

Insert Grades

A1~A20

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Insert Grades

A6~A20

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Summary of Insert Grades

A

Kyocera promotes research 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	TN610					TN610								
		TN6010					TN6010								
		TN620					TN620								
		TN6020					TN6020								
		TN60					TN60								
		TN90					TN90								
	TC Series		TC60M				TC60M								
	PV Series	PV7020					PV7020								
		PV90					PV90								
	MEGACOAT (PV Series)	PV7010					PV7010								
		PV7025					PV7025								
	MEGACOAT NANO (PV Series)	PV710					PV710								
		PV720					PV720								
Coated Carbide	CA Series	CA510													
		CA515					CA6515								
		CA525					CA6525								
		CA530													
		CA5505													
		CA5515													
		CA5525													
		CA5535													
	PR Series	PR930					PR930								
		PR1005					PR1025								
		PR1025					PR1125								
	MEGACOAT (PR Series)		PR1225				PR1225								
			PR1425				PR1425								
	MEGACOAT NANO (PR Series)		PR1535				PR1535								
Ceramic	Ceramic											KA30			
												KT66			
												A66N			
Carbide	Carbide											PT600M			
												KS6050			
												CS7050			
CBN	CBN											KW10			
												GW15			
												KBN475			



Turning

Workpiece Material		Non-ferrous Metals (Aluminum / Non-ferrous metals / Non-metals)				Difficult-to-cut Materials (Heat-resistant alloys / Ni-base heat-resistant alloys)				Hard 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										
	PR Series							CA6525									
	MEGACOAT (PR Series)						PR1305										
	MEGACOAT NANO (PR Series)						PR1310										
								PR1325									
								PR1535									
	Cermet													TN6010			
														TN60			
	Ceramic						CF1			KT66							
							KS6030			A66N							
							KS6040			PT600M							
	CBN									KBN510							
										KBN525							
										KBN900							
	MEGACOAT									KBN05M							
										KBN10M							
										KBN25M							
										KBN30M							
										KBN35M							
														KBN65M			
														KBN70M			
														KBN570			

Workpiece Material		Non-ferrous Metals (Aluminum / Non-ferrous metals / Non-metals)				Difficult-to-cut Materials (Titanium / Titanium alloys)				Hard 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	MEGACOAT NANO (PR Series)							PR1535									
	Carbide						SW05										
							SW10										
							SW25										
		KW10					KW10										
		GW15					GW15										
	DLC Coated Carbide	PDL025															
	PCD	KPD001				KPD001											
		KPD010				KPD010											
		KPD230															
		KPD250															

PVD Coated Carbide for Small Tools

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
Coated Carbide	PR Series	PR930					PR930								
		PR1005					PR1025								
		PR1025					PR1125								
		PR1115					PR1115								
	MEGACOAT (PR Series)	PR1225					PR1225								
	MEGACOAT NANO (PR Series)	PR1535					PR1535								
		PR1425					PR1425								

Summary of Insert Grades

A

Grooving / Cut-Off

Insert Grades

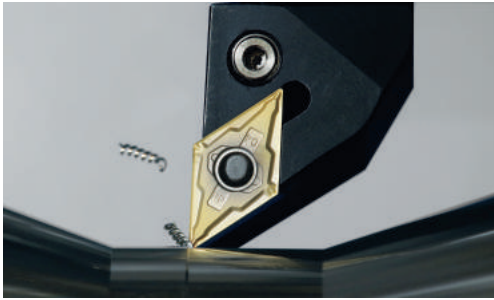
Workpiece Material		Steel (Carbon steel / Alloy steel)					Stainless steel / Cast steel					Cast Iron (Gray cast iron / Nodular cast iron)			
Cutting Range		Finishing ← → Roughing					Finishing ← → Roughing					Finishing ← → Roughing			
Classification		P01	P10	P20	P30	P40	M01	M10	M20	M30	M40	K01	K10	K20	K30
Cermet	MEGACOAT (PV Series)	PV7040										PV7040			
	TN Series	TN620					TN620								
		TN6020					TN6020								
		TN60					TN60					TN60			
Coated Carbide	TC Series	TN90					TN90								
		TC40N					TC40N					TC40N			
	CR Series	TC60M					TC60M								
		CR9025					CR9025								
	PR Series	PR630					PR630								
		PR660					PR660								
		PR915					PR915					PR905			
		PR930					PR930								
		PR1025					PR1025								
		PR1115													
	MEGACOAT (PR Series)	PR1215					PR1215					PR1215			
		PR1225					PR1225								
	MEGACOAT NANO (PR Series)	PR1535					PR1535								
Ceramic												A65 A66N PT600M			
Carbide												KW10 GW15			

Workpiece Material		Non-ferrous Metals (Aluminum / Non-ferrous metals / Non-metals)				Difficult-to-cut Materials (Titanium / Titanium alloys)				Hard 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	MEGACOAT (PR Series)														PR1215		
															PR1225		
Cermet														TN60			
Ceramic										A65							
										A66N							
										PT600M							
Carbide			KW10			KW10											
			GW15			GW15											
DLC Coated Carbide			PDL025														
CBN										KBN510					KBN570		
										KBN525							
PCD		KPD001				KPD001											
		KPD010				KPD010											

Insert Grades

A

Cermet



Cermet

KYOCERA is known as one of the leading manufacturer of cermets. Cermets combine toughness with superior wear resistance, and provide longer tool life and excellent surface finishes. Typical materials used in cermets are TiC, TiN, TiCN and NbC.

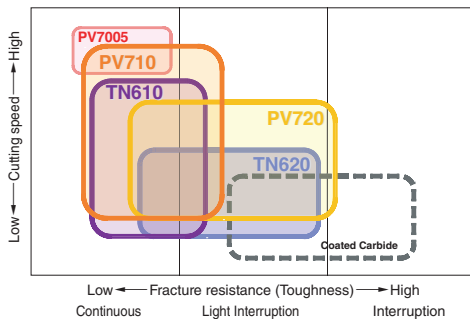
PVD Coated Cermet (MEGACOAT / MEGACOAT NANO Cermet)

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

Classification	Symbol	Color	Main Component (Coated Composition)	Advantages and Applications
P Steel	Cermet	TN610	TiCN	- High wear resistant cermet due to three types of special reinforcement technology - Application: Cermet for steel machining, long tool life in high speed and continuous
		TN620	TiCN	- Three types of special reinforcement technology realized the superior fracture resistance and wear resistance - Application: Stable machining of steel
		TN6010 (Super Micro-Grain)	TiCN	Application: Uncoated cermet for steel
		TN60	TiCN+NbC	Application: Machining of steel, continuous to interruption
		TN6020 (Super Micro-Grain)	TiCN	Application: For steel machining
		TN100M	TiCN+NbC	- Tough cermet with improved oxidation resistance and thermal shock resistance - Application: Milling of steel at high speed
		TC40N	TiC+TiN	- Good balance of wear resistance and toughness - Application: Grooving and threading of steel
	MEGACOAT NANO Cermet	PV710	TiCN (MEGACOAT NANO)	- Superior wear and adhesion resistant MEGACOAT NANO on the high wear resistant cermet - Application: Long tool life and stability in high speed continuous machining of steel, excellent surface
		PV720	TiCN (MEGACOAT NANO)	- Superior wear and adhesion resistant MEGACOAT NANO on the special reinforcement cermet - Application: First choice PVD coated cermet for steel machining, high efficient machining and high quality surface finish
K Cast Iron	MEGACOAT Cermet	PV7010 (Super Micro-Grain)	TiCN (MEGACOAT)	Application: Long tool life in steel machining
		PV7025 (Super Micro-Grain)	TiCN (MEGACOAT)	Application: PVD coated cermet for steel machining
		PV7040	TiC+TiN (MEGACOAT)	- MEGACOAT Cermet for Grooving - Application: Excellent surface finish and longer tool life in steel grooving
		PV7005	TiC+TiN (MEGACOAT)	- Heat-resistant MEGACOAT on cermet with excellent wear resistance - Application: High speed finishing of gray and nodular cast iron

