Insert Grades

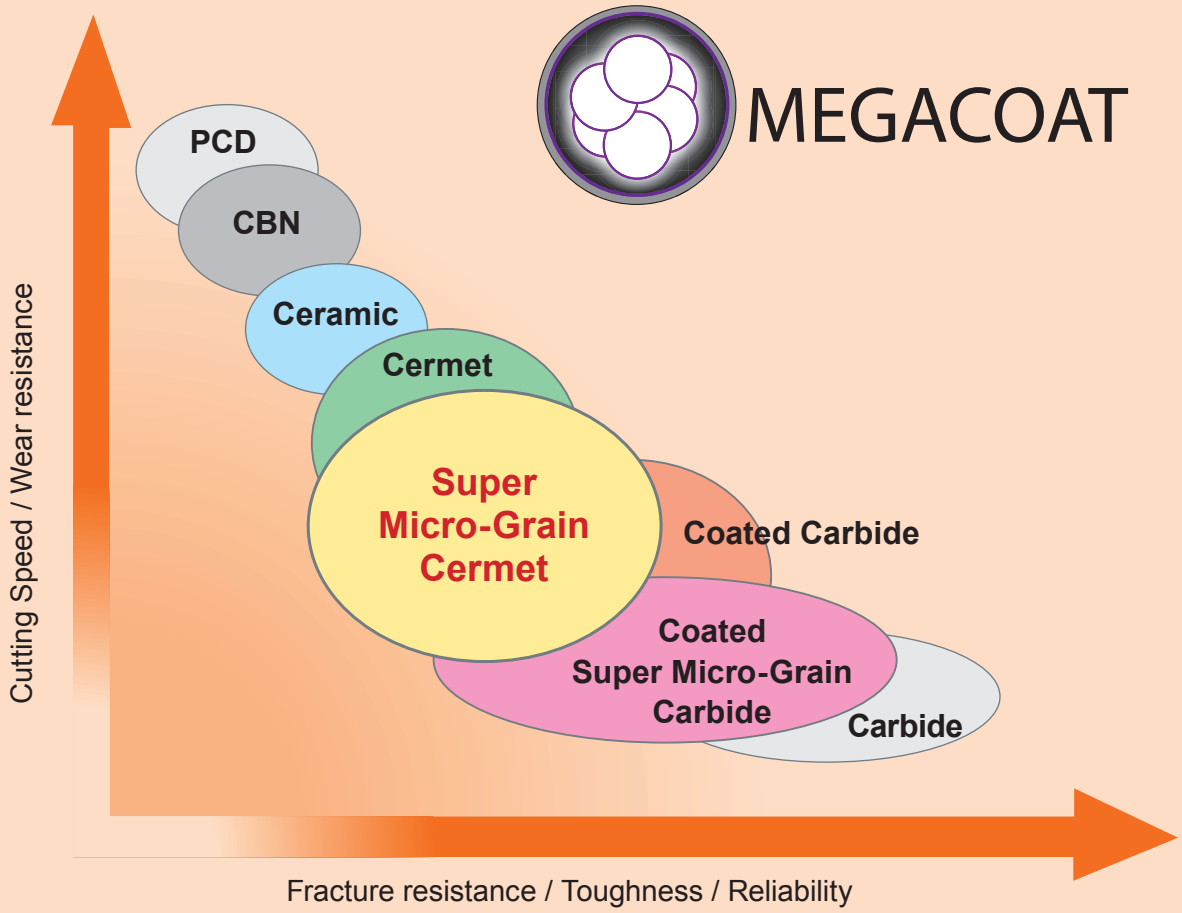
A1~A16

A

Summary of Insert Grades	A2~A6
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PCD (Polycrystalline diamond)	A14
CBN (Cubic Boron Nitride)	A15
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MEGACOAT



Summary of Insert Grades

Kyocera promotes reseach and development to help improve customers' productivity and profitability.
Kyocera provides high-quality inserts in various grades including Cermet, Coated Carbide, Coated Super Micro Grain Carbide, Carbide, Ceramic, PCD and CBN.

Turning

Workpiece Material		Steel (Carbon steel / Alloy steel)					Stainless steel / Cast steel					Cast Iron (Gray cast iron / Nodular cast iron)			
Cutting Range		Finishing ← → Roughing					Finishing ← → Roughing					Finishing ← → Roughing			
Classification		P01	P10	P20	P30	P40	M01	M10	M20	M30	M40	K01	K10	K20	K30
Cermet	TN Series	TN6010, TN6020, TN60, TN90					TN6010, TN6020, TN60, TN90					TN60			
	TC Series	TC40	TC60				TC60					TC40			
	PV Series	PV7020, PV60, PV90					PV7020, PV60, PV90								
	MEGACOAT (PV Series)	PV7010, PV7025					PV7010, PV7025					PV7005			
Coated Carbide	CA Series	CA5505, CA5515, CA5525			CA5535		CA6515, CA6525					CA4010, CA4115, CA4120, CA4505, CA4515			
	CR Series	CR9025					CR9025								
	PR Series	PR915, PR930, PR1005	PR1025, PR1115	PR630, PR660			PR915, PR930	PR1025, PR1125	PR630, PR660						
	MEGACOAT (PR Series)	PR1225					PR1225								
Ceramic												KA30, A65, A66N, PT600M, KS6000, KS6050, CS7050			
Carbide												KW10, GW15			
CBN												KBN60M, KBN900			

Turning

Workpiece Material		Non-ferrous Metals (Aluminum / Non-ferrous metals / Non-metals)				Heat-resistant alloys / Inconel				Hardened materials (Hardened steel / Chilled cast Iron)				Sintered steel			
Cutting Range		Finishing ⟷ Roughing				Finishing ⟷ Roughing				Finishing ⟷ Roughing				Finishing ⟷ Roughing			
Classification		N01	N10	N20	N30	S01	S10	S20	S30	H01	H10	H20	H30	01	10	20	30
Coated Carbide	CA Series						CA6515	CA6525									
	PR Series							PR1125							PR930		
	MEGACOAT (PR Series)						PR1305	PR1310	PR1325								
Cermet														TN6010			
															TN60		
Ceramic							CF1			A65							
										A66N							
										PT600M							
CBN										KBN510							
										KBN525							
										KBN900							
MEGACOAT										KBN05M							
										KBN10M					KBN65M		
										KBN25M					KBN70M		
										KBN30M							
										KBN35M							

Workpiece Material	Non-ferrous Metals (Aluminum / Non-ferrous metals / Non-metals)				Titanium / Titanium alloys				Hardened materials (Hardened steel / Chilled cast Iron)				Sintered steel			
Cutting Range	Finishing ⟷ Roughing				Finishing ⟷ Roughing				Finishing ⟷ Roughing				Finishing ⟷ Roughing			
Classification	N01	N10	N20	N30	S01	S10	S20	S30	H01	H10	H20	H30	01	10	20	30
Carbide					SW05											
						SW10										
							SW25									
		KW10				KW10										
		GW15				GW15										
PCD	KPD001				KPD001											
	KPD010				KPD010											

PVD Coated Carbide for Small Tools A10

Workpiece Material		Steel (Carbon steel / Alloy steel / Free-cutting steel)					Stainless steel / Cast steel					Cast Iron (Gray cast iron / Nodular cast iron)			
Cutting Range		Finishing ⟷ Roughing					Finishing ⟷ Roughing					Finishing ⟷ Roughing			
Classification		P01	P10	P20	P30	P40	M01	M10	M20	M30	M40	K01	K10	K20	K30
Coated Carbide	PR Series		PR930					PR930							
		PR1005							PR1025						
			PR1025							PR1125					
			PR1115					PR1115							
	MEGACOAT (PR Series)			PR1225						PR1225					

