Conditions : V=180m/min、f=0.18mm/rev、
d=0.5mm、Wet

AC630M reduced chattering, resulting in 2.5 times better tool life than competitor's P20 grade.

■ Performance of AC630M(General Steel)

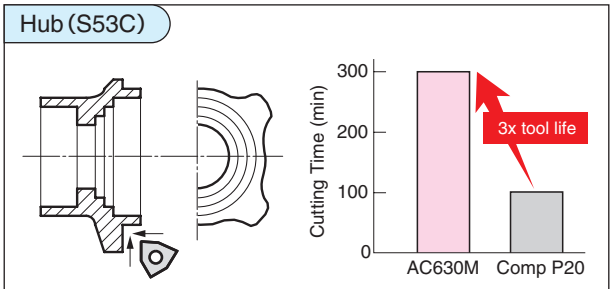


Work : SCM435-Grooved Insert : CNMG120408 Holder : PCLNR2525-43
Conditions : V=220m/min f=0.3mm/rev d=1.5mm Wet

AC630M is able to withstand impact fractures to provide a stable tool life for light interrupted cutting.

■ Application Example of AC630M (General Steel)

Hub (S53C)



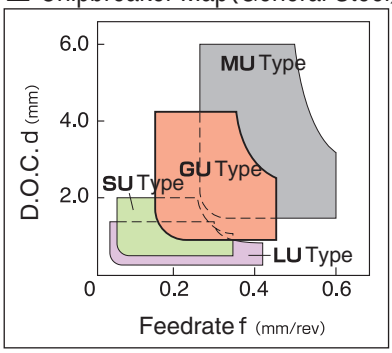
Insert : WNMG080412N-GU
Conditions : V=180m/min、f=0.35mm/rev、
d=0.8mm、Wet

AC630M has no chipping during light interrupted cutting and achieved 3 times better too life than competitor's P20 grade.

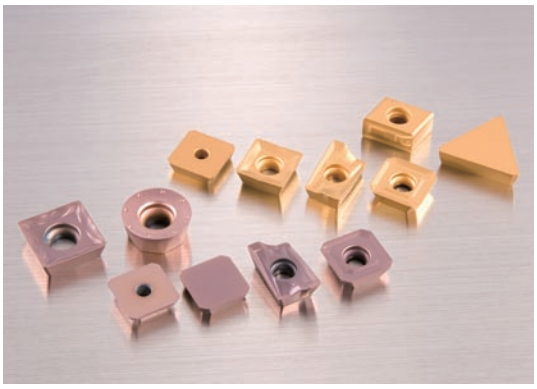
■ Recommended Conditions of AC630M(General Steel)

Work	C/Speed V (m/min) / Feedrate f (mm/rev)
Structural Steel 150HB or less (ex. SS41)	50 – 400 / 0.1 – 0.5
Alloy Steel, Carbon Steel Below 280HB (ex. SCM435)	50 – 250 / 0.1 – 0.5
Alloy Steel, Carbon Steel 280HB and above (ex. SCM440)	50 – 220 / 0.1 – 0.5

■ Chipbreaker Map(General Steel)



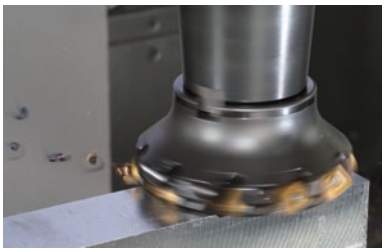
ACE-Coat
ACP100 • 200 • 300 / ACK200 • 300



New

■ General Features

Introducing 5 new coated grades which utilize the latest in PVD coating "Super ZX Coat" and CVD coating "Super FF Coat", for high cutting edge reliability during high speed and high efficiency milling operations.
Achieving stability and longer tool life with ACE-Coat ACP100/ACP200/ACP300 for General Steel, Die Steel and Stainless Steel, and ACE-Coat ACP200/ACP300 for Cast Iron and Ductile Cast Iron



■ Characteristics

● Grades for Genera Steel, Die Steel and Stainless Steel

Grade	Coating	Application	Characteristics	Conventional Grade
ACP100	Super FF Coat	General - High speed machining and wet cutting	Utilizing the new fine Ti-based CVD coating,coupled with super tough substrate for better wear and thermal cracking resistance.	AC230
ACP200	Super ZX Coat	General machining of general steel and die steel	Utilizing the new super multi-layered PVD coating of nanometer thick TiAlN and AlCrN layers, coupled with a special tough substrate that makes it a general grade with an excellent balance of fracture and wear resistance.	ACZ330
ACP300	Super ZX Coat	Interrupted machining and stainless steel machining	Utilizing the new super multi-layered PVD coating of nanometer thick TiAlN and AlCrN layers, coupled with a super tough substrate for excellent fracture resistance.	ACZ350

● Grade for Cast Iron

Grade	Coating	Application	Characteristics	Conventional Grade
ACK200	Super FF Coat	General machining of cast iron and ductile cast iron	Utilizing the new smooth and fine Ti-based CVD coating. A general grade with excellent anti-adhesion and wear resistance.	AC211、EH20Z ACZ310
ACK300	Super ZX Coat	General - interrupted machining of cast iron and ductile cast iron	Utilizing the new super multi-layered PVD coating of nanometer thick TiAlN and AlCrN layers, coupled with a fine-grained super tough substrate for excellent fracture resistance.	ACZ310

■ Recommended Conditions

Type	P10 M10 (Light)	P20 M20 (Medium)	P30 M30 (Roughing)	P40 M40 (Heavy)
P Steel / M Stainless Steel	ACP100	ACP200	ACP300	

Type	K01 (Finishing)	K10 (Light)	K20 (Medium)	K30 (Roughing)
K Cast Iron	ACK200	ACK300		