Application Map



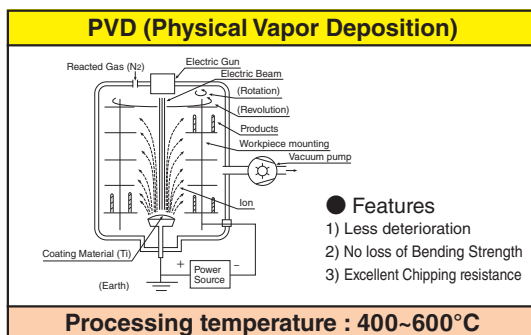
TN Series (Uncoated Cermet)

TN610 : Superior wear resistant cermet
TN620 : Superior fracture and wear resistance

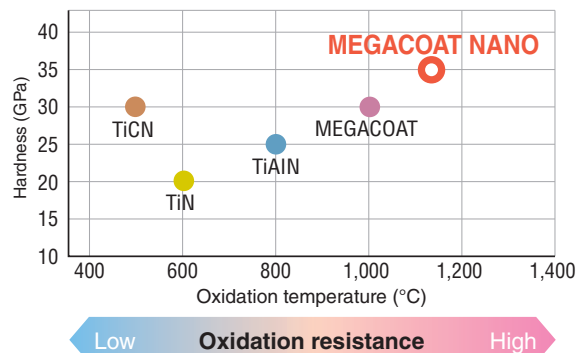
PV Series (MEGACOAT NANO Cermet)

PV710 : Long tool life and stable machining of steel at high speed and continuous
PV720 : High efficiency and excellent surface finish (1st choice)

PVD Coating



Properties of PVD Coating



Hybrid Cermet

Three attributes of the Hybrid Technology contributes to superior surface finish and machining stability

A



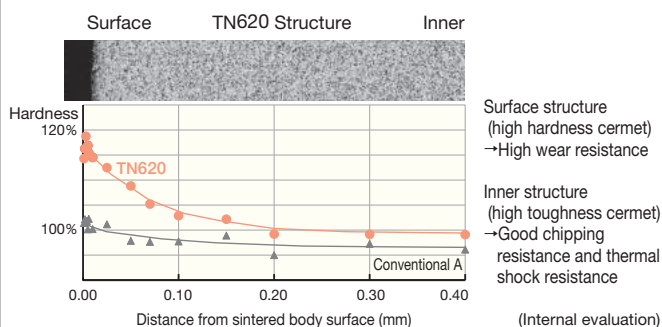
Insert Grades



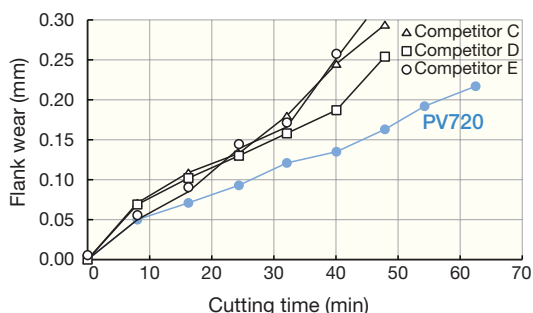
Special Surface-Hardened “Hybrid Structure”

Excellent fracture resistance with the surface-hardened layer using the gradient composition technology.
Good balance of stable wear resistance and fracture resistance by continuously-varied hardness.

TN620's inner structure has high toughness and chipping resistance as well as thermal shock resistance. And surface area has higher hardness and wear resistance compared to the conventional super micro-grain cermet A. (see attached chart)

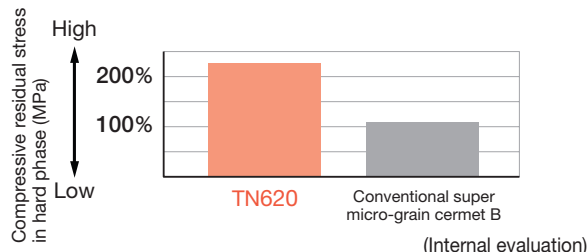
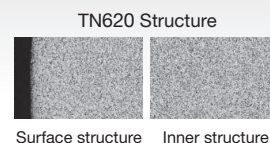


Wear Resistance Comparison

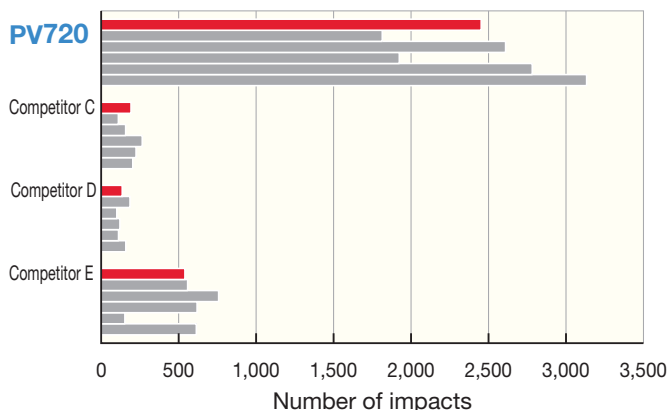


Super micro-grain “hybrid hard phase”

Improved strength by uniform super micro-grain hard phase and superior compressive stress by high melting point bonded phase. Fracture resistance improved.

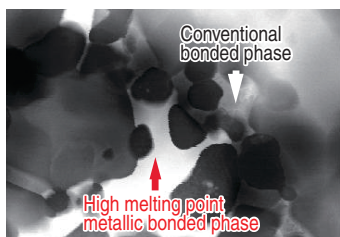


Fracture Resistance Comparison



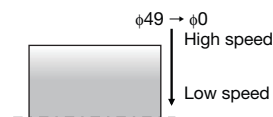
High melting point “hybrid bonded phase”

Combining the conventional cermet bonded phase (nickel, cobalt) and the special high melting point metallic bonded phase. Improved adhesion resistance and better surface finish are realized by higher thermal resistance of the bonded phase.



Surface finish comparison

Cutting Conditions
Workpiece Material : S10C
Vc=180~0m/min (Constant late)
ap=0.5mm f=0.1mm/rev Wet CNMG120404 type



	PV720	Competitor C	Competitor D	Competitor E
Surface Finish				
Surface Roughness (φ4~φ15) (Vc=15~55m/min)	Good	Bad	Good	Bad

(Internal evaluation)

CVD Coated Carbide (Turning)



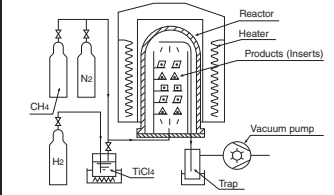
CVD Coated Carbide

Using Chemical Vapor Deposition coating technology, CVD coated carbide grades provide stable, efficient machining at high speeds or for heavy interrupted applications.

Features

- Applicable from low to high speed machining and from finishing to roughing
- Stable machining 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