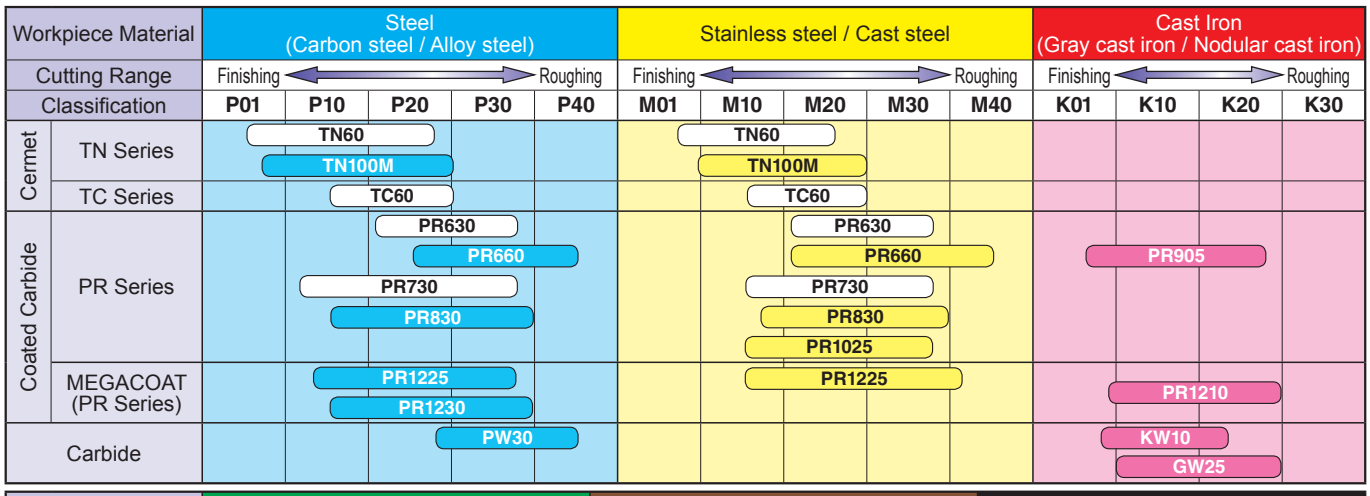
Summary of Insert Grades

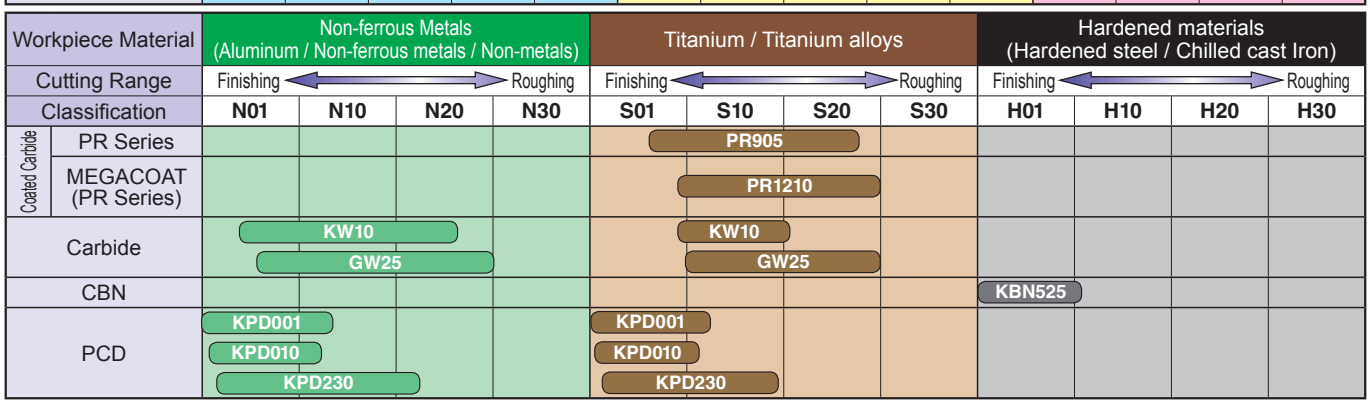
Grooving / Cut-Off

Workpiece Material		Steel (Carbon steel / Alloy steel)					Stainless steel / Cast steel					Cast Iron (Gray cast iron / Nodular cast iron)			
Cutting Range		Finishing ⟷ Roughing					Finishing ⟷ Roughing					Finishing ⟷ Roughing			
Classification		P01	P10	P20	P30	P40	M01	M10	M20	M30	M40	K01	K10	K20	K30
Cermet	TN Series	TN6020, TN60, TN90					TN6020, TN60, TN90					TN60			
	TC Series	TC40	TC60					TC60				TC40			
Coated Carbide	CR Series	CR9025					CR9025								
	PR Series	PR915, PR930, PR1025, PR1115		PR630, PR660			PR915, PR930, PR1025		PR630, PR660			PR905			
	MEGACOAT (PR Series)	PR1215, PR1225					PR1215, PR1225					PR1215			
Ceramic												A65, A66N, PT600M			
Carbide												KW10, GW15			

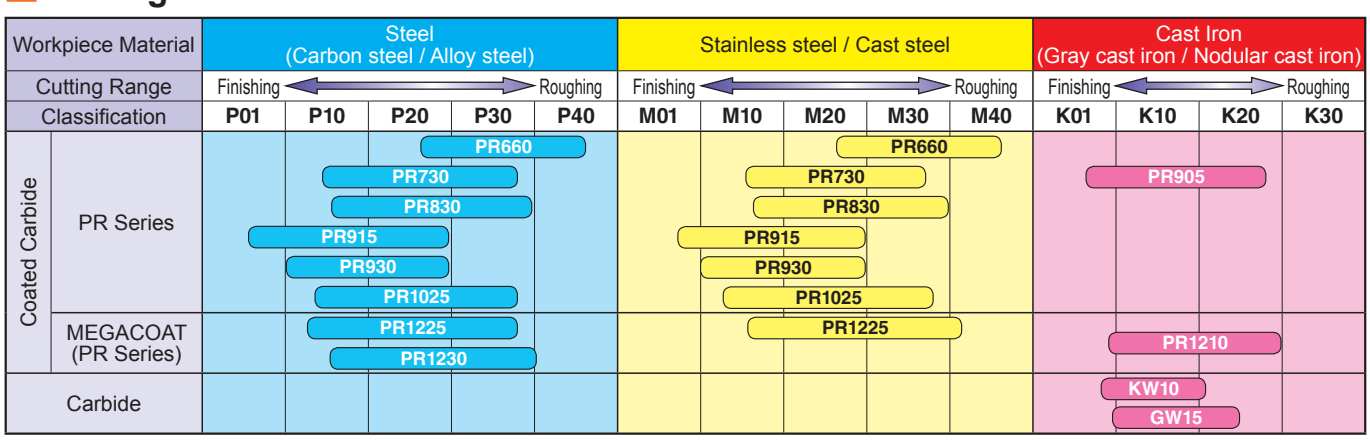
Workpiece Material		Non-ferrous Metals (Aluminum / Non-ferrous metals / Non-metals)				Titanium / Titanium alloys				Hardened materials (Hardened steel / Chilled cast Iron)				Sintered steel			
Cutting Range		Finishing ⟷ Roughing				Finishing ⟷ Roughing				Finishing ⟷ Roughing				Finishing ⟷ Roughing			
Classification		N01	N10	N20	N30	S01	S10	S20	S30	H01	H10	H20	H30	01	10	20	30
Coated Carbide	PR Series														PR930		
	MEGACOAT (PR Series)														PR1215, PR1225		
Cermet															TN60		
Ceramic										A65, A66N, PT600M							
Carbide			KW10, GW15				KW10, GW15										
CBN										KBN510, KBN525							
PCD		KPD001, KPD010				KPD001, KPD010											

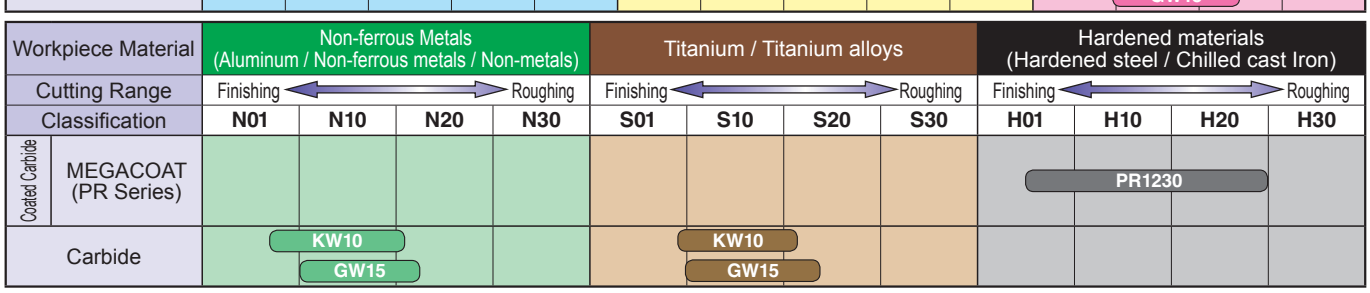
Milling





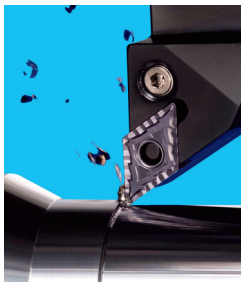
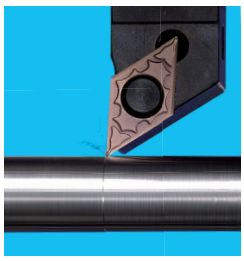
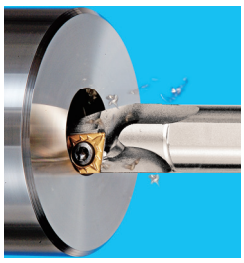
Drilling