■ Recommended Conditions

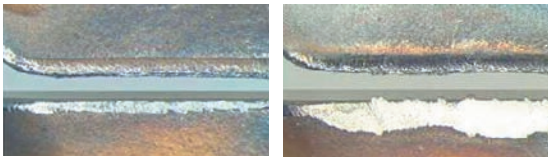
Work		C/Speed V (m/min) / Feedrate f (mm/t)
P Steel	Carbon Steel Alloy Steel	80 – 300 / 0.1 – 0.4
P Steel	Die steel (~30HRC)	80 – 230 / 0.07 – 0.3
P Steel	Die steel (30~60HRC)	80 – 200 / 0.07 – 0.3
M Stainless Steel	Stainless Steel	70 – 250 / 0.1 – 0.3
K Cast Iron	FC (Grey Cast Iron)	80 – 250 / 0.1 – 0.3
K Cast Iron	FCD (Ductile Cast Iron)	80 – 230 / 0.1 – 0.3

ACE-Coat
ACP100 • 200 • 300 / ACK200 • 300

■ Performance of ACP100

(Edge Wear Comparison)

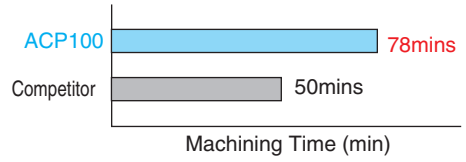
Work : SKD11 Raw material
Cutter : WGC4100R Insert : SEMT13T3AGSN-G
Conditions : V = 150m/min, f = 0.15mm/rev,
Ad = 2.0mm, Rd = 50mm,DRY



ACP100 Competitor

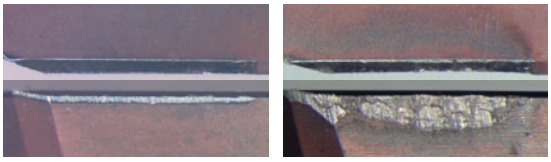
(Tool Life or Output Comparison)

Work : S50C
Cutter : WGC4160R Insert : SEMT13T3AGSN-H
Conditions : V=204m/min, f=0.32mm/rev,
Ad=2.0mm, Rd=25mm,DRY



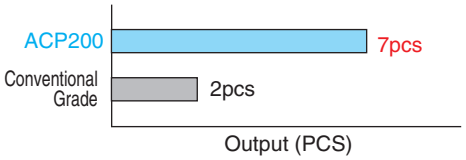
■ Performance of ACP200

Work : SKD61 Raw material
Cutter : FPG4160R Insert : SDKN42MT
Conditions : V = 180m/min, f = 0.2mm/rev, d=2mm,DRY



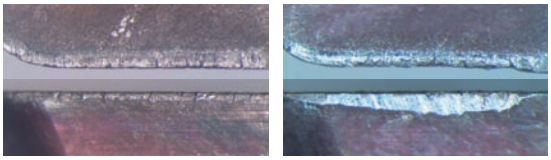
ACP200 Conventional Grade

Work : SCM440
Cutter : WGC4080R Insert : SEET13T3AGSN-G
Conditions : V=254m/min, f=0.2mm/rev,
d=2mm,DRY



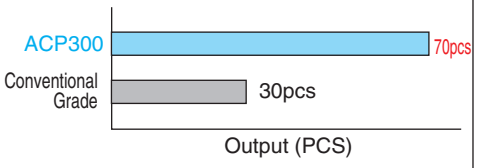
■ Performance of ACP300

Work : SUS304
Cutter : UFO4160R Insert : SFKN12T3AZTN
Conditions : V = 200m/min, f = 0.15mm/rev, d=2mm,DRY



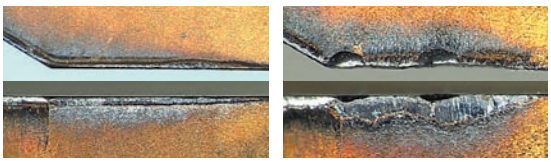
ACP300 Conventional Grade

Work : SUS316
Cutter : FPG4160R Insert : SDKN42MT
Conditions : V=63m/min, f=0.2mm/rev,
d=1.5mm,WET



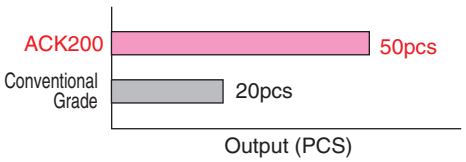
■ Performance of ACK200

Work : FC250
Cutter : DPG4200R Insert : SPCH42R
Conditions : V = 150m/min, f = 0.15mm/rev, d=3mm,DRY



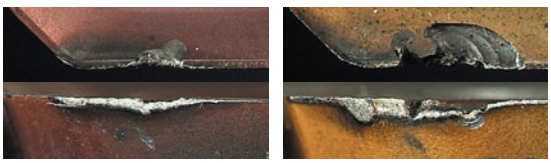
ACK200 Conventional Grade

Work : FCD450
Cutter : UFO4100R Insert : SFKN12T3AZTN
Conditions : V=230m/min, f=0.3mm/rev,
d=3mm,DRY



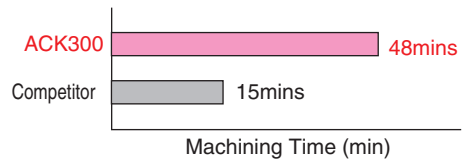
■ Performance of ACK300

Work : FCD450
Cutter : WGC4100R Insert : SEMT13T3AGSN-G
Conditions : V = 200m/min, f = 0.12mm/rev, d=2mm,DRY

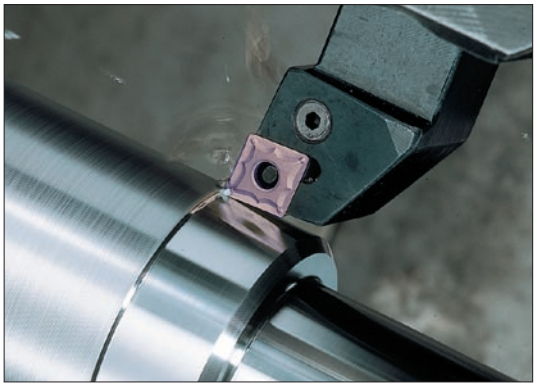


ACK300 Competitor

Work : FC250
Cutter : WGC4160R Insert : SEMT13T3AGSN-G
Conditions : V=250m/min, f=0.2mm/rev,
d=2mm,DRY