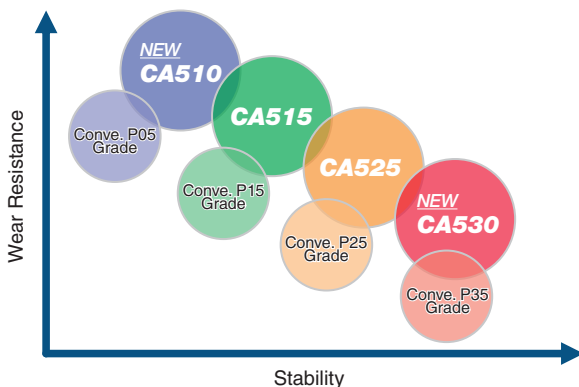
Processing temperature: 900~1100°C

Features of CVD Coated Carbide

Classification	Symbol	Color	Coated Composition	Advantages and Applications
P Steel	CA510	Gold	Micro columnar TiCN+Al ₂ O ₃ +TiN	· Special substrate with thermal deformation resistance along with a thick and tough coating layer providing high wear resistance · Application: High speed and high efficiency steel machining
	CA515	Gold	Micro columnar TiCN+Al ₂ O ₃ +TiN	· Improved wear resistance and stability due to special substrate with heat deformation resistance and hard and tough coating layer with reinforced interface · Application: Light interrupted machining of steel
	CA525	Gold	Micro columnar TiCN+Al ₂ O ₃ +TiN	· Stable and long tool life machining due to special substrate with heat deformation resistance and tougher coating layer and reinforced interface · Application: Interrupted to general machining of steel
	CA530	Gold	Micro columnar TiCN+Al ₂ O ₃ +TiN	· Special tough substrate and tough coating layer providing high stability and wear resistance · Application: General to heavy interrupted machining (stability oriented)
	CA5505	Gold	Micro columnar TiCN+Al ₂ O ₃ +TiN	· Application: High speed continuous machining of steel, continuous to light interrupted machining of cast iron
	CA5515	Gold	Micro columnar TiCN+Al ₂ O ₃ +TiN	· Application: Machining of steel, continuous to light interruption
	CA5525	Gold	Micro columnar TiCN+Al ₂ O ₃ +TiN	· Application: For general machining of steel, roughing to interruption
	CA5535	Gold	Micro columnar TiCN+Al ₂ O ₃ +TiN	· Application: Roughing to heavy interrupted machining 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 machining of steel
M Stainless steel	CA6515	Gold	Micro columnar TiCN+Al ₂ O ₃ +TiN	· Specialized carbide substrate for machining stainless steel, excellent wear resistance · Application: Continuous machining of stainless steel
	CA6525	Gold	Micro columnar TiCN+Al ₂ O ₃ +TiN	· Specialized carbide substrate for machining stainless steel, excellent notching resistance and toughness · Application: First choice for general machining of stainless steel, from finishing to roughing, continuous to interruption
K Cast Iron	CA4010	Gold	Columnar TiCN+Al ₂ O ₃ +TiN	· Application: Continuous to light interrupted high speed machining of cast iron
	CA4115	Gold	Micro columnar TiCN+Al ₂ O ₃ +TiN	· Application: Continuous to light interrupted machining of nodular cast iron
	CA4120	Gold	Micro columnar TiCN+Al ₂ O ₃ +TiN	· Application: Roughing to heavy interrupted machining of nodular cast iron
	CA4505	Blackish gray	Micro columnar TiCN+Al ₂ O ₃	· Stable, longer tool life due to improved bonding strength of coating layers and special treatment of the surface of the top coating layer · Application: For gray cast iron and nodular cast iron at high speed in continuous to light interrupted machining
	CA4515	Blackish gray	Micro columnar TiCN+Al ₂ O ₃	· Stable, longer tool life due to improved bonding strength of coating layers and special treatment of the surface of the top coating layer · Application: First choice for gray cast iron and nodular cast iron in light to heavy interrupted machining

Application Map

● Steel



● Stainless steel

Cutting speed	High	CA6515		
	Low	CA6525 (1st choice grade)	PR1125	
Applications	Continuous		Light Interruption	Interruption

CVD coated carbide grades for steel

CA5 Series

New coating technology to provide longer tool life and stable machining



A



Insert Grades

★ High Adhesion Strength of Coating Layer Ultra fine interface

- Longer tool life and stable machining by improved adhesion strength
- **40% improved** adhesion strength

★ Smooth and Flat Surface

- Generates low cutting force and stable machining
- Prevents adhesion (edge build-up) and sudden fracturing

CA510

- Special substrate with thermal deformation resistance along with a thick and tough coating layer providing high wear resistance
- Application: High speed and high efficiency steel machining

CA525

- Special substrate and tough coating layer provides high wear and fracture resistance
- Application: First choice for steel machining

★ High Hardness with Tougher α -Al₂O₃ coating layer

- Special crystal control technology
- Longer tool life due to high-aspect ratio of micro columnar α -Al₂O₃ coating layer

★ New Carbide Substrate

- Special carbide substrate with deformation resistance at high temperature
- **10% improved** hardness at high temperature
- Good for high efficient machining

CA515

- Special substrate and tough coating layer providing thermal deformation and high wear resistance
- Application: For continuous to light interrupted machining of steel (general use)

CA530

- Special tough substrate and tough coating layer providing high stability and wear resistance
- Application: General to heavy interrupted machining (stability oriented)

Kyocera's unique crystal control technology and advanced layer adhesion lead CVD coating to the next stage

Longer tool life

Control α -Al₂O₃ crystal growth for improving wear resistance and fracture resistance



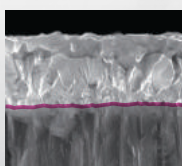
CA5



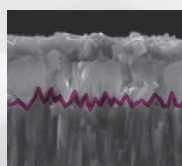
Conventional

Prevents peeling of coating layer

40% improved layer adhesion by optimized interface



CA5



Conventional

Control chipping

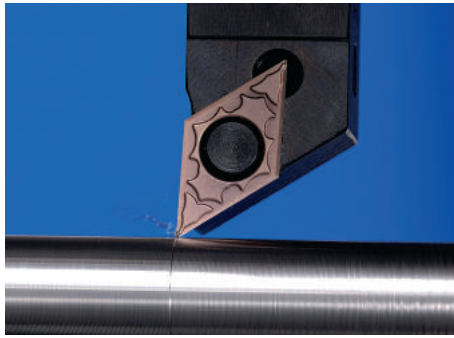
Higher layer strength and fracture resistance with high aspect ratio TiCN



CA5

— TiCN layer
— Carbide substrate

PVD Coated Carbide (Turning)



PVD Coated Carbide (MEGACOAT / MEGACOAT NANO)

Using a Physical Vapor Deposition coating technology, Generally because of the low processing temperature of PVD compared with CVD, PVD coated carbide features less deterioration and more bending strength. PVD coated carbide grades are coated on a very tough carbide substrate and suitable for turning.

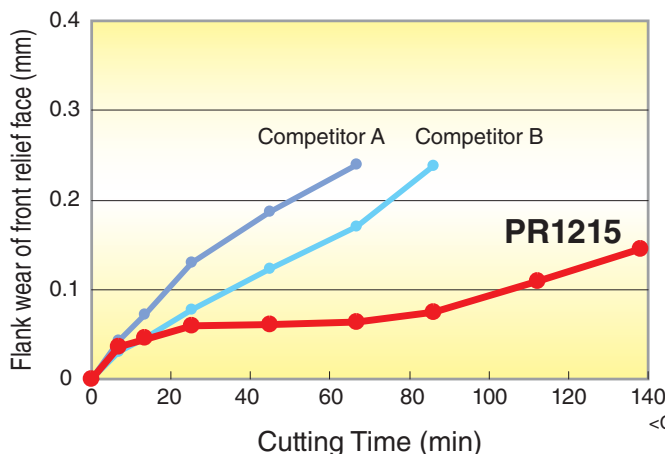
PVD Coated Super Micro-Grain Carbide

- Smooth fine surface of PVD coated carbide provides good surface finish and high precision machining
- Stable machining with excellent toughness

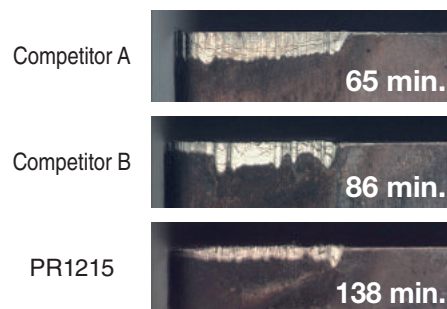
Features of PVD Coated Carbide

Classification	Symbol	Color	Coated Composition	Advantages and Applications
P Steel	PR915 (Super Micro-Grain)	Bluish violet	TiAlN	· Application: Stable and reliable high precision machining of steel
	PR930 (Super Micro-Grain)	Reddish gray	TiCN	· Application: Low machining speed, precise machining with sharp edge
	PR1005	Reddish gray	TiCN	· TiCN base PVD coated hard micro-grain carbide · Application: Turning of free-cutting steel, longer tool life achieved through anti-adhesion performance
	PR1025	Reddish gray	TiCN	· Application: General machining of steel and stainless steel, stable and longer tool life
	PR1115	Purple red	TiAlN	· Superior oxidation resistance with well balanced wear resistance and toughness · Application: Machining of steel and stainless steel, for grooving, cut-off and threading
	PR1215	Blackish red	MEGACOAT	· Superior wear and oxidation-resistant MEGACOAT on micro-grain carbide substrate · Application: Superior adhesion resistance and longer tool life for steel and stainless steel machining
	PR1425	Blackish red	MEGACOAT NANO	· New coating technology [MEGACOAT NANO] is applied. Nano thin multi-layer coating performs superior wear resistance and high oxidation resistance · Application: Various applications of machining steel, High speed machining of stainless steel, extended tool life
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 machining of stainless steel
	PR1225	Blackish red	MEGACOAT	· Superior wear and oxidation-resistant MEGACOAT on micro-grain carbide substrate · Application: Light interrupted to interrupted machining of stainless steel
	PR1535	Reddish green	MEGACOAT NANO	· Nano thin multi-layer coating [MEGACOAT NANO] improved wear resistance and stability · Application: Medium to roughing of stainless steel and heat-resistant alloys, cut-off of stainless steel
K Cast Iron	PR905	Bluish violet	TiAlN	· Smooth fine surface PVD coated hard carbide with plastic deformation resistance · Application: Suitable for machining gray and nodular cast iron
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 machining and finishing of heat-resistant alloys
	PR1325	Blackish red	MEGACOAT	· MEGACOAT on tough carbide · Application: Light interrupted machining and roughing of heat-resistant alloys