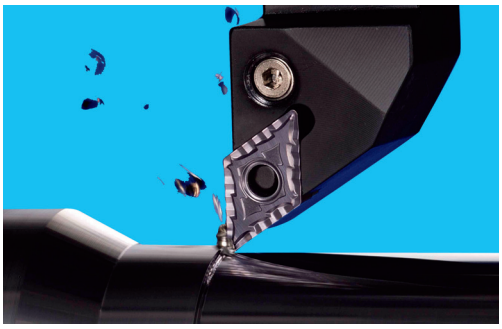
Summary of Insert Grades

Insert Material Selection Table

Application		Cutting Range	P	M	K		N	S		H	Sintered steel
			Steel	Stainless Steel	Gray Cast Iron	Nodular Cast Iron	Non-ferrous Metals	Heat-Resistant Steel	Titanium Alloys	Hardened materials	
Turning		Finishing ↑ Roughing	TN6010 TN60 TN6020 PV7010 PV7025 CA5505 CA5515 CA5525 CA5535	TN60 PV7025 CA6515 CA5525 CA5535 CA6525 PR1125 PR660	KBN60M KA30 PV7005 CA5505 CA4505 CA4515	TN60 PV7005 CA5505 CA4505 CA4515	KPD001 KPD010 KW10	CF1 KW10 CA6515 CA6525 PR1305 PR1310 PR1325	KPD001 KPD010 SW05 SW10 SW25	A65 A66N PT600M KBN05M KBN10M KBN25M KBN30M KBN35M KBN900	TN6010 TN60 PR930 KBN65M KBN70M
Small Tools		Finishing ↑ Roughing	TN6010 TN60 TN6020 PV7010 PV7025 PR1005 PR930 PR1025 PR1225	PV7025 PR930 PR1025 PR1225	CA4505 CA4515 KW10	CA4505 CA4515 KW10	KPD001 KPD010 KW10	CA6515 PR1125 PR660	KPD001 KPD010 KW10	KBN05M KBN10M KBN25M KBN30M	TN6010 TN60 PR930 KBN65M KBN70M
Boring		Large ↑ Cutting Dia. ↓ Small	TN6010 TN60 TN6020 PV7010 PV7025 CA5515 CA5525 CA5535 PR930 PR1025	TN60 PV7025 CA6515 CA6525 PR930 PR1125 PR1025 PR1225	KBN60M PV7005 CA4505 CA4515 KW10 KBN60M	PV7005 CA4505 CA4515 KW10	KPD001 KPD010 KW10	CA6515 CA6525 PR1125 PR660	KPD001 KPD010 KW10	PT600M KBN05M KBN10M KBN25M KBN30M	TN6010 TN60 PR930 KBN65M KBN70M
Cut-Off		Large ↑ Cutting Dia. ↓ Small	CR9025 PR1215 PR1225 PR660 PR930 PR915	CR9025 PR1215 PR1225 PR660 PR930 PR915	KW10 PR1215	KW10 PR1215	KW10	KW10 PR660	KW10	-	-
Cut-Off		(Depends on the workpiece material)	PR1025	PR1025 PR1225	KW10	KW10	KW10	KW10 PR1025	KW10	-	-
Grooving		Glossy finish ↑ Stable Cutting	TC40 TN6020 TN90 TC60 PR930 PR1115 PR1215 PR1225	TC40 TN6020 TN90 TC60 PR915 PR1115 PR1215 PR1225	PR905 PR1215 KW10 GW15	PR905 PR1215 KW10 GW15	KPD001 KW10 GW15	PR915 KW10	KPD001 KW10	KBN510 KBN525 PT600M	TC40 PR930
Threading		Glossy finish ↑ Stable Cutting	TC60 PR630 PR930 PR1115	TC60 PR630 PR930 PR1115	KW10 GW15	KW10 GW15	KW10 GW15	KW10 GW15	KW10 GW15	-	PR930 PR1115
Drilling		Wear Resistance ↑ Toughness	PR930 PR730 PR830 PR915 PR1025 PR1225 PR1230 PR660	PR730 PR830 PR915 PR1025 PR1225 PR660	PR905 PR1210 KW10	PR905 PR1210 KW10	KW10 GW15	PR660 PR1025 PR1230 KW10 GW15	KW10	-	-
Milling		Finishing ↑ Roughing	TN100M PR630 PR730 PR830 PR1025 PR660 PR1225 PR1230	PR630 PR730 PR830 PR1025 PR660 PR1225	PR905 PR1210 KW10	PR905 PR1210 KW10	KPD230 KPD001 KPD010 KW10 GW25	PR630 PR730 PR830 PR1025 PR1225 PR660	KPD230 KPD001 KPD010 KW10 PR905	-	-

・Highlighted materials are recommended choice.

Cermet



Cermet

KYOCERA is known as the leading manufacturer of cermets.
Cermet is composed of the words Ceramic and Metal. Typical materials used in cermets are TiC, TiN, TiCN and NbC. Designed to provide long tool life and excellent surface finishes, cermets combine toughness with superior wear resistance.

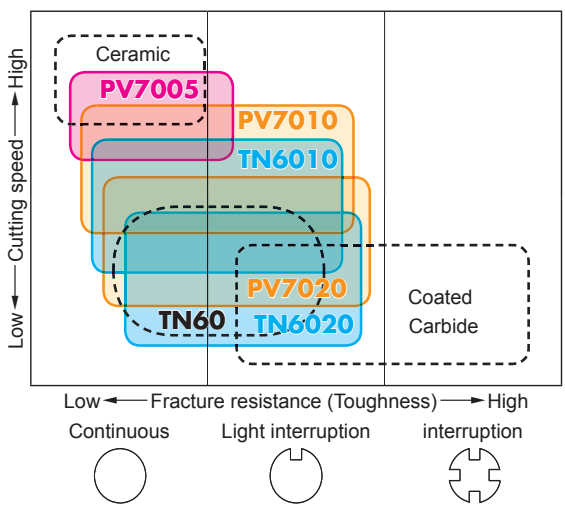
PVD Coated Cermet

PVD Coated Cermet is coated on cermet substrate with a thin layer of high wear resistance and high adhesion resistance by PVD (Physical Vapor Deposition) technology. Generally because of the low processing temperature of PVD compared with CVD, PVD Coated Cermet features less deterioration and more bending strength.

Features of Cermet and PVD Coated Cermet

Workpiece Material		Symbol	Color	Main Component (Coated Composition)	Advantages
P Steel	Cermet	**TN6010** (Super Micro-Grain)	Gray	TiCN	• Improved surface cermet with superior wear resistance and toughness • Application: Economical uncoated cermet for steel
		TN60	Gray	TiCN+NbC	• Typical choice cermet with superior wear resistance and toughness • Application: Cutting of steel and stainless steel
		TN6020 (Super Micro-Grain)	Gray	TiCN	• Super micro-grain cermet with superior wear resistance and toughness • Application: First choice cermet for steel and stainless steel cutting
		TN100M	Gray	TiCN+NbC	• Tough cermet with improved oxidation resistance and thermal shock resistance • Application: Milling of steel at high speed
		TC40	Gray	TiC+TiN	• Good balance of wear resistance and toughness • Application: Grooving and threading of steel
	PVD	**PV7010** (Super Micro-Grain)	Blackish red	TiCN (MEGACOAT)	• Heat-resistant MEGACOAT on improved surface cermet with excellent wear resistance and toughness • Application: Stable and improved tool life in steel cutting, excellent surface finish
		PV7020 (Super Micro-Grain)	Gold	TiCN (TiAlN+TiN)	• TiAlN base PVD coat on super micro-grain cermet • Application: First choice PVD coated cermet for steel cutting, good balance of superior wear resistance and toughness
		PV7025 (Super Micro-Grain)	Blackish red	TiCN (MEGACOAT)	• MEGACOAT on the super micro-grain cermet • Application: First choice PVD cermet for general steel cutting. High strength and long life given by MEGACOAT.
K Cast Iron		**PV7005**	Blackish red	TiC+TiN (MEGACOAT)	• Heat-resistant MEGACOAT on cermet with excellent wear resistance • Application: High speed finishing of gray and nodular cast iron

Application Map



PV7025, PV7010, PV7005, TN6020, TN6010

MEGACOAT Cermet

- Improved tool life and high speed capability due to its superior heat resistance and hardness
- Stability improvement through prevention of crater wear (oxidation, diffusional wear)
- High thermal stability and surface smoothness provide excellent surface finish

PV7025: MEGACOAT for Steel
PV7010: MEGACOAT for Steel
PV7005: MEGACOAT for Cast Iron

MEGACOAT

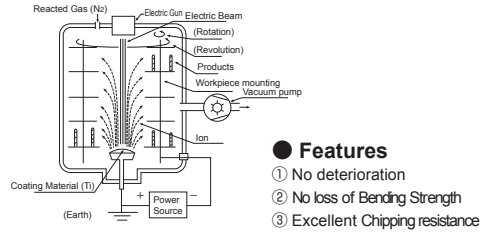
Improved Surface Cermet

- Hard surface and tougher inner phase
- Achieves balance between wear resistance and toughness
- Economical uncoated cermet

TN6020: Uncoated Cermet for Steel
TN6010: Uncoated Cermet for Steel

Features of PVD

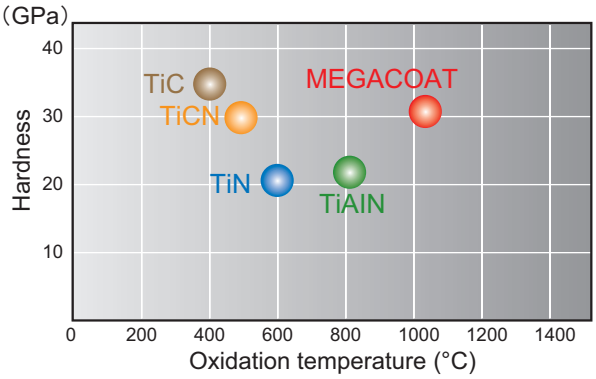
PVD (Physical Vapor Deposition)



Features
① No deterioration
② No loss of Bending Strength
③ Excellent Chipping resistance

Processing temperature: 400~600°C

Properties of PVD Coating



Insert Grades

CVD Coated Carbide



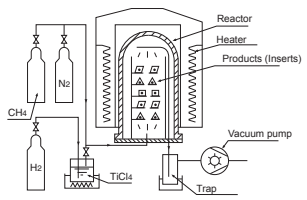
CVD Coated Carbide

KYOCERA's CVD coated carbide grades are based on ceramic thin film technology and provide stable, efficient cutting at high speeds or heavy interrupted applications.