Coated Cermet
T2000Z/T3000Z



■ General Features

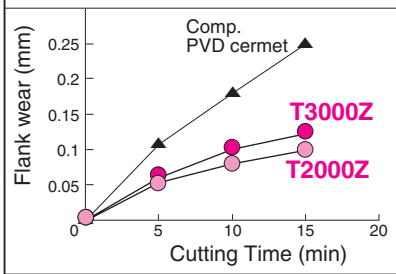
Responding to the good reviews for coated cermet T2000Z, Sumitomo Electric has introduced a tougher coated cermet T3000Z.
By achieving beautiful surfaces, machining time is substantially shorten as roughing and finishing can be done in a single process.

■ Characteristics and Application

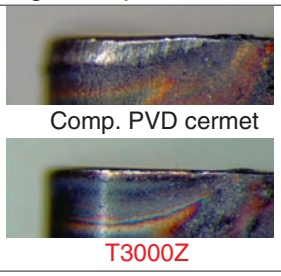
- High hardness ZX-Coat doubles the tool life as compared to conventional cermets.
- Improvements on the density and smoothness of the coating results in consistent beautiful finishing.
- T2000Z: For continuous machining, from high speed cutting to medium cutting.
- T3000Z: Special tough cermet substrate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

■ Characteristics and Efficiency

● Wear Resistance

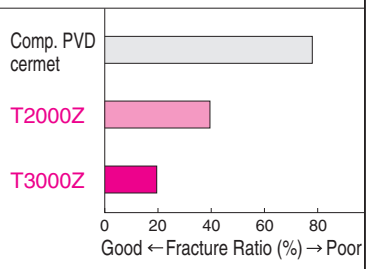


● Edge Comparison



Work : SCM435(260HB) Insert : CNMG120408 Holder : PCLNR2525-43
Conditions : V=200m/min, f=0.30mm/rev. d=1.5mm Wet

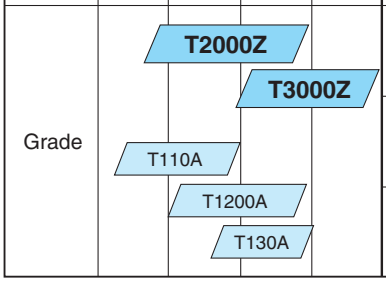
● Fracture Resistance



Work : SCM435(with Slits) Insert : CNMG120408
Holder : PCLNR2525-43 Conditions : V=200m/min, f=0.25mm/rev. d=1.5mm Wet

■ Recommended Conditions

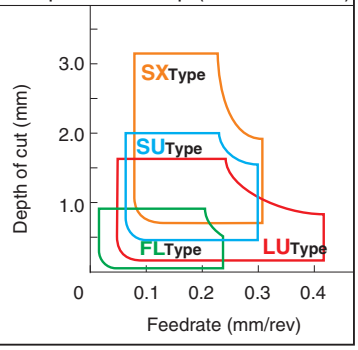
● Application Range



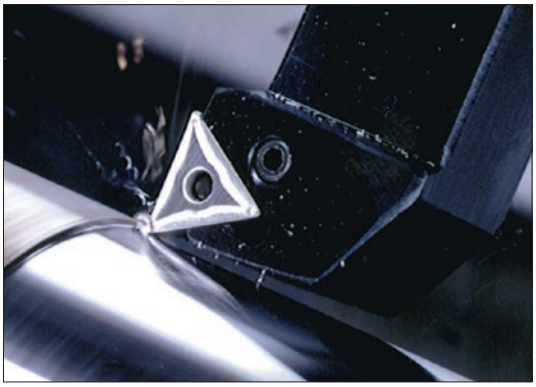
● Recommended Conditions

Work	C/Speed (m/min) / Feedrate (mm/rev)
Soft Steel Below 150HB (SS41)	100 – 400 / 0.1 – 0.3
Alloy Steel, Carbon Steel Below 280HB (SCM435)	100 – 300 / 0.1 – 0.3
Alloy Steel, Carbon Steel 280HB and above (SCM440)	50 – 250 / 0.1 – 0.2

● Chipbreaker Map (General Steel)



For Steel Turning
T1200A



■ General Features

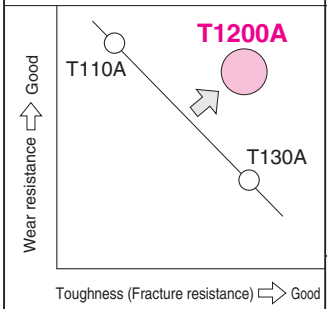
T1200A was developed for a wide application range from finishing to rough machining.
With its improved wear and fracture resistance, high speed machining of steel is also possible.
Furthermore, with good thermal cracking resistance, wet cutting can be performed.

■ Characteristics and Application

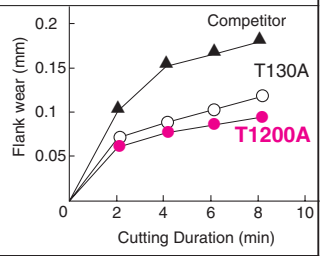
- High efficiency, high speed machining with improved wear resistance.
- Sharp cutting edge that produces excellent surface finish.
- Wet cut possible with good thermal cracking resistance.
- Stable tool life with good fracture resistance
- Available in a variety of chipbreakers.