PR1215 Wear Resistance Comparison (Off-centered grooving)



Flank wear of front relief face

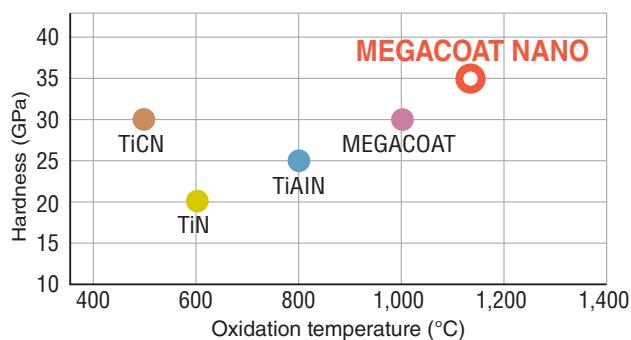
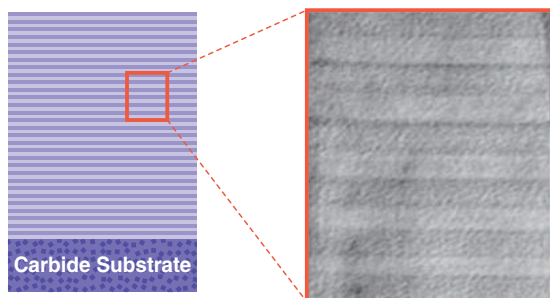


<Cutting Conditions> Vc=150m/min, ap=1.5mm, f=0.1mm/rev, Wet
SNCM439 φ198 → φ48 (Internal evaluation)



Properties of MEGACOAT NANO

Multi-layer composition of MEGACOAT

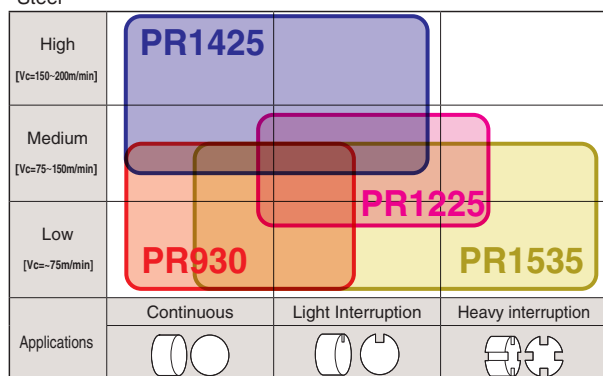


Low Oxidation resistance High

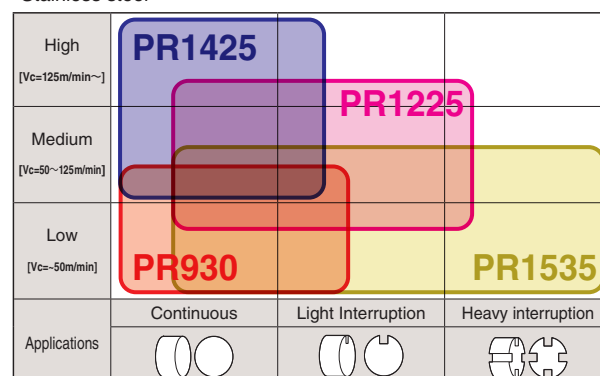
Prevents wear and fracture with high hardness (35GPa) and superior oxidation resistance (oxidation temperature: 1,150°C)

Application Map

• Steel

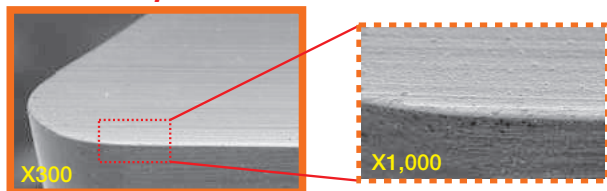


• Stainless steel



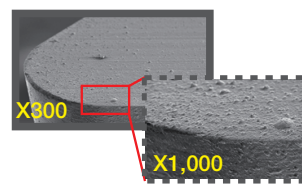
Cutting edge quality (Sharp edge insert)

PR1225 / PR1425



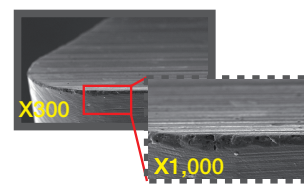
<Superior edge-sharpening performance and Smooth surface>

Competitor A



<Delamination (coating peeling) and rough surface>

Competitor B



MEGACOAT Series (PR1225 / PR1425) shows high edge sharpening performance and adhesion resistance.

(Internal evaluation)

Advantages of PR13 Series

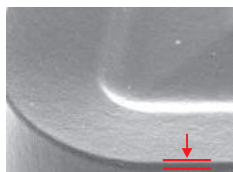
- 1) Superior wear and fracture resistance attained with uniform grain size and MEGACOAT on superior thermal shock resistant carbide
- 2) New edge preparation technology (FET: Fine Edge Treatment) controls and minimizes R honing and provides large tip rake angle, and thus prevents burrs and notching.

● Special carbide substrate



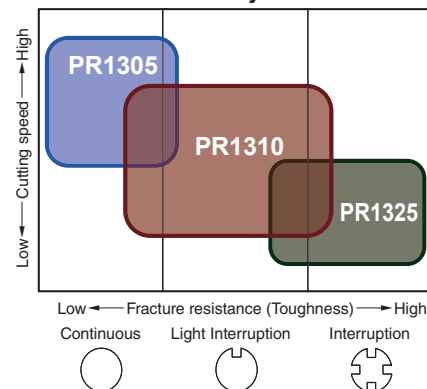
Uniform grain size enables superior thermal shock resistance and constant hardness

● New edge preparation technology



Edge control of FET technology

● Heat-resistant alloys



Low ← Fracture resistance (Toughness) → High
Continuous Light Interruption Interruption

PVD / CVD Coated Carbide (Milling / Drilling)



PVD Coated Carbide (MEGACOAT / MEGACOAT NANO)

PVD coated carbide grades for milling and drilling are coated on a very tough carbide substrate. Because of the low processing temperature of PVD compared with CVD, it features less deterioration and more bending strength.