Features

- Applicable from low to high speed cutting and from finishing to roughing
- Stable cutting is achieved due to the superior toughness and crack resistance
- Cutting times are reduced due to good chip control from effective chipbreakers

CVD (Chemical Vapor Deposition)



Features

① Equally deposited on face
② Easy application for multilayer deposition
③ Enabling thick coating

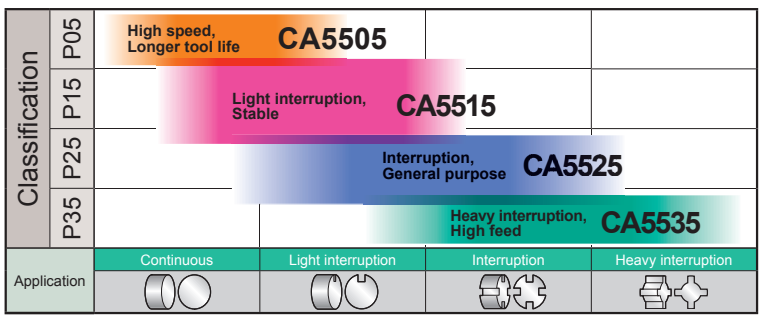
Processing temperature: 900~1100°C

Features of CVD Coated Carbide

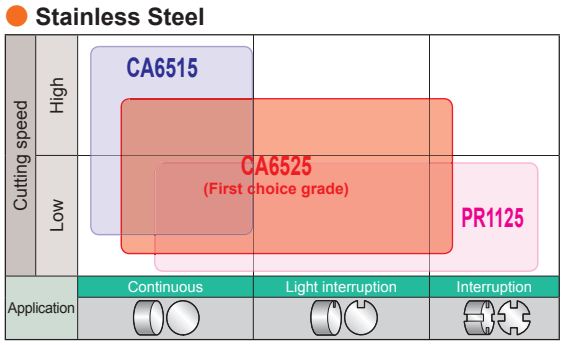
Workpiece Material	Symbol	Color	Coated Composition main Component	Advantages
P Steel	CA5505	Gold	Micro columnar TiCN+Al_2O_3+TiN	• Improved wear resistance due to hard carbide substrate and micro columnar structure of coated composition • Application: High speed continuous cutting of steel, continuous to light interrupted cutting of cast iron
	CA5515	Gold	Micro columnar TiCN+Al_2O_3+TiN	• Improved wear resistance and longer tool life due to micro columnar structure of coated composition • Application: High speed cutting of steel, continuous to light interruption
	CA5525	Gold	Micro columnar TiCN+Al_2O_3+TiN	• Improved toughness and wear resistance due to tougher carbide substrate and micro columnar structure of coated composition • Application: First choice for general cutting of steel, roughing to interruption
	CA5535	Gold	Micro columnar TiCN+Al_2O_3+TiN	• Improved toughness due to tougher carbide substrate • Application: Roughing to heavy interrupted cutting of steel
	CR9025	Gold	Columnar TiCN+TiN	• Improved toughness and stability due to specialized carbide substrate with plastic deformation resistance • Application: Cut-off, grooving and multi-function cutting of steel
M Stainless Steel	CA6515	Gold	Micro columnar TiCN+Al_2O_3+TiN	• Specialized carbide substrate for stainless steel cutting, excellent wear resistance • Application: Continuous to light interrupted cutting of stainless steel
	CA6525	Gold	Micro columnar TiCN+Al_2O_3+TiN	• Specialized carbide substrate for stainless steel cutting, excellent notching resistance and toughness • Application: First choice for general cutting of stainless steel, from finishing to roughing, continuous to interruption
K Cast Iron	CA4010	Gold	Columnar TiCN+Al_2O_3+TiN	• Excellent high temperature stability resists plastic deformation and oxidation wear. • Application: Continuous to light interrupted high speed cutting of cast iron
	CA4115	Gold	Micro columnar TiCN+Al_2O_3+TiN	• Improved wear resistance due to micro columnar structure of coated composition • Application: Nodular cast iron cutting, continuous to light interruption
	CA4120	Gold	Micro columnar TiCN+Al_2O_3+TiN	• Improved toughness and wear resistance due to tougher carbide substrate and micro columnar structure of coated composition • Application: Roughing to heavy interrupted cutting of nodular cast iron
	CA4505	Blackish gray	Micro columnar TiCN+Al_2O_3	• Stable, long tool life due to improved bonding strength of coated layers and special treatment of the surface of the top coated layer • Application: For gray cast iron and nodular cast iron at high speed in continuous to light interrupted cutting
	CA4515	Blackish gray	Micro columnar TiCN+Al_2O_3	• Stable, long tool life due to improved bonding strength of coated layers and special treatment of the surface of the top coated layer • Application: First choice for gray cast iron and nodular cast iron in light to heavy interrupted cutting

Application Map

Steel

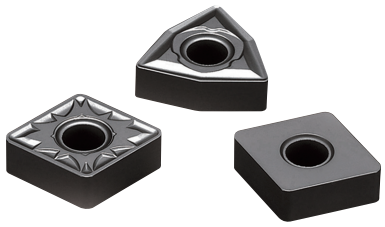


Stainless Steel



CVD Coated Carbide for Gray and Nodular Cast Iron

CA45series



CA4515

- Preferred for stability
- Wide application range for continuous to heavy interrupted cutting

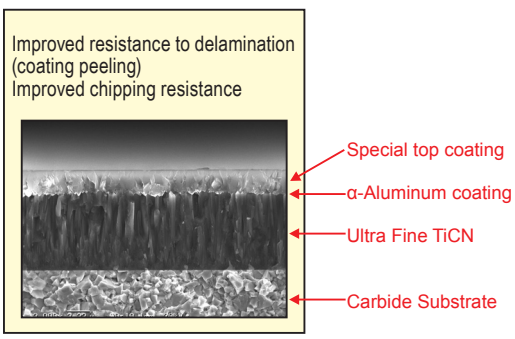
CA4505

- Suitable for high-speed and efficient cutting
- Improved tool life through superior wear resistance

New Coating Technology

New special coating structure

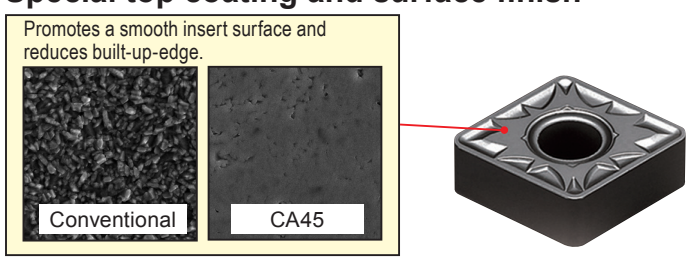
Long and stable tool life is attained through the use of a multi-layer coating structure with a dedicated substrate for cast iron turning.



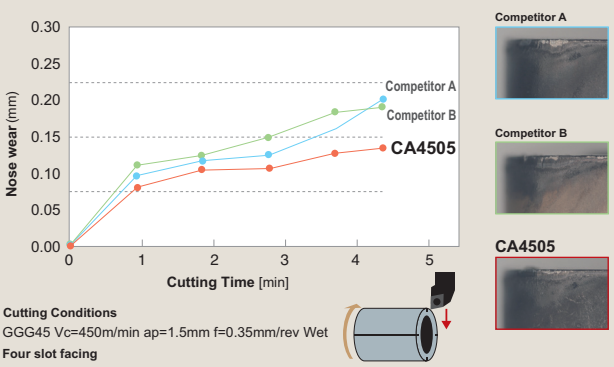
Special top coating

The innovative surface treatment applied to the top layer of coating prevents adhesion.

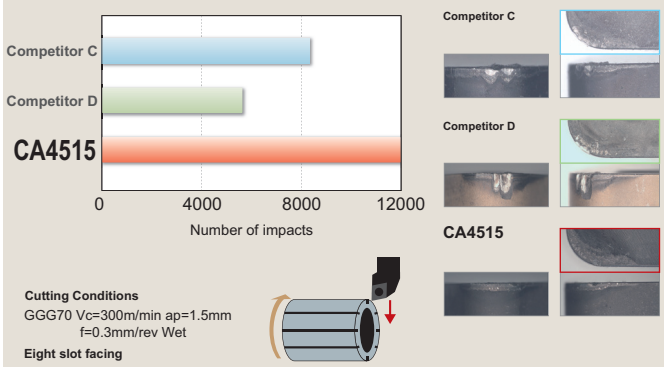
Special top coating and surface finish



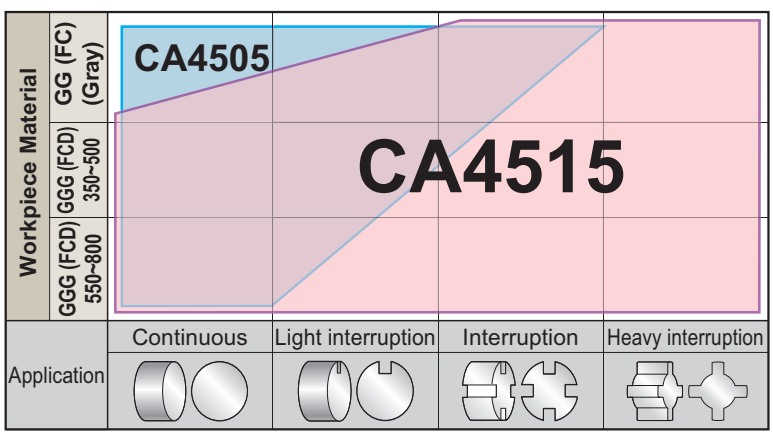
Wear resistance comparison [GGG 45]



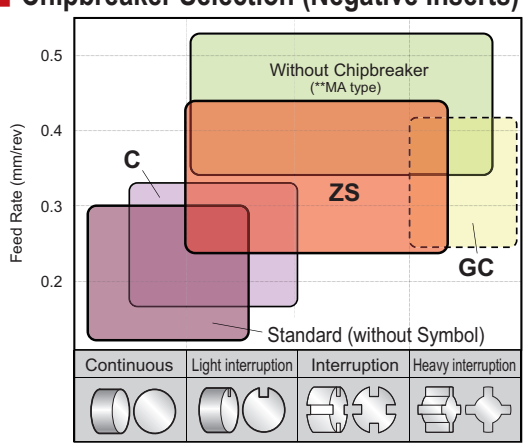
Chipping resistance comparison [GGG 70]



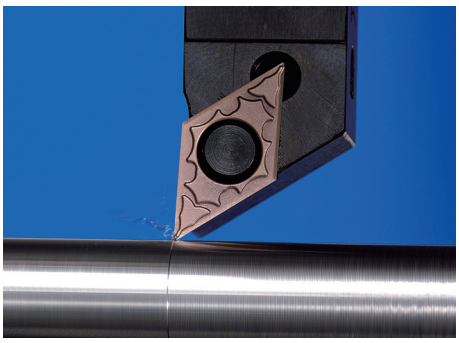
Material Application Map



Chipbreaker Selection (Negative Inserts)



PVD Coated Carbide (for Turning)



PVD Coated Carbide

KYOCERA's PVD coated carbide grades are based on ceramic thin film coating and precise edging technologies and are good for precision turning, grooving, threading and cut-off. Very tough carbide substrate and innovative coating technology promotes excellent wear resistance and strong coating adhesion for long tool life and stable cutting.