■ Performance

● Balance of wear resistance and toughness



● Wear Resistance



Work: SCM435
Insert: CNMG120408
V=200 m/min, f=0.36mm/rev d=1.5mm, Wet

■ Recommended Conditions

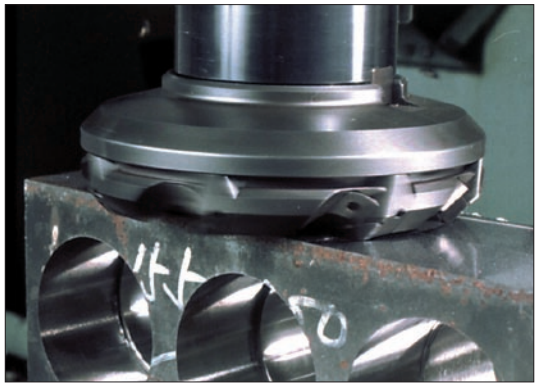
● Application Range

Application	High-Speed Cutting	Finishing	Light Cut	Medium Cut
Grade		T1200A		
		T110A		
				T130A

● Recommended Conditions

Work	C/Speed (m/min) / Feedrate (mm/rev)
Soft Steel Below 150HB (SS41)	100 – 300 / 0.1 – 0.3
Alloy Steel Carbon steel below 280HB (SCM435)	100 – 250 / 0.1 – 0.3
Alloy Steel Carbon Steel Above 280HB (SCM440)	50 – 200 / 0.1 – 0.2

For Steel Milling
T250A



■ General Features

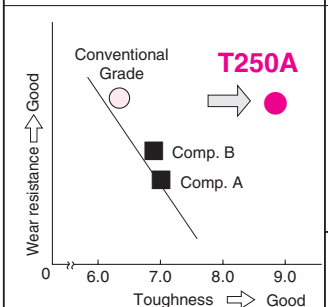
T250A features a strong cutting edge and excellent wear resistance with a tool life 2 to 3 times that of conventional cermets. With its high toughness properties, high effciency and excellent tool life can be expected in the milling of Alloy steel, Carbon steel, Stainless steel, Die steel as well as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

■ Characteristics and Application

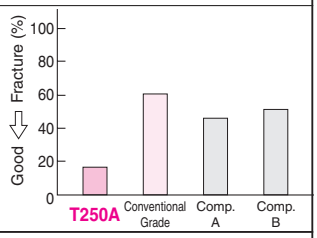
- 30% higher K_{1C} value, as compared to conventional cermets, improves edge toughness and tool life.
- High toughness and hardness improve wear resistance.
- Stable milling of General steel, Stainless steel and Die steel etc.

■ Performance

● Wear Resistance vs Toughness



● Fracture Resistance



Material : SCM435 (260HB), 3 Grooves
Insert: SDKN42MT
Conditions: V = 216 m/min, f =0.27~0.45 mm/ tooth
D=2.0 mm, Dry

■ Recommended Conditions

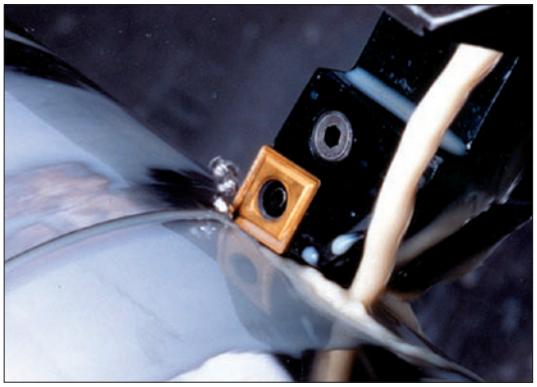
● Application Range

Application	Finishing	Light Cut	Medium Cut	Roughing
Grade		T250A		

● Recommended Conditions (C/Speed (m/min) / Feedrate (mm/rev))

Carbon Steel	120 – 250 / 0.1 – 0.3
Alloy Steel	120 – 250 / 0.1 – 0.3
Structural Steel	150 – 300 / 0.1 – 0.3
Stainless Steel	80 – 230 / 0.1 – 0.2
Die Steel	60 – 180 / 0.1 – 0.2

For Exotic Alloy Machining
EH510Z/EH520Z



■ General Features

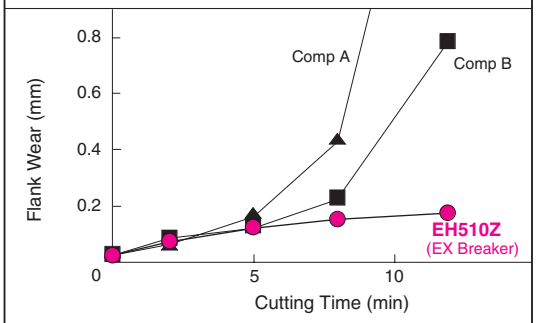
EH510Z/EH520Z are special grades for the machining of exotic alloys such as Heat Resistive steels and Titanium alloys.
With better wear and notch-wear resistance, these grades exhibit a more stable tool life as compared to conventional grades.

■ Characteristics and Application

- For exotic alloys such as Heat Resistive Steel and Titanium Alloy
- Notch wear is greatly reduced resulting in longer tool life
- New ZX-Coat with excellent wear and adhesion resistance
- Special chipbreaker series for hard-to-cut materials
- EH510Z: For continuous machining.
- EH520Z: For roughing, interrupted machining and milling.