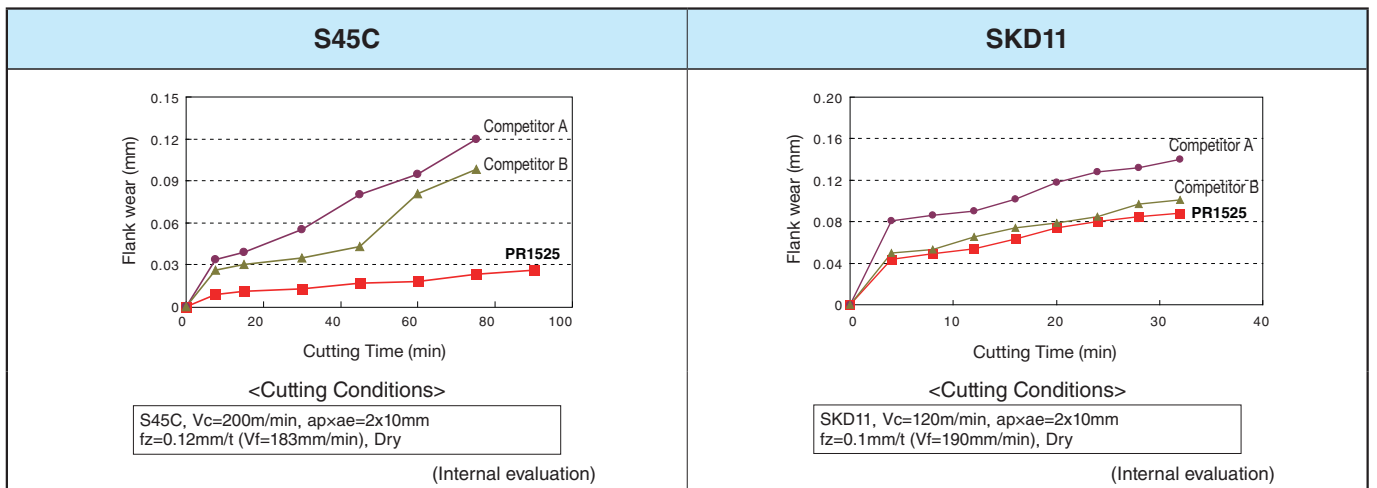
CVD Coated Carbide

CVD coated carbide grades provide stable, efficient machining at high speeds or for heavy interrupted applications. Ti-base (TiN, TiCN) coating with superior hardness and wear resistance or ceramic-base (Al_2O_3) coating with high-thermal stability is applied on a tough carbide substrate. Superior fracture resistance and wear resistance.

Features of CVD / PVD Coated Carbide

Classification	Symbol	Color	Coated Composition	Advantages and Applications
P Steel	PR830	Gold	TiAlN+TiN	- Improved high temperature stability and wear resistance by TiAlN base PVD coating - Application: Milling of steel
	PR1230	Blackish red	MEGACOAT	- Superior wear and oxidation-resistant MEGACOAT on a special tough carbide substrate - Application: Stable and high feed milling and drilling of steel
	PR1525	Reddish green	MEGACOAT NANO	- New coating technology [MEGACOAT NANO] is applied. Nano thin multi-layer coating performs superior wear resistance and high oxidation resistance - Application: Stable and longer tool life for milling of steel and stainless steel
M Stainless steel	PR1225	Blackish red	MEGACOAT	- Superior wear and oxidation-resistant MEGACOAT on micro-grain carbide substrate - Application: General machining and high feed milling and drilling of steel and stainless steel
K Cast Iron	PR1210	Blackish red	MEGACOAT	- Superior wear and oxidation-resistant MEGACOAT coated on special carbide substrate - Application: Highly efficient stable milling and drilling of gray and nodular cast iron
	PR1510	Reddish green	MEGACOAT NANO	- New coating technology [MEGACOAT NANO] is applied. Nano thin multi-layer coating performs superior wear resistance and high oxidation resistance - Application: Highly fracture resistance and wear resistance for gray and nodular cast iron
	CA420M	Gold	Micro columnar TiCN+ Al_2O_3 +TiN (CVD)	- Kyocera's unique crystal control technology and advanced layer adhesion CVD coating with superior wear resistance and toughness - Application: Milling of gray and nodular cast iron
S Heat-resistant Alloys Titanium Alloys	PR1535	Reddish green	MEGACOAT NANO	- Nano thin multi-layer coating [MEGACOAT NANO] improved wear resistance and stability - Application: For milling of Ni-base heat-resistant alloys, titanium alloys and precipitation hardened stainless steel
S Heat-resistant alloys	CA6535	Gold	Micro columnar TiCN+ Al_2O_3 +TiN (CVD)	- High heat-resistance and wear resistance with CVD coating - Application: For milling of Ni-base heat-resistant alloys and martensitic stainless steel

Properties of wear resistance (PR1525)





● New grade for heat-resistant alloys and difficult-to-cut materials



CA6535(CVD) For martensitic stainless steel and Ni-base heat-resistant alloys

PR1535(PVD) For Ni-base heat-resistant alloys, titanium alloys and precipitation hardened stainless steel

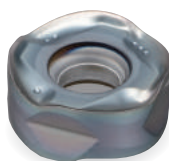
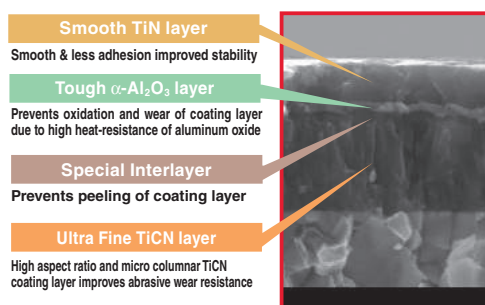
Suitable for variety of workpiece materials!

Stable machining by preventing sudden insert fracture
Suitable for high-efficiency machining



CA6535

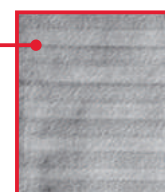
For martensitic stainless steel and Ni-base heat-resistant alloys
High heat resistance and wear resistance with CVD coating
Improved stability due to thin layer coating technology



PR1535

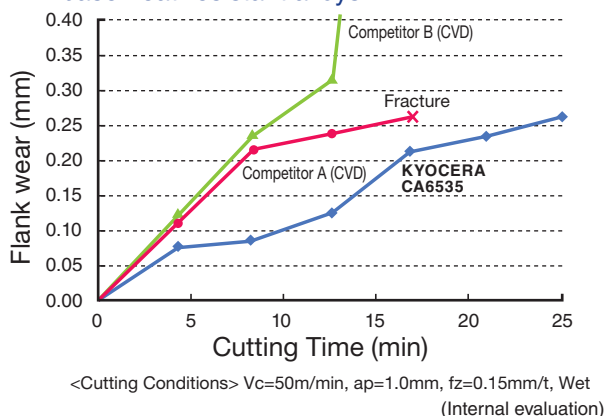
For Ni-base heat-resistant alloys, titanium alloys and precipitation hardened stainless steel
Stable and longer tool life by special nano thin multi-layer coating [MEGACOAT NANO]

MEGACOAT base multi-layer composition

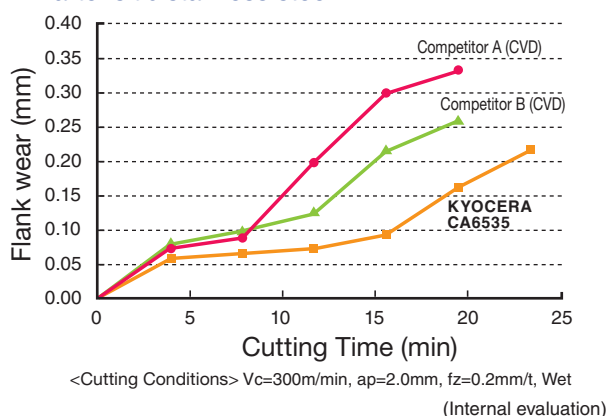


Tool Life Comparison

● Ni-base heat-resistant alloys



● Martensitic stainless steel

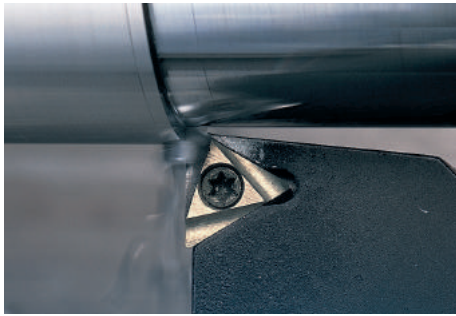


Longer tool life and more stable machining than competitors!

Insert Grades

A

Carbide



Carbide

Uncoated tungsten carbide grade is used in a variety of applications due to its superior mechanical properties.