Features

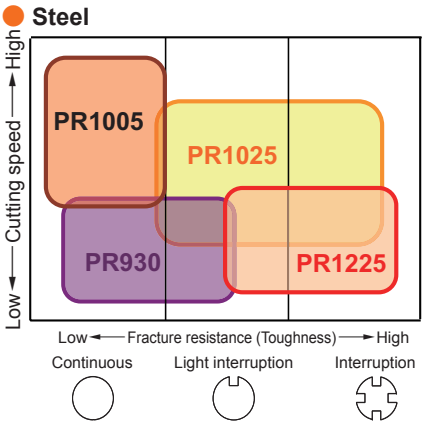
- Good for low to high speeds and finishing to heavy roughing cutting
- Stable cutting with excellent toughness
- Smooth fine surface of PVD coated carbide provides good surface finish and high precision cutting

Features of PVD Coated Carbide

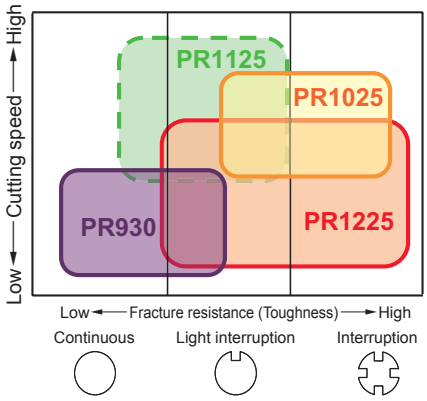
Workpiece Material	Symbol	Color	Main Component	Advantages
P Steel	**PR915** (Super Micro-Grain)	Bluish violet	TiAlN	• TiAlN base PVD coated super micro-grain carbide, superior wear and oxidation resistance • Application: Stable and reliable high precision cutting of steel
	PR930 (Super Micro-Grain)	Reddish gray	TiCN	• Hard TiCN base PVD coated super micro-grain carbide • Application: Low cutting speed, precise cutting with sharp edge
	PR1005	Reddish gray	TiCN	• TiCN base PVD coated hard micro-grain carbide • Application: Turning of free-cutting steel, long tool life achieved through anti-adhesion performance
	PR1025	Reddish gray	TiCN	• TiCN base PVD coated micro-grain carbide • Application: General purpose cutting of steel and stainless steel, stable and long tool life
	PR1115	Purple red	TiAlN	• Hard TiAlN base PVD coated super micro-grain carbide • Application: Superior anti-oxidation performance with well balanced wear resistance and toughness
M Stainless Steel	**PR1125**	Purple red	TiAlN	• Hard TiAlN base PVD coated super micro-grain carbide, superior toughness and heat resistance • Application: Finishing and light interrupted cutting of stainless steel
	PR1225	Blackish red	MEGACOAT	• Superior wear and oxidation resistant MEGACOAT on micro grain carbide substrate • Application: Light interrupted to interrupted cutting of stainless steel
K Cast Iron	**PR905**	Bluish violet	TiAlN	• Smooth fine surface PVD coated hard carbide with plastic deformation resistance • Application: Suitable for milling of gray and nodular cast iron and turning of heat-resistant alloys
S Heat-Resistant Alloys	**PR1305**	Blackish red	MEGACOAT	• MEGACOAT on hard and superior heat resistant carbide, superior wear resistance • Application: Finishing of heat resistant alloys
	PR1310	Blackish red	MEGACOAT	• MEGACOAT on hard and superior heat resistant carbide, superior wear and oxidation resistance • Application: First choice for continuous and light interrupted cutting and finishing of heat-resistant alloys
	PR1325	Blackish red	MEGACOAT	• MEGACOAT on tough carbide • Application: Light interrupted cutting and roughing of heat-resistant alloys

Application Map

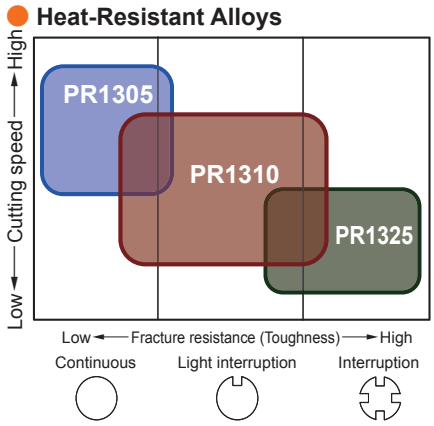
Steel



Stainless Steel



Heat-Resistant Alloys

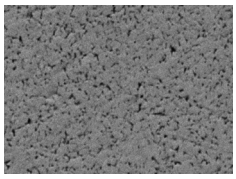


Advantages of PR13 Series

1) Superior wear and fracture resistance attained with uniform grain size and MEGACOAT on superior thermal shock resistant carbide

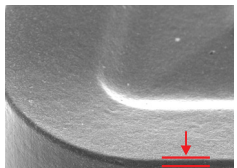
2) New edge preparation technology (FET: Fine Edge Treatment) controls and minimizes R horning and realizes large tip rake angle, and thus prevents burrs and notching.
It provides good finished surface.

Special carbide substrate



Uniform grain size enables superior thermal shock resistance and constant hardness

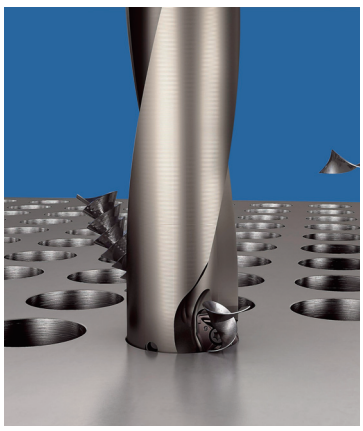
New edge preparation technology



Edge control of FET technology
(FET: Fine Edge Treatment)

PVD Coated Carbide for Milling and Drilling





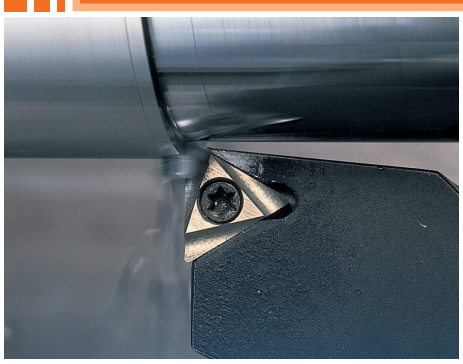
PVD Coated Carbide

KYOCERA's PVD coated carbide for milling and drilling is coated on a very tough carbide substrate. The low processing temperature, compared with CVD, leads to improved bending strength, less deterioration of the coating and superior long tool life as well as stable machining.

Features of PVD Coated Carbide for Milling and Drilling

Workpiece Material	Symbol	Color	Main Component	Advantages
P Steel	PR630	Gold	TiN	• TiN base PVD coated carbide • Application: General propose for milling, grooving and threading of steel
	PR730	Gold	TiAlN+TiN	• Superior oxidation resistance with well balanced wear resistance and toughness • Application: Stable and long tool life at high speed cutting of steel
	PR830	Gold	TiAlN+TiN	• Improved high temperature stability and wear resistance by TiAlN base PVD coating • Application: Stable and long tool life for milling of steel
	PR1230	Blackish red	MEGACOAT	• Superior wear and oxidation resistant MEGACOAT on special tough carbide substrate • Application: Stable and high feed drilling of steel
M Stainless Steel	PR660	Gold	TiN	• Superior adhesion-resistant TiN base PVD coated carbide on special tough carbide substrate • Application: For steel, stainless steel, cast steel and heat-resistant alloys, low speed cutting
	PR1025	Reddish gray	TiCN	• TiCN base PVD coated on micro-grain carbide • Application: Stable and long tool life milling of stainless steel
	PR1225	Blackish red	MEGACOAT	• Superior wear and oxidation-resistant MEGACOAT on micro-grain carbide substrate • Application: General and high feed drilling of steel and stainless steel
K Cast Iron	PR905	Bluish violet	TiAlN	• TiAlN base PVD coated on special tough carbide substrate for cast iron • Application: Highly efficient stable milling and drilling of gray and nodular cast iron
	PR1210	Blackish red	MEGACOAT	• Superior wear and oxidation resistant MEGACOAT on special carbide substrate for cast iron • Application: Highly efficient stable drilling of gray and nodular cast iron

Carbide



Carbide

Due to its superior mechanical properties carbide is used in a variety of applications. KYOCERA produces a variety of carbides, including KW10 for non-ferrous materials and micro-grain carbides for precision cutting.

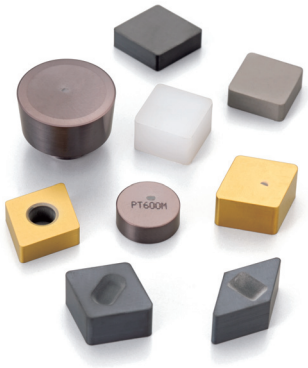
Features

- Tough and hard
- Good thermal conductivity
- Suitable for cutting non-ferrous metals and non-metals
- Stable cutting at low cutting speeds, including milling operations

Features of Carbide

Workpiece Material	Symbol	Color	Main Component	Advantages
P Steel	PW30	Gray	WC+Co+TiC+TaC	• ISO identification symbol P carbide (K10 relevant) • Application: Milling of steel, stable wear resistance and toughness
N Non-ferrous materials	KW10	Gray	WC+Co	• ISO identification symbol K carbide (K10 relevant) • Application: Stable cutting of cast iron, non-ferrous materials and non-metals
	GW15	Gray	WC+Co	• ISO identification symbol K carbide (equivalent to K10), tough micro-grain carbide • Application: High wear resistance and toughness for cast iron, non-ferrous materials and non-metals
	GW25	Gray	WC+Co	• ISO identification symbol K carbide (K30 relevant) • Application: Stable wear resistance and anti-chipping performance for milling operations of aluminum
S Heat-Resistant Alloys	SW05	Gray	WC+Co	• ISO identification symbol K carbide (K05 relevant) • Application: Continuous cutting and finishing of titanium alloys maintaining superior wear resistance
	SW10 (Made to order)	Gray	WC+Co	• ISO identification symbol K carbide (K10 relevant) • Application: Continuous and light interrupted cutting of titanium alloys maintaining superior wear resistance and stable result
	SW25 (Made to order)	Gray	WC+Co	• ISO identification symbol K carbide (K25 relevant) • Application: Interrupted and light interrupted cutting of titanium alloys maintaining stable result

Ceramic



Ceramic

Ceramic inserts are capable of running at high speeds, thus reducing expensive machining time. Hard turning of 38HRC to 64HRC hardened steel, or rough to finished turning of cast iron are recommended applications for ceramic inserts. KYOCERA's ceramic grades are designed to resist oxidation and maintain hardness at high temperatures.