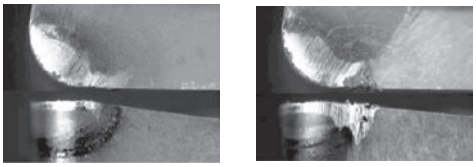
■ Performance of EH510Z

● Wear Resistance



Work : Inconel 718 (45HRC)
Insert : CNMG120408 Holder : PCLNR2525-43
Conditions : V=50m/min f=0.16mm/rev. d=0.5mm, Wet

● Edge Wear Comparison



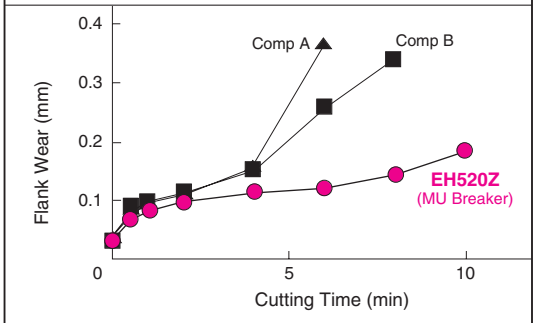
EH510Z
(No notch wear)

Conventional Grade
(Notch wear occurred)

Work : Inconel 718 (45HRC)
Insert : CNMG120408 Holder : PCLNR2525-43
Conditions : V=35m/min f=0.16mm/rev. d=1.0mm, Wet

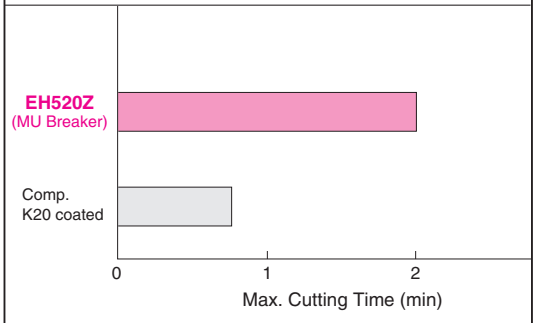
■ Performance of EH520Z

● Wear Resistance



Work : Inconel 718 (45HRC)
Insert : CNMG120408 Holder : PCLNR2525-43
Conditions : V=35m/min f=0.16mm/rev. d=1.0mm, Wet

● Fracture Resistance



Work : Inconel 718 Grooved
Insert : CNMG120408 Holder : PCLNR2525-43
Conditions : V=35m/min f=0.16mm/rev. d=2.0mm, Wet

■ Recommended Conditions

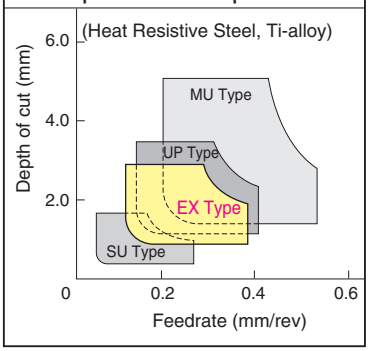
● Application Range

Finish~Light cut	Med~Interrupt cut
EH510Z	
EH520Z	

● Recommended Conditions(Turning)

Work \ Conditions	C/Speed (m/min) / Feedrate (mm/rev.)
N-based alloy Inconel 718 Waspaloy Hastelloy	30 – 60 0.1 – 0.3
Fe-based alloy Incoloy 800 A286 Disculoy	30 – 70 0.1 – 0.3
Co- based alloy Stellite S816. HS30	20 – 70 0.1 – 0.2
Ti-alloy Ti-6Aℓ-4V	30 – 80 0.1 – 0.3

● Chipbreaker Map



AURORA COAT Series

■ General Features

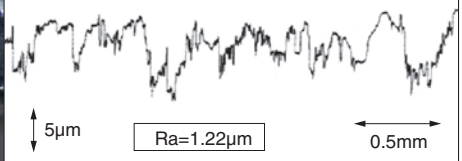
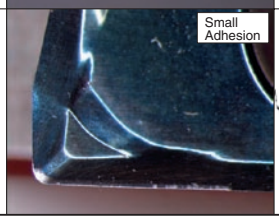
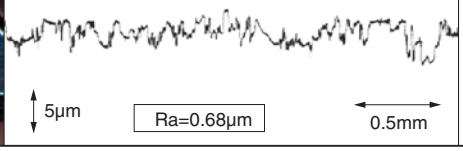
Sumitomo Electric's AURORA COAT is a high hardness, low coefficient layer of DLC (Diamond Like Carbon). Other than producing excellent surface finish for machining of Aluminum and Non-Ferrous Metals, DLC coat can be used for dry cutting and is environmental friendly.

■ Characteristics and Application

- **Super Smooth Surface and Low Coefficient of Friction**
  Achieving beautiful finishing on Aluminum and Non-Ferrous Metals with its high resistance to built-up edge.
- **High Coating Strength Withstand Tough Cutting Conditons**
  Special DLC coating technique that improves coating adhesion. It is the world's first application of DLC coat on cutting tools.
- **Wide Application Possibilities**
  This coating may be applied on inserts, drills and endmills etc.
- **A Spectrum of Colours**
  Glittering colours are a result of the special coating technique.

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

■ Performance

Grade	Rake Face Conditon	Surface Finish	Conditions
Uncoated			Work : ADC12 Tool : WEM3032E Conditions : V=300m/min fz=0.15mm/rev. Ad=Rd=5mm Cutting Length : 36m, Dry
AURORA COAT DL1000			

■ Applicable Tooling

● WaveMill Inserts (DL1000)

● AURORA COAT Endmills (ASM2000/4000DL, SNB2000DL)

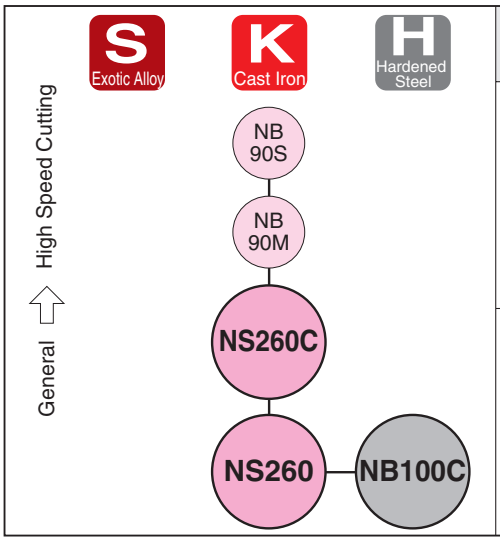
● AURORA COAT Drills (DLH Type)