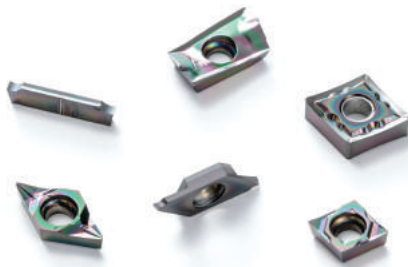
Features

- KW10: Suitable for machining cast iron with high hardness and toughness
- GW15, GW25 : Suitable for machining non-ferrous metals and non-metals
- SW series : Suitable for machining of titanium and titanium alloy

Features of Carbide

Classification	Symbol	Color	Main Component	Advantages and Applications
N Non-ferrous Metals	KW10	Gray	WC+Co	· ISO identification symbol K carbide (K10 relevant) · Application: Machining cast iron, non-ferrous materials and non-metals
	GW15	Gray	WC+Co	· ISO identification symbol K carbide (K10 relevant), tough micro-grain carbide · Application: Machining cast iron, non-ferrous materials and non-metals
	GW25	Gray	WC+Co	· ISO identification symbol K carbide (K30 relevant) · Application: Milling operations of aluminum
S Heat-resistant alloys	SW05	Gray	WC+Co	· ISO identification symbol K carbide (K05 relevant) · Application: Titanium alloys for continuous machining and finishing
	SW10 (Made to order)	Gray	WC+Co	· ISO identification symbol K carbide (K10 relevant) · Application: Titanium alloys for continuous and light interrupted machining
	SW25 (Made to order)	Gray	WC+Co	· ISO identification symbol K carbide (K25 relevant) · Application: Titanium alloys for interrupted and light interrupted machining

DLC Coated Carbide



DLC Coated Carbide

DLC (Diamond-Like Carbon) Coated Carbide is coated on carbide substrate with a thin layer of amorphous carbon.

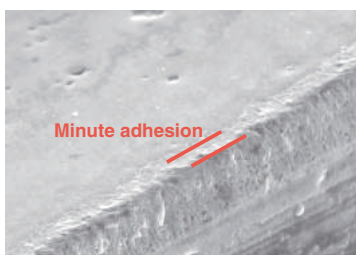
Features

- High Hardness with Kyocera's Proprietary Hydrogen-free DLC Coating
- Excellent surface finish achieved through anti-adhesion performance

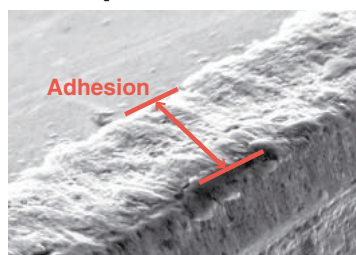
Features of DLC Coated Carbide

Classification	Symbol	Color	Coated Composition	Advantages and Applications
N Non-ferrous Metals	PDL025	Rainbow color	C	· High Hardness with Kyocera's Proprietary Hydrogen-free DLC Coating · Application: Long tool life and stable machining of aluminum alloys

Adhesion Resistance Comparison



PDL025

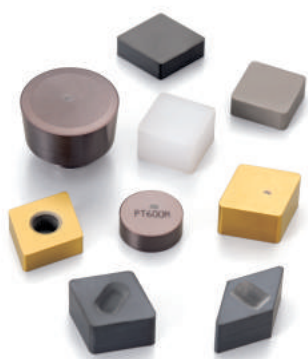


Competitor A

Cutting Conditions : $V_c=800\text{m/min}$, $f_z=0.1\text{mm/t}$, $a_{pxae}=3\times 5\text{mm}$, Dry Cutter Dia. $\phi 25\text{mm}$
 Workpiece Material : A5052 Cutting length : 57m (Internal evaluation)



Ceramic



Ceramic

Ceramics inserts are capable of machining at high speeds. Recommended for hard turning of hardened steel or rough to finish turning of cast iron and heat-resistant alloys.

Features

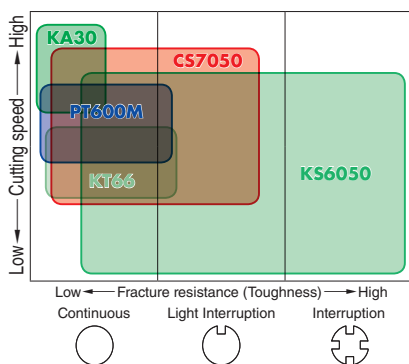
- Excellent wear resistance enables high speeds machining of cast iron
- Ceramic maintains good surface finishes due to the low affinity to workpiece materials
- Silicon nitride ceramic can machine cast iron with coolant due to its superior thermal shock resistance

Features of Ceramic

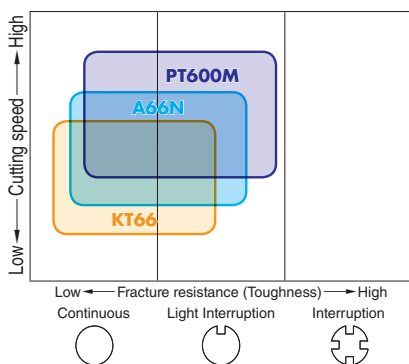
Classification	Symbol	Color	Main Component (Coated Composition)	Coating Layer	Hardness of Substrate (GPa)	Fracture Toughness (MPa·m ^{1/2})	Transverse Strength (MPa)	Advantages and Applications
K Cast Iron	KA30	White	Al ₂ O ₃	-	17.5	4.0	750	· Aluminum Oxide ceramic (Al ₂ O ₃) · Application: Finishing of cast iron at high cutting speeds without coolant
	KS6050	Gray	Si ₃ N ₄	-	15.6	8.0	1,200	· Silicon nitride ceramic (Si ₃ N ₄) · Application: Roughing and interrupted machining of cast iron. Focusing on stability. (with or without coolant)
	CS7050	Grayish white	Si ₃ N ₄ (Special Al ₂ O ₃ COAT)	Thin coating	15.6	8.0	1,200	· Silicon nitride ceramic (Si ₃ N ₄)+CVD Coated Carbide (Special Al ₂ O ₃ COAT) · Application: Finishing and continuous machining, and high speed and high efficient machining. (with or without coolant)
K Cast Iron H Hard Materials	KT66	Black	Al ₂ O ₃ +TiC	-	20.1	4.1	980	· Aluminum Oxide and Titanium Carbide ceramic (Al ₂ O ₃ +TiC) · Application: Semi-roughing to finishing of cast iron, and hard materials
	A66N	Gold	Al ₂ O ₃ +TiC (TiN COAT)	Thin coating	20.1	4.1	980	· TiN PVD coated Aluminum Oxide and Titanium Carbide ceramic (TiN coated Al ₂ O ₃ +TiC) · Application: Semi-roughing to finishing of hard materials
	PT600M	Blackish red	Al ₂ O ₃ +TiC (MEGACOAT)	Thin coating	20.1	4.1	980	· Heat-resistant MEGACOAT on Aluminum Oxide and Titanium Carbide ceramic (MEGACOAT Al ₂ O ₃ +TiC) · Application: Semi-roughing to finishing of cast iron, hard materials and hardened roll materials
S Heat-resistant alloys	KS6030	Gray	SiAlON	-	15.2	6.0	600	· SiAlON Ceramic with superior wear resistance and high resistance against boundary wear · Application: Finishing to medium machining of heat-resistant alloys
	KS6040	Brown	SiAlON	-	16.7	7.0	900	· High stability SiAlON ceramic with wear resistance and fracture resistance · Application: Roughing of heat-resistant alloys

Application Map

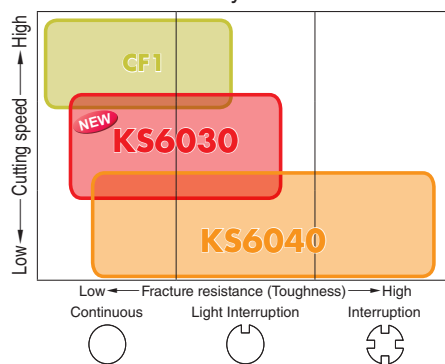
Cast Iron



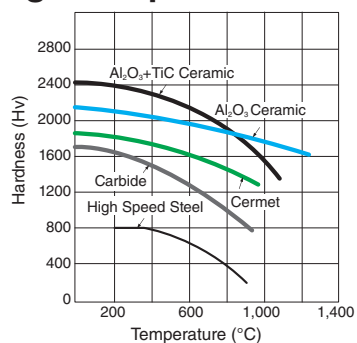
Hard Materials



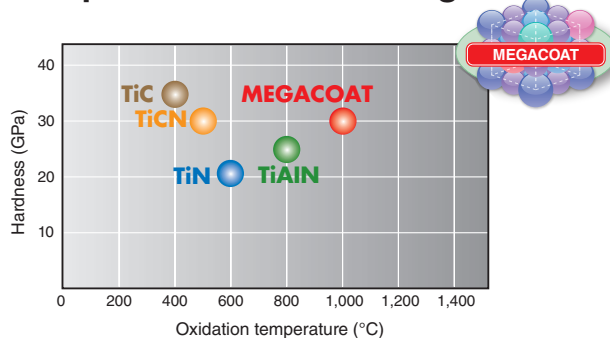
Heat-resistant alloys



High-Temperature Hardness



Properties of PVD Coating



Insert Grades

A

CBN (Cubic Boron Nitride)



CBN

CBN (Cubic Boron Nitride) is second only to diamond in hardness, and is a synthetically produced material with high thermal conductivity.