Features

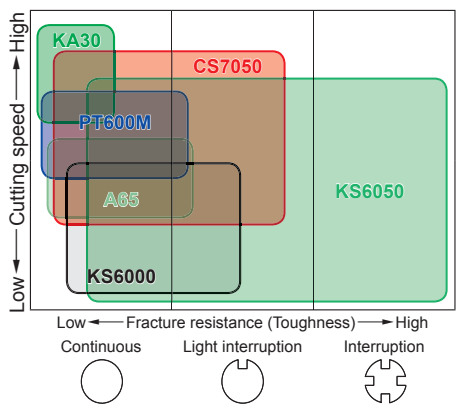
- Excellent wear resistance enables high cutting speeds
- Ceramic maintains good surface finishes due to the low affinity to workpiece materials
- Silicon nitride ceramic has improved thermal shock resistance allowing cast iron cutting using coolants

Features of Ceramic

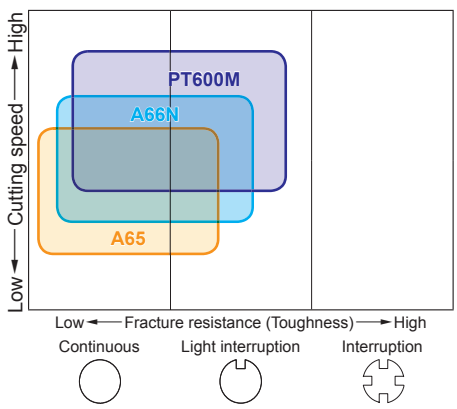
Workpiece Material	Symbol	Color	Main Component	Hardness of Coated Layer (GPa)	Hardness of Substrate (GPa)	Fracture Toughness (MPa•m$^{1/2}$)	Transverse Strength (MPa)	Advantages
K Cast Iron	KA30	White	Al_2O_3	-	17.5	4.0	750	• Aluminum Oxide ceramic (Al_2O_3) • Application: Finishing of cast iron at high cutting speeds without coolant
	KS6000	Gray	Si_3N_4	-	15.7	6.5	1230	• Silicon nitride ceramic (Si_3N_4) • Application: High feed and interrupted cutting of cast iron (with or without coolant)
	KS6050	Gray	Si_3N_4	-	15.6	7.8	1200	• Silicon nitride ceramic (Si_3N_4) • Application: Roughing and interrupted cutting of cast iron. Focusing on stability. Wet processing is possible.
	CS7050	Grayish white	Si_3N_4 (Special Al_2O_3 COAT)	Thin coating	15.6	7.8	1200	• Silicon nitride ceramic (Si_3N_4) + CVD Coated Carbide (Special Al_2O_3 COAT) • Application: Finishing and continuous cutting, and high speed and high efficient cutting. Wet processing is possible.
K Cast Iron	A65	Black	Al_2O_3+TiC	-	20.6	4.5	780	• Aluminum Oxide and Titanium Carbide ceramic (Al_2O_3+TiC) • Application: Semi-roughing to finishing of cast iron, and hardened materials.
K Cast Iron H Hardened Materials	A66N (TiN coat)	Gold	Al_2O_3+TiC	20	20.1	4.1	980	• TiN PVD coated Aluminum Oxide and Titanium Carbide ceramic (TiN coated Al_2O_3+TiC) • Application: Semi-roughing to finishing of hardened materials
H Hardened Materials	PT600M (MEGACOAT)	Blackish red	Al_2O_3+TiC	30	20.1	4.1	980	• Heat-resistant MEGACOAT on Aluminum Oxide and Titanium Carbide ceramic (MEGACOAT Al_2O_3+TiC) • Application: Semi-roughing to finishing of cast iron, hardened materials and roll materials

Application Maps

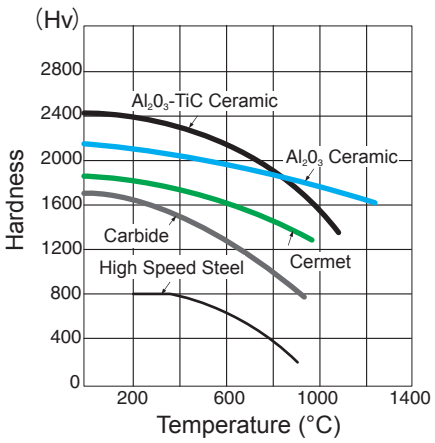
Cast Iron



Hardened Materials

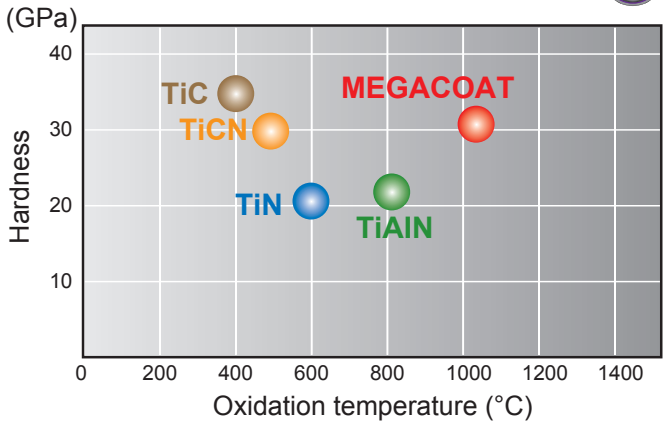


High-Temperature Hardness



Properties of PVD Coating

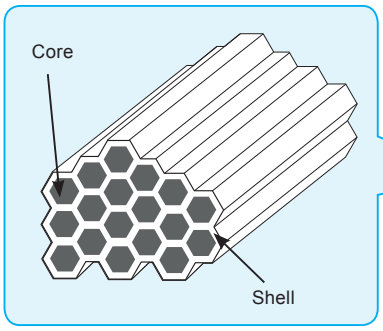
MEGACOAT

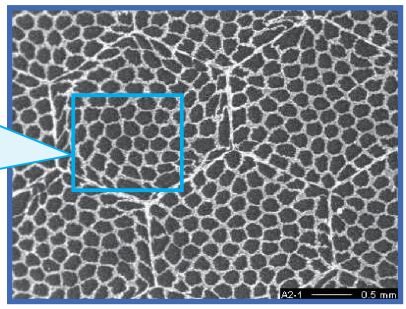


Cell Fiber

Cell Fiber

Cell Fiber is a composite material consisting of a fiber core (gray portion) and shell (white portion).





Features

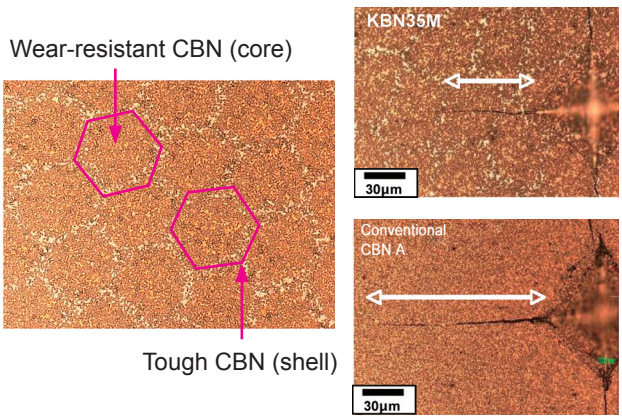
- Cell Fibers combine a hard, wear-resistant core and a tough shell into one insert.
- The tough shell stops cracks that form in the core.
- The characteristics of Cell Fiber are a result of the combination of materials and structures.