Advanced Ceramic

■ General Features

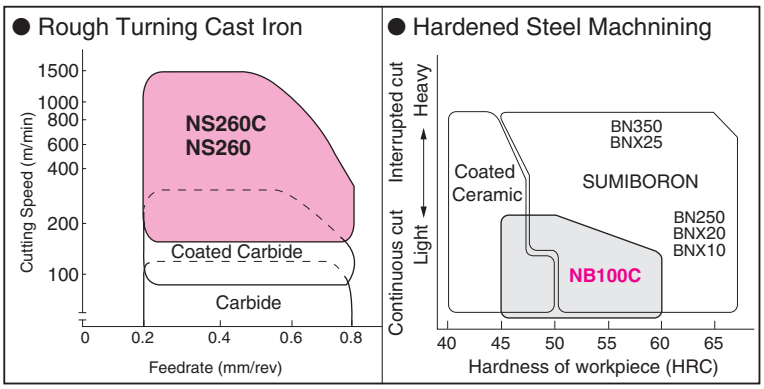
Sumitomo Electric's "Advanced Ceramic" utilises a special process and materials to enhance the toughness of ceramic cutting tools. This new development permits ultra-high speed machining of cast iron with high reliability. All this and more can be found in our latest NS260 and NS260C, with improved grain boundary microstructure for higher hot hardness and good notch wear resistance.

■ Application

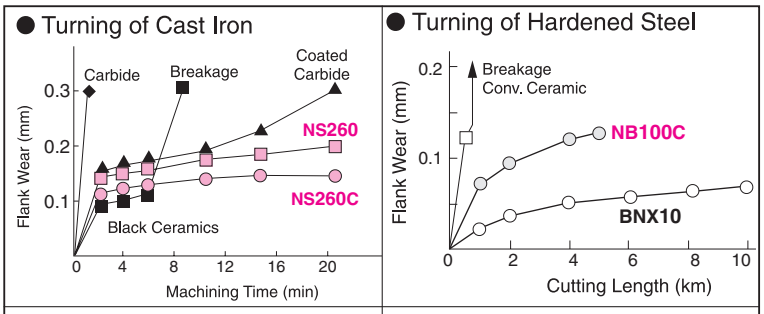


Class	Grade	Characteristic · Application
Advance Si_3N_4 Ceramic	**NS260**	· High strength, high toughness Si_3N_4 ceramic. · Roughing, interrupted turning and wet cutting of cast iron.
	NS260C	· High wear resistance coating. · Suitable for high speed continuous cutting.
Al_2O_3 Ceramic	NB90S	· Al_2O_3 based ceramic. · Suitable for medium to finishing of cast iron.
	NB90M	· Al_2O_3 based tough ceramic · For high speed finish milling of cast iron
	NB100C	· Very tough Al_2O_3 based ceramic with new ZX Coat. · Low speed, continuous turning of hardened steel

■ Application Range



■ Performance



Material : FC250
Holder : FN11R44A Insert : SNMN120412
V=300m/min, f=0.4mm/rev, d=1.5mm, Dry

Material : SUJ2(62HRC)
Holder : PCLNR2525, Insert : CNGA120408
V=120m/min, f=0.1mm/rev, d=0.2mm, Dry

■ Negative Type

Class	Application	Sumitomo	Mitsubishi	Tungaloy	Kyocera	Hitachi	Sandvik	Kennametal
P Steel	Fine Finishing	**FA**	FH	TF	GP		QF	FF
		FL	FS,FY	NS,ZF	XP	FE		
	Finishing	**SU**	SH,C	TS,AS,TSF	HQ	CE,B	PF	
		LU	SA,SY	NM,ZF,11	XQ,CQ	BE		FN
	Wiper Edge	**LUW**	SW	ASW,AFW	WP,WQ		WF	FW
	Light to Medium Cut	**SX**		ZM,27	XS	AB,CT		LF
	Medium Cut	**GU**	MA,MV	TM,37,38	HS,PS	AH	PM,QM	P,MG
		UX	MH	DM	CS,GS,PT	AE,AY	SM	MN
	Wiper Edge	**GUW**	MW				WM	MW
	Roughing	**MU**	GH	TH,51	HT,GT	RE,AR	MG-PR	RP,RN
		MX	MT					
	Heavy Cut	**HG**	HA,HZ,HX,HBS	TU,57	HX	TE,UE	MM-PR,QR	RM,MR
		HP	HH,HXD	65		H	HR	RH
		HU	HV			HE		
		HW	HCS			HX		
M Stainless Steel	Finishing	**SU**	SH	SS	GU	SE	MF	FP
	Light to Medium Cut	**EX**	MS	SA	SU	DE	23	MS
	Medium Cut	**GU**		SM	HU		MM	MP
	Roughing	**HM**	ES	S	ST			
		MU	GH				HR	
K Cast Iron		**UZ**		CM,33	GC	V	KF	UN
		UX	GH,Standard	Standard	ZS,Standard	RE	KM,KR	UM

■ Positive Type

Class	Application	Sumitomo	Mitsubishi	Tungaloy	Kyocera	Hitachi	Sandvik	Kennametal
—	Finishing	**LU**	FV,SQ	PF,23	GP,XP	JQ	PF,UF,MF	11,UF
	Wiper Edge	**LUW**	SW				WF	FW
		SDW					WK	
	Light Cut	**SU**	SV,MQ	PS,24	HQ,XQ,GK	JE	PM,UM,MM	LF
	Light to Medium Cut	**MU**	MV	PM	G	J	PR,UR,MR	MF
N Non- Ferrous Metal		**AG,AW**		AL,PP	AH		AL	HP

(Note) The above data was collected from the various published catalogues therefore the information may not be updated.