Features

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

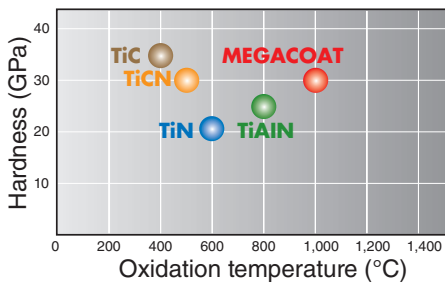
Features of CBN

Classification	Symbol	Color	Ave. grain size (μm)	Hardness of Substrate (GPa)	Transverse Strength (MPa)	Advantages and Applications
H Hard Materials	KBN510	Black	2	28	1,000	· Excellent wear resistance and crack resistance, non-coated CBN · Application: Finishing and continuous machining of hardened die steel
	KBN525	Black	1 and under	25	1,250	· Application: General purpose for hardened steel
	KBN05M (MEGACOAT)	Blackish red	0.5-1.5	27	1,000	· Heat-resistant MEGACOAT on highly heat-resistant CBN substrate · Application: High speed finishing of hardened steel
	KBN10M (MEGACOAT)	Blackish red	2	28	1,000	· Application: High speed finishing of hardened die steel
	KBN25M (MEGACOAT)	Blackish red	1 and under	25	1,250	· Heat-resistant MEGACOAT on micro-grain CBN with heat-resistant binder phase · Application: Stable machining of hardened steel at high cutting speeds
	KBN30M (MEGACOAT)	Blackish red	1-4	30	1,350	· Application: Stable machining of hardened steel for continuous to interrupted machining
Sintered Steel	KBN65B	Black	2	32	1,150	· Application: Stable machining of sintered steel (ferrous sintered alloy) at low speed
	KBN570	Black	2-4	34	1,350	· High CBN content ratio · Application: Machining of sintered steel (preventing burr formation)
	KBN65M (MEGACOAT)	Blackish red	2	32	1,150	· Heat-resistant MEGACOAT on CBN with heat-resistant binder phase · Application: Stable machining of sintered steel (ferrous sintered alloys)
	KBN70M (MEGACOAT)	Blackish red	2-4	34	1,350	· Heat-resistant MEGACOAT on CBN rich substrate · Application: Stable machining of sintered steel (ferrous sintered alloys)
K Cast Iron	KBN475	Black	2	39	1,400	· Excellent wear resistance due to high CBN content and special binder · Application: High speed machining of gray cast iron
	KBN60M (MEGACOAT)	Blackish red	0.5-6	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	31	630	· TiN coated solid CBN · Application: Heavy duty, interrupted machining and finishing of hardened steel, hardened roll steel and cast iron

· For KBN35M, ref. to page [A18](#)

MEGACOAT CBN

Properties of PVD Coating



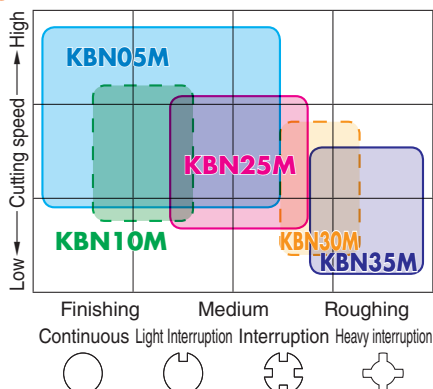
Advantages of MEGACOAT



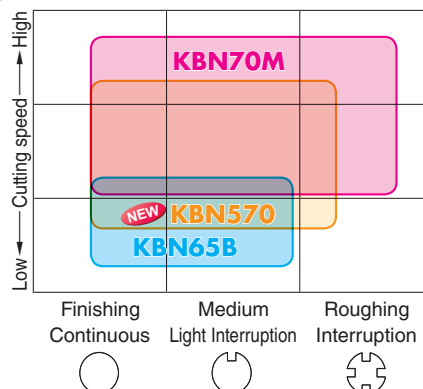
- Longer tool life and high speed machining due to superior heat resistance and hardness.
- Stability improvement through prevention of crater wear (oxidation, diffusional wear)
- High thermal stability and surface smoothness provide excellent surface finish

Application Map

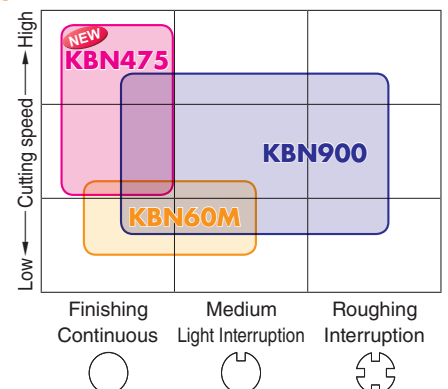
Hard Materials



Sintered Steel



Cast Iron





PCD (Polycrystalline Diamond)



PCD (Polycrystalline Diamond)

PCD (Polycrystalline Diamond) is a synthetic diamond sintered under high temperatures and pressures.

Features

- Applicable for milling of non-ferrous metals and non-metals
 - No edge build-up provides high precision machining
 - Diversified applications for machining of non-ferrous metals and non-metals
 - Finished surface will be rainbow colored
- (Because of polycrystalline diamond, a mirror-like finished surface will not be obtained)

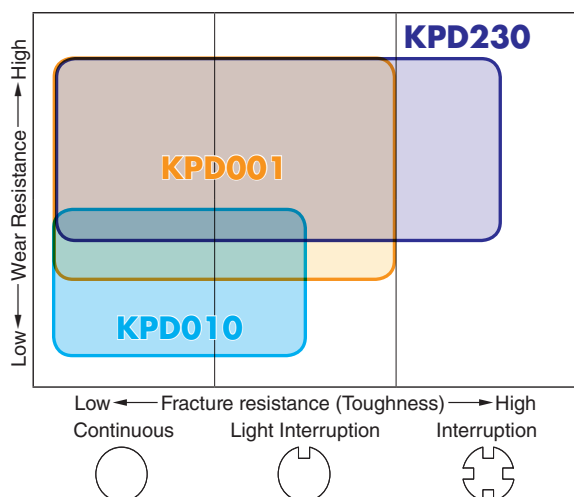
Features of PCD

Classification	Symbol	Ave. grain size (μm)	Advantages and Applications
N Non-ferrous Metals	KPD001	0.5	· Super Micro-Grain PCD features cutting edge strength, wear resistance, fracture resistance, good edge-sharpening performance and longer, stable tool life · Application: High speed machining of aluminum alloys, brass, non-ferrous metals and non-metals including plastics, and carbide.
	KPD010	10	· Good wear resistance and toughness, good grindability · Application: High speed machining of aluminum alloys, brass, non-ferrous metals and non-metals including plastics, and carbide.
	KPD230	2-30	· Superior abrasive wear resistance and toughness due to high density PCD with mixed rough and fine grains · Application: High speed machining of aluminum alloys, brass, non-ferrous metals and non-metals including plastics.
	KPD250 (Made to order)	25	· Superior wear resistance due to rough grain PCD (25μm) · Application: High speed machining of high silicon aluminum alloy and machining of carbide