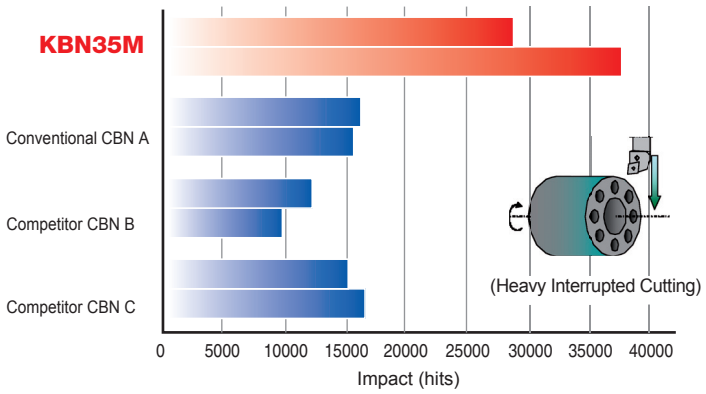
Features of Cell Fiber

Workpiece Material	Symbol	Color	Main Component	Advantages
H Hardened Materials	KBN35M (MEGACOAT)	Blackish red	CBN	• Cell Fiber CBN composite material consisting of wear resistant CBN (core) and tough CBN (shell) • Heat-resistant MEGACOAT on tough Cell Fiber CBN • Application: Stable cutting of hardened steel at interrupted range
S Heat-Resistant Alloys	CF1	Gray	Ceramic	• Cell Fiber ceramic composite material consisting of wear resistant ceramic (core) and tough ceramic (shell) • Application: Cutting of heat-resistant alloys like Inconel

KBN35M (MEGACOAT Cell Fiber CBN)

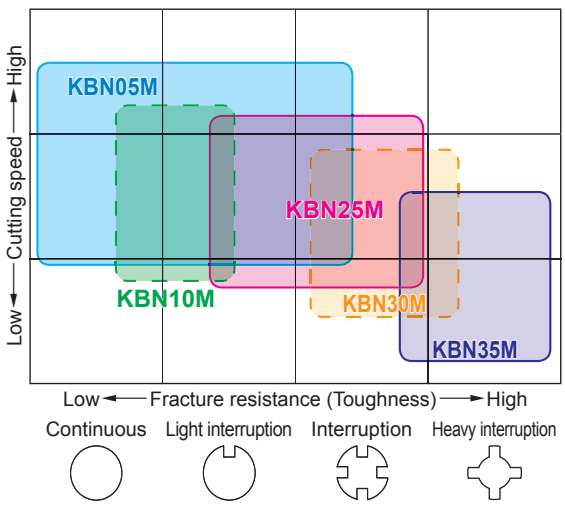
Tough CBN (shell) prevents crack growth



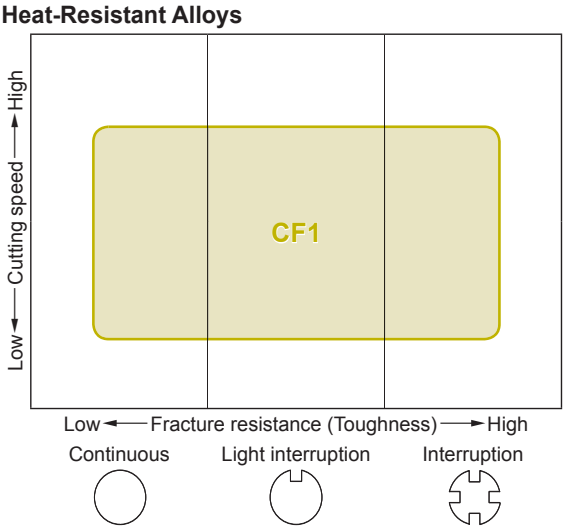


Application Map

Hardened Steel / Chilled Cast Iron



Heat-Resistant Alloys



PCD



PCD

KYOCERA diamond material is a synthetic diamond sintered under high temperatures and pressures. PCD (Polycrystalline diamond) is ideal for non-ferrous metals and non-metals.

Features

- Applicable for non-ferrous metals, non-metals turning, milling and other various type of cutting
- Long tool life due to extreme hardness
- Capable of high cutting speeds which increases cutting productivity
- Reduced edge build-up allows for high precision cutting
- Diversified applications for cutting of non-ferrous materials and non-metals
- Finished surface will be rainbow colored. (a mirror-like finished surface will not be obtained when single crystal diamond is used.)

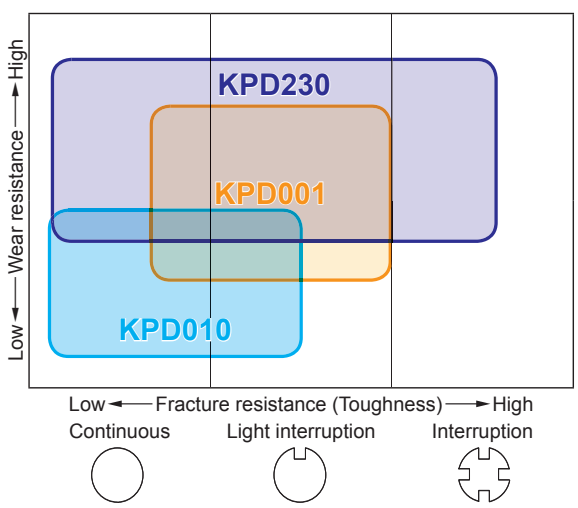
Features of PCD

Workpiece Material	Symbol	Av. grain size (μm)	Advantages
N Non-ferrous metals	KPD001	0.5	• Super Micro-Grain PCD features cutting edge strength, wear resistance, fracture resistance, good edge-sharpening performance and long, stable tool life. • Application: High speed cutting of aluminum alloys, brass, non-ferrous metals and non-metals including plastics, fiberglass, carbide and ceramics.
	KPD010	10	• Good wear resistance and toughness, good grindability • Application: General purpose, high speed cutting of aluminum alloys, non-ferrous metals and non-metals including plastics, fiberglass, carbide and ceramics.
	KPD230	2-30	• Superior abrasive wear resistance and toughness due to high density PCD with mixed rough and fine grains • Application: High speed milling of aluminum alloys, non-ferrous metals, plastics and fiberglass

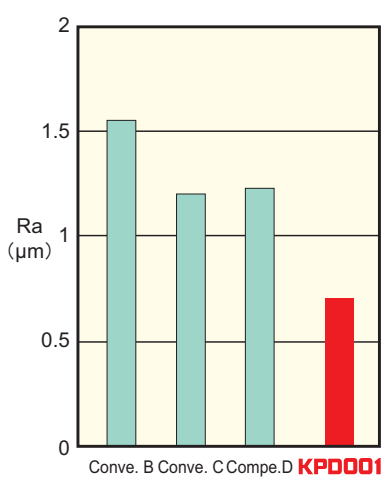
Applications

Workpiece Material		Non-ferrous materials (Aluminum / Non-ferrous metals / Non-metals)				Titanium / Titanium alloys			
Cutting Range		Finishing ← → Roughing				Finishing ← → Roughing			
Classification		N01	N10	N20	N30	S01	S10	S20	S30
Turning Milling	PCD	KPD001 KPD010 KPD230				KPD001 KPD010 KPD230			

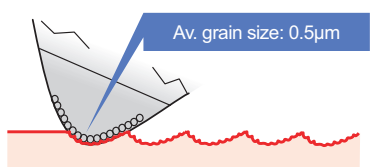
Application Map



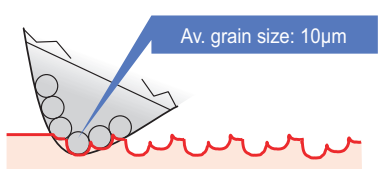
Surface Finish Roughness Comparison of Aluminum Cutting



Excellent surface finish provided by Super Micro-Grain KPD001

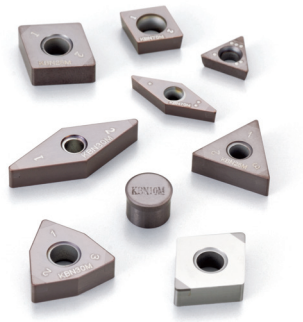


Surface finish of conventional PCD



(Grain size affects surface finish quality)

CBN



CBN

KYOCERA CBN is second only to diamond in hardness. CBN (Cubic Boron Nitride) is a synthetically produced material with high thermal conductivity which provides stable cutting.

Features

- Superior wear resistance when cutting hardened materials
- Suitable for high speed cutting of cast iron and sintered steel
- High thermal conductivity provides stable cutting

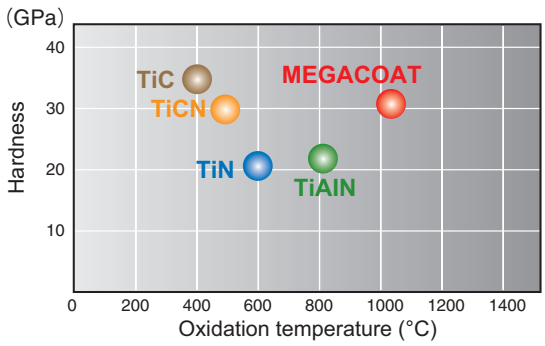
Features of CBN

Workpiece Material	Symbol	Color	Av. Grain Size (μm)	CBN Content Rate (%)	Hardness of Substrate (GPa)	Transverse Strength (MPa)	Advantages
H Hardened Materials	KBN510	Black	2	50	28	1,000	• Excellent wear resistance and crack resistance, non-coated CBN • Application: Finishing and continuous cutting of hardened die steel
	KBN525	Black	1 and under	45	25	1,250	• Good balance of toughness and wear resistance, non-coated CBN • Application: General grade for hardened steel, high stability at high speed and high feed cutting
	KBN05M (MEGACOAT)	Blackish red	0.5-1.5	55	27	1,000	• Heat-resistant MEGACOAT on highly heat-resistant CBN substrate • Application: High speed finishing of hardened steel
	KBN10M (MEGACOAT)	Blackish red	2	50	28	1,000	• Heat-resistant MEGACOAT on CBN with hard binder phase, superior anti-crater wear resistance • Application: High speed finishing of hardened die steel
	KBN25M (MEGACOAT)	Blackish red	1 and under	45	25	1,250	• Heat-resistant MEGACOAT on micro-grain CBN with heat resistant binder phase • Application: Stable cutting of hardened steel at high speed
	KBN30M (MEGACOAT)	Blackish red	1-4	65	30	1,350	• Heat-resistant MEGACOAT on tougher CBN • Application: Stable cutting of hardened steel for continuous to interrupted cutting
Sintered Steel	KBN65B	Black	2	85	32	1,150	• Excellent wear resistance due to CBN with heat-resistant binder phase, non-coated CBN • Application: Stable cutting of sintered steel (ferrous sintered alloy) at low speed
	KBN65M (MEGACOAT)	Blackish red	2	85	32	1,150	• Heat-resistant MEGACOAT on CBN with heat-resistant binder phase • Application: Stable cutting of sintered steel (ferrous sintered alloy) at low speed
	KBN70M (MEGACOAT)	Blackish red	2-4	90	34	1,350	• Heat-resistant MEGACOAT on CBN rich substrate • Application: General cutting of sintered steel (ferrous sintered alloy) at high speed
K Cast Iron	KBN60M (MEGACOAT)	Blackish red	0.5-6	80	33	1,250	• Heat-resistant MEGACOAT on CBN rich substrate with hard binder phase • Application: High speed finishing of gray cast iron
	KBN900 (TiN COAT)	Gold	9	90	31	1,050	• TiN coated solid CBN • Application: Heavy duty, interrupted cutting and finishing of hardened steel, hardened roll steel and cast iron

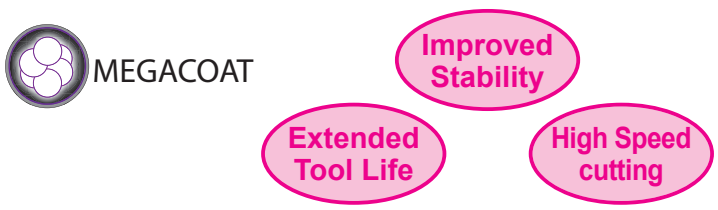
• For **KBN35M**, see page ⓐ**A13**.