Grade Comparison Chart

■ Coated Carbide

Application	Class	Grade	Sumitomo	Mitsubishi	Tungaloy	Kyocera	Hitachi	Sandvik	Kennametal	Dijet	Valenite	SECO
Turning	P Steel	P01	**AC700G**	UE6005	T9005	CR7015 CA5505	HG8010 GM8015	GC4005 GC4015	KC9315 KC9110	JC110V	SV305	TP1000
		P10	**AC700G** **AC2000**	UE6110 UE6010	T9015	CR7015 CA5515	HG8010 GM8015	GC4015 GC4025 GC4225	KC9110 KC9125	JC110V JC215V	SV310 SV315	TP1000 TP2000
		P20	**AC2000**	UE6020	T9025 AH710	CR7025 CA5525	HG8025 GM8020 GM25	GC4225 GC4025 LC25	KC9125 KC8050	JC215V	SV320 SV325	TP2000
		P30	**AC3000** **AC630M**	UE6035 US73S VP20MF VP15TF	T9035 GH730	CR7025 PR630 CA5535	GM8035	GC4035	KC8050 KC5025	JC215V JC325V	SV325 SV330	TP3000
		P40	**AC3000** **AC630M**	UE6035 US735 UH6400	T9035	PR660	GM8035	GC4035	KC9040	JC325V JC450V	SV230 V1N VC911	TP400
	M Stainless Steel S Exotic Alloy	M10 S10	**EH10Z** **EH510Z**	VP05RT VP10RT	T6020 AH110 J740	CA6015 PR905 PR915	GM25	GC1005	KC9225 KC5010	JC5003 JC110V	V05 V88 VC929	TP200
		M20 S20	**AC610M** **EH20Z** **EH520Z**	US7020 VP20MF UP20M	T6020 AH120 J740	CA6015 PR930	GM8035	GC1025 GC2015	KC9225 KC5020 KC8050	JC110V JC5015	V88 VX8 VC928	TP3000 TP300
		M30	**AC630M** **AC3000** **AC530U**	US735 VP15TF	GH330 T6030	CR9025 PR630	GX30	GC2025	KC8050 KC9240	JC5015	V88 VX8 VC928 V1N	TP400
		M40	**AC630M** **AC530U**	US735 VP15TF	GH330	PR660	GX30	GC2035	KC9240		V1N	
	K Cast Iron	K01	**AC410K** **AC300G**	UC5105 UC5115	T5010	CA4115 CA4010	GM3005 GM8015	GC3205	KC9315 KC9320	JC105V	SV405 SV510	TP1000
		K10	**AC410K** **EH10Z**	UC5115 UC6010	T5010 T5020 AH110 GH110	CA4120	GM8020	GC3210 GC3215	KC9320	JC215V	SV410 SV515	TP2000 TX150
		K20	**AC700G** **EH20Z** **AC530U**	UC6010 VP15TF	T5020 AH120 GH120	CA5225	GM25	GC3215 GC3025	KC9325	JC215V	SV415 SV515	TP3000
Milling	P Steel		**ACP100**	F7030	T3030		GF30	GC4020 GC4030 GC4040	KC930M KC935M	JC730U	V1N	T20M T25M T250M
			ACP200 **ACP300**	VP15TF UP20M VP30RT VP20MF	AH120 GH330 AH330	PR630 PR660 PR730 PR830	CY150 CY25 CY250 HC844	GC1025 GC2030	KC792M KC725M KC735M	JC5030 JC5040	VC935	F20M F25M F40M
	M Stainless Steel		**ACP300** **EH20Z**	VP15TF VP30RT VP20MF	GH330 AH120 AH140	PR630 PR925 PR660 PR730 PR830	CY25 CY250	GC1025 GC2030 GC2040	KC930M KC725M KC735M	JC730U JC5040	V1N VC935	T25M F25M F40M
	K Cast Iron		**ACK200**	F5010 F5020	T1015 T1020	PR510 PR905		GC3020 GC3040	KC920M KC925M	JC610	VN5	T150M T200M
			ACK300 **EH20Z**	VP15TF VP20MF	AH110 AH120	PR510 PR905	CY10H CY100H	GC3040 GC1025	KC520M KC525M		VC928	F20M F30M

■ Cermet

Application	Class	Sumitomo	Mitsubishi	Tungaloy	Kyocera	Hitachi	Sandvik	Kennametal	Dijet	Valenite	SECO
Turning	P Steel	**T110A**	NX33 NS1010	GT720 NS520 NS710 AT710★	TN30 PV30★	CH350	CT5005	KT125	LN10 CX50	VC605	
		T1200A **T2000Z★**	NX2525 AP25N★ UP35N★ NX3035 NX55	NS530 GT530★ AT530★ NS720 GT720★ NS730 GT730★	TN60 PV60★ TN6020 PV7020★	CH550 CZ25★	CT5015 GC1525★ CT525	KT175 KT315★	NIT CX75	VC610	CM
	K Cast Iron	**T3000Z★**	NX3035 NX99	NS540	TN90 PV90★	CH625		KZ205	NAT		
		T110A	NX33 NX1010	NS520	TN30 PV30★	CH350	CT5015 CT515	KT125	LN10	VC605	
Milling	P Steel	**T250A**	NX2525 NX4545	NS540 NS740	TC60M TN100M	CH7030 CH7035 MZ1000★	CT530	KT530M★ HT7	CX90	VC630	C15M