MEGACOAT CBN

Properties of PVD coated layer



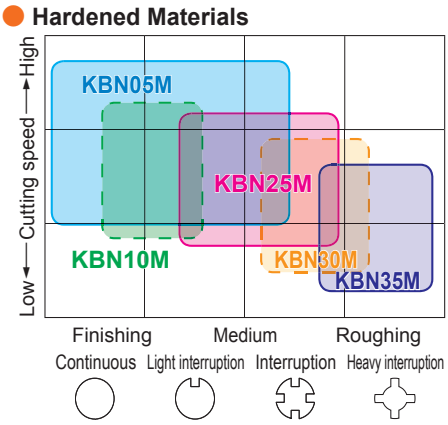
Advantages of MEGACOAT



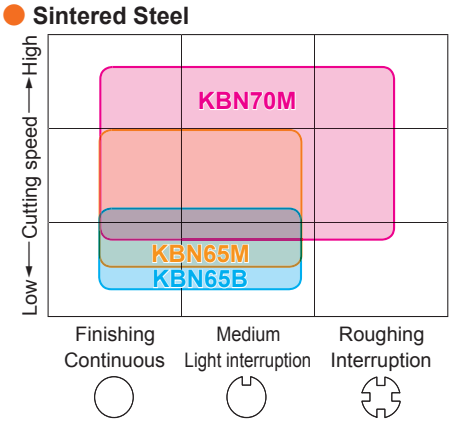
- Long tool life and stable cutting due to superior heat-resistance and hardness.
- Improvement of crater wear resistance.

Application Map

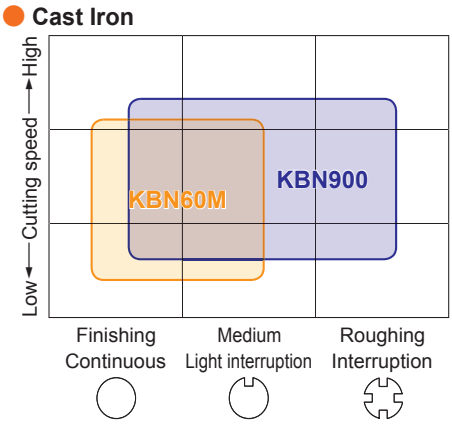
Hardened Materials



Sintered Steel



Cast Iron



Grade Properties

Cermet

Symbol	Color	Main Component	Coating Layer	Ratio	Hardness of Substrate		Fracture Toughness ($MPam^{1/2}$)	Transverse Strength (MPa)
					(HV)	(GPa)		
TN6010	Gray	TiCN	-	6.5	1,700	16.7	7.0	2,000
TN6020	Gray	TiCN	-	6.4	1,500	14.7	10.0	2,500
TN60	Gray	TiCN+NbC	-	6.6	1,600	15.7	9.0	1,760
TN90	Gray	TiCN+NbC	-	6.4	1,450	14.2	10.0	1,960
TN100M	Gray	TiCN+NbC	-	6.7	1,520	14.9	10.5	1,860
TC40	Gray	TiC+TiN	-	6.0	1,650	16.2	9.0	1,570
TC60	Gray	NbC	-	8.1	1,500	14.7	10.5	1,670

PVD Coated Cermet

Symbol	Color	Main Component	Coating Layer	Ratio	Hardness of Substrate		Fracture Toughness ($MPam^{1/2}$)	Transverse Strength (MPa)
					(HV)	(GPa)		
PV7005	Blackish red	MEGACOAT	Thin coating	6.0	1,650	16.2	8.5	1,470
PV7010	Blackish red	MEGACOAT	Thin coating	6.5	1,700	16.7	7.0	2,000
PV7025	Blackish red	MEGACOAT	Thin coating	6.4	1,500	14.7	10.0	2,500
PV7020	Gold	TiAlN+TiN	Thin coating	6.4	1,500	14.7	10.0	2,500
PV60	Gold	TiN	Thin coating	6.6	1,600	15.7	9.0	1,760
PV90	Gold	TiN	Thin coating	6.4	1,450	14.2	10.0	1,960

CVD Coated Carbide

Symbol	Color	Main Component	Coating Layer	Ratio	Hardness of Substrate		Fracture Toughness ($MPam^{1/2}$)	Transverse Strength (MPa)
					(HV)	(GPa)		
CA4010	Gold	Columnar TiCN+Al_2O_3+TiN	Thick coating	14.8	1,670	16.4	10.0	3,000
CA4115	Gold	Micro columnar TiCN+Al_2O_3+TiN	Thick coating	14.7	1,550	15.2	12.0	2,750
CA4120	Gold	Micro columnar TiCN+Al_2O_3+TiN	Thick coating	14.7	1,550	15.2	12.0	2,750
CA4505	Blackish gray	Micro columnar TiCN+Al_2O_3	Thick coating	14.9	1,780	17.4	9.5	2,350
CA4515	Blackish gray	Micro columnar TiCN+Al_2O_3	Thick coating	14.9	1,570	15.4	12.0	2,780
CA5505	Gold	Micro columnar TiCN+Al_2O_3+TiN	Thick coating	14.7	1,730	17.0	10.0	2,540
CA5515	Gold	Micro columnar TiCN+Al_2O_3+TiN	Thick coating	14.7	1,550	15.2	12.0	2,750
CA5525	Gold	Micro columnar TiCN+Al_2O_3+TiN	Thick coating	14.5	1,400	13.7	12.0	2,780
CA5535	Gold	Micro columnar TiCN+Al_2O_3+TiN	Thick coating	14.1	1,340	13.1	16.5	2,970
CA6515	Gold	Micro columnar TiCN+Al_2O_3+TiN	Thin coating	14.7	1,530	15.0	12.0	2,780
CA6525	Gold	Micro columnar TiCN+Al_2O_3+TiN	Thin coating	14.7	1,370	13.4	16.0	3,100
CR9025	Gold	Columnar TiCN+TiN	Thick coating	14.5	1,400	13.7	12.0	2,780

PVD Coated Carbide

Symbol	Color	Main Component	Coating Layer	Ratio	Hardness of Substrate		Fracture Toughness ($MPam^{1/2}$)	Transverse Strength (MPa)
					(HV)	(GPa)		
PR630	Gold	TiN	Thin coating	12.5	1,500	14.7	11.0	2,160
PR660	Gold	TiN	Thin coating	13.7	1,450	14.2	12.0	2,250
PR730	Gold	TiAlN+TiN	Thin coating	13.7	1,450	14.2	12.0	2,250
PR830	Gold	TiAlN+TiN	Thin coating	13.7	1,450	14.2	12.0	2,250
PR905	Bluish violet	TiAlN	Thin coating	14.8	1,670	16.4	10.0	3,000
PR915	Bluish violet	TiAlN	Thin coating	14.1	1,700	16.7	11.0	4,140
PR930	Reddish gray	TiCN	Thin coating	14.1	1,700	16.7	11.0	4,140
PR1005	Reddish gray	TiCN	Thin coating	14.9	1,800	17.6	10.0	3,300
PR1025	Reddish gray	TiCN	Thin coating	14.5	1,600	15.8	13.0	3,400
PR1115	Purple red	TiAlN	Thin coating	14.7	1,700	16.7	11.0	3,000
PR1125	Purple red	TiAlN	Thin coating	14.5	1,600	15.8	13.0	3,400
PR1210	Blackish red	MEGACOAT	Thin coating	14.8	1,670	16.4	10.0	3,000
PR1215	Blackish red	MEGACOAT	Thin coating	14.7	1,700	16.7	11.0	3,000
PR1225	Blackish red	MEGACOAT	Thin coating	14.5	1,600	15.8	13.0	3,400
PR1230	Blackish red	MEGACOAT	Thin coating	13.7	1,450	14.2	12.0	2,250
PR1305	Blackish red	MEGACOAT	Thin coating	15.0	1,790	17.5	9.5	2,350
PR1310	Blackish red	MEGACOAT	Thin coating	14.8	1,670	16.4	10.0	3,000
PR1325	Blackish red	MEGACOAT	Thin coating	14.7	1,370	13.4	16.0	3,100

Carbide

Symbol	Color	Main Component	Ratio	Hardness of Substrate		Fracture Toughness ($MPam^{1/2}$)	Transverse Strength (MPa)
				(HV)	(GPa)		
PW30	Gray	WC+Co+TiC+TaC	12.5	1,500	14.7	12.0	2,160
KW10	Gray	WC+Co	15.0	1,650	16.2	10.0	1,470
GW15	Gray	WC+Co	14.7	1,700	16.7	11.0	3,000
GW25	Gray	WC+Co	14.5	1,600	15.8	13.0	3,400
SW05	Gray	WC+Co	15.0	1,790	17.5	9.5	2,350
SW10	Gray	WC+Co	14.8	1,670	16.4	10.0	3,000
SW25	Gray	WC+Co	14.7	1,370	13.4	16.0	3,100