★ denotes coated cermet

Grade Comparison Chart

■ Carbide

Class	Grade	Sumitomo	Mitsubishi	Tungaloy	Kyocera	Hitachi	Sandvik	Kennametal	Dijet	Valenite	SECO
P Steel	P10	**ST10P**	STi10T	TX10S		WS10	S1P	P10	SRT	VC7 VC165	S10M
	P20	**ST20E**	UTi20T	TX20 TX25		EX35	SMA	K125M TTM	SRT DX30	VC7	S25M
	P30	**A30** **A30N**	UTi20T	TX30 UX30	PW30	EX35 EX40	SM30	GK K600 TTR	SR30 DX30	VC5 VC35M	S25M
	P40	**ST40E**		TX40		EX45	S6	G13	SR30 DX35	VC111	S60M
M Stainless Steel	M10	**U10E** **EH510**		TU10		WA10B	H10A	K313	UMN	VC29 VC2	890
	M20	**U2** **EH520**	UTi20T	TU20		EX35	H13A	K68 KMF K125M TTM	DX25 UMS	VC28 VC901	HX 883
	M30	**A30** **A30N**	UTi20T	UX30	PW30	EX40 EX45	H10F SM30	K600 TTR	DX25 UMS	VC35M	HX
K Cast Iron	K01	**H2** **H1**	HTi05T	TH03 KS05F		WH05	H1P	K605	KG03		
	K10	**EH10** **EH510**	HTi10	TH10 G1F	KW10	WH10	H10 HM	K10 K313 KF1 KM1 K110M THM THM-U	KG10 KT9	VC3 VC29	890
	K20	**G10E** **EH20** **EH520**	UTi20T	G2 KS20		WH20	H13A	K715 KMF K600	KG20 CR1	VC2 VC29 VC28	883 HX
	K30	**G10E**	UTi20T	G3		WH30		THR	KG30	VC111 VC101	
Fine-grained Carbide		**F0,BL130**		F							
		F1,AFU **AF0,SF2**	MF10	MD08F MD10	FW30	NM10,EXH EX15	6UF,8UF PN90,H6FF		FB10 FB15,FZ15		
		AF1	MF20,UF20	M,EM10,MD20		BRM20	12UF		FB20		
		A1,CC	UF30,TF15	UM,MD30		NM25	N6F,H10F				

■ Ceramic

Class	Sumitomo	Tungaloy	Kyocera	Sandvik	Kennametal	Dijet	Valenite	Nippon Tungsten	NTK
H Hardened Steel	**NB100C**	LX11	A66N A65	CC650	MC2 KYON2000 KYON2100	CA100	Q32 V44	NPC-A2	HC4 HC5
S Exotic Alloy	**WX120**	WG300		CC670	MC3 KYON4000 KYON4300	CA200		WHISKAL	WA1 WA2
K Cast Iron	**NB90S** **NB90M** **NS260C** **NS260**	LX21 FX105	SN60 KA30 KS500 KS6000 KS7000	CC620 CC690 CC6090 GC1690	KW80 AC5 KB90 KB90X KYON3000 KYON3400 KYON3500	CA010 CS100	Q6	NAICON-NXA NAICON-NX	HC1 HC2 HC6 SX1 SX2 SP2 SX8

Properties of Sumitomo Grades

■ Properties of Coated Carbide Grades

Class	Grade	Hardness (HRA)	T.R.S. (GPa)	Coating Type	Main Coating Components	Coating Thickness (μm)
P Steel	**AC700G**	91.0	2.2	CVD	Ti compound + α Alumina	12
	AC2000	90.1	2.2	CVD	Ti compound + Alumina	10
	AC3000	89.4	2.6	CVD	Ti compound + Alumina	10
	ACP100	89.3	3.1	CVD	Fine Ti compound + Fine Alumina	6
	ACP200	89.5	3.2	PVD	AlCrN/TiAlN multi-layered	3
	ACP300	89.3	3.1	PVD	AlCrN/TiAlN multi-layered	3
M Stainless Steel	**AC610M**	91.0	2.2	CVD	Fine Ti compound + Fine α Alumina	5
	AC630M	89.5	2.7	CVD	Fine Ti compound + Fine α Alumina	5
	EH10Z	92.3	3.4	PVD	TiN/AlN multi-layered	3
	EH20Z	91.2	3.4	PVD	TiN/AlN multi-layered	3
K Cast Iron	**AC410K**	92.0	2.4	CVD	Fine Ti compound + Thick layer fine α Alumina	18
	AC300G	92.0	2.4	CVD	Ti compound + α Alumina	15
	AC700G	91.0	2.2	CVD	Ti compound + α Alumina	12
	ACK200	91.7	2.5	CVD	Fine Ti compound + Fine α Alumina	6
	ACK300	91.4	3.3	PVD	AlCrN/TiAlN multi-layered	3
S Exotic Alloy	**EH510Z**	92.6	2.6	PVD	TiN/AlN multi-layered	3
	EH520Z	91.7	2.5	PVD	TiN/AlN multi-layered	3

■ Properties of Uncoated Carbide Grades

Class	Grade	Hardness (HRA)	T.R.S. (GPa)	Young Modulus (GPa)	Thermal Conductivity Expansion Coefficent (W/m · ℃)	Compressive Strength (GPa)	Linear-Thermal Expansion Coefficient (X 10^{-6}/℃)
P Steel	**ST10P**	92.1	1.9	470	25	4.9	6.2
	ST20E	91.8	1.9	550	42	4.8	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	—	—	—	—
Fine-grained Carbide	**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	—	—	—

■ Properties of Cermet Grades

Class	Grade	Hardness (Hv) (GPa)	T.R.S. (GPa)
Cermet	**T110A**	16.5	1.6
	T1200A	15.7	2.2
	T250A	14.0	2.1
Coated Cermet	**T2000Z**	15.2	2.3
	T3000Z	13.9	2.4

■ Properties of Ceramic Grades

Class	Grade	Hardness (Hv) (GPa)	T.R.S. (GPa)
Ceramic	**NS260**	15.7	1.3
	NB90S	20.6	0.9
	NB100C	21.0	1.0

■ Material Properties

Material		Specific Gravity	Micro Vickers Hardness (mHv) (GPa)	Young's Modulus (GPa)	Thermal Conductivity Expansion Coefficent (W/m · ℃)	Linear-Thermal Expansion Coefficient (X 10^{-6}/℃)	Melting Point (℃)
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
Nobium Carbide	**NbC**	8.2	20	340	17	6.8	3,500
Titanium Nitrate	**TiN**	5.43	20	260	29	9.2	2,950
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	1300	4.7	—
Cubic Boron Nitride	**C**	3.52	>90	970	2100	3.1	—
Cobait	**Co**	8.9	—	100～180	69	12.3	1,495
Nickel	**Ni**	8.9	—	200	92	13.3	1,455
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	—