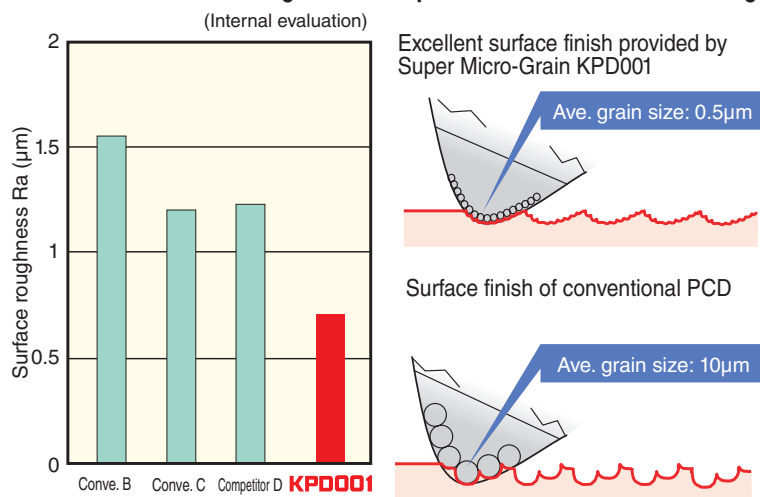
Applications

Workpiece Material		Non-ferrous Metals (Aluminum / Non-ferrous metals / Non-metals)				Difficult-to-cut Materials (Titanium / Titanium alloys)			
Cutting Range		Finishing ← → Roughing				Finishing ← → Roughing			
Classification		N01	N10	N20	N30	S01	S10	S20	S30
Turning Milling	PCD	KPD001				KPD001			
		KPD010				KPD010			
		KPD230							
		KPD250							

Application Map



Surface Finish Roughness Comparison of Aluminum Machining



(Grain size affects surface finish quality)

Insert Grades

A

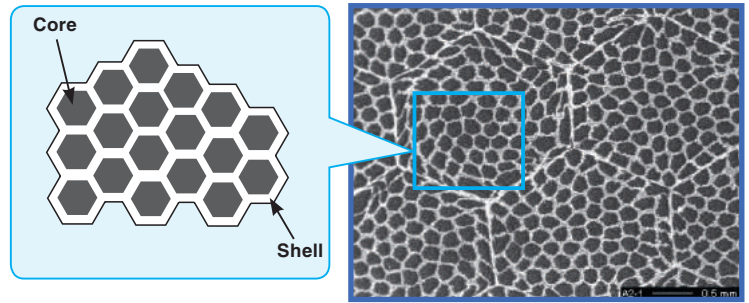
Honeycomb structure CBN / Ceramic

Honeycomb structure CBN / Ceramic

Honeycomb structure is the high structural controlled composite material consisting of a hard and superior wear-resistance core (gray portion) and a tough shell (white portion).

Features

- Honeycomb structure CBN / Ceramic combine a hard, wear-resistant core and a tough shell into one insert.
- The tough shell stops cracks that form in the core.
- CBN is suitable for interrupted machining of exceptionally hard material and ceramic is suitable for heat-resistant alloys

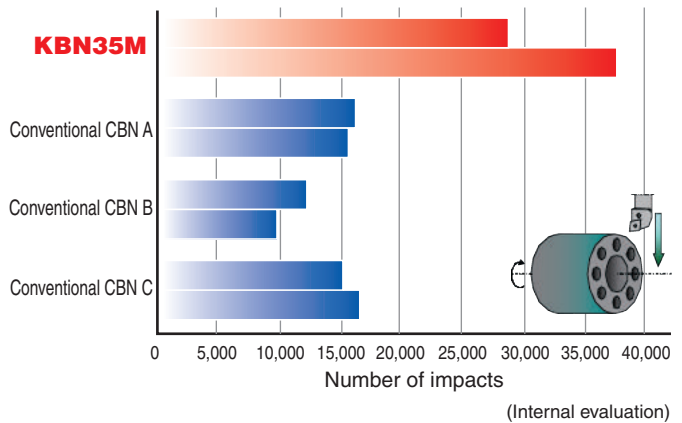
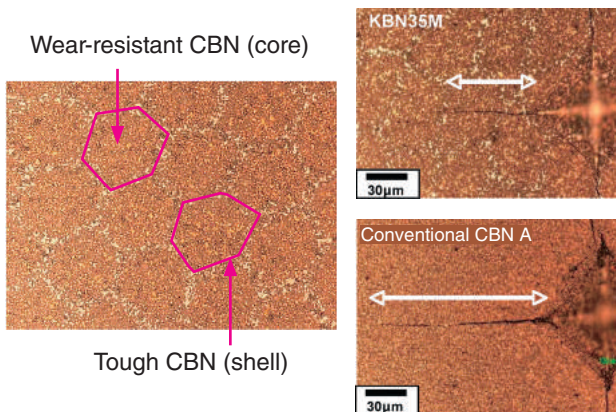


Features of Honeycomb structure CBN / Ceramic

Classification	Symbol	Color	Main Component	Advantages and Applications
H Hard Materials	KBN35M (MEGACOAT)	Blackish red	CBN	· Honeycomb structure CBN composite material consisting of wear resistant CBN (core) and tough CBN (shell) · Heat-resistant MEGACOAT on tough Honeycomb structure CBN · Application: Stable machining of hardened steel at interrupted machining
S Heat-resistant alloys	CF1	Gray	Ceramic	· Honeycomb structure ceramic composite material consisting of wear resistant ceramic (core) and tough ceramic (shell) · Application: Machining of heat-resistant alloys like Ni-base heat-resistant alloys

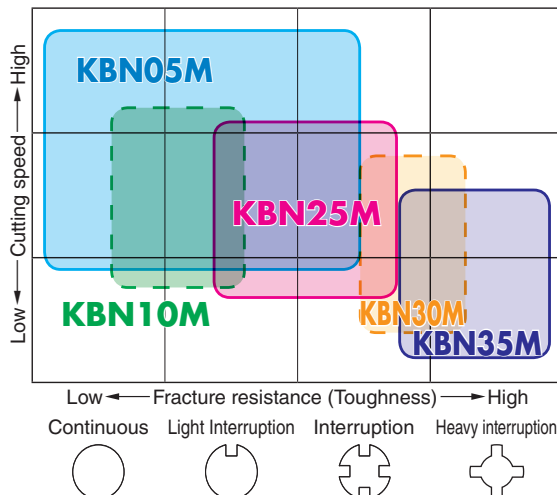
KBN35M (MEGACOAT Honeycomb structure CBN)

- Tough CBN (shell) prevents crack growth

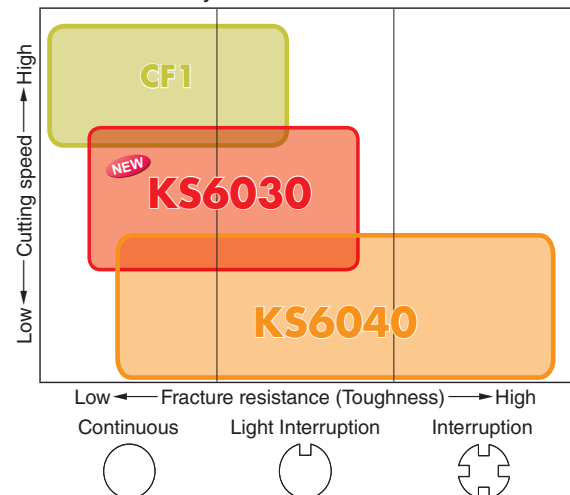


Application Map

- Hard Materials



- Heat-resistant alloys



Grade Properties

A



Insert Grades

Cermet

Symbol	Color	Main Component	Coating Layer	Ratio	Hardness of Substrate		Fracture Toughness (MPa · m ^{1/2})	Transverse Strength (MPa)
					(HV)	(GPa)		
TN610	Gray	TiCN	-	6.6	1,750	17.2	6.0	2,100
TN620	Gray	TiCN	-	6.9	1,550	15.2	9.0	2,500
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
TC40N	Gray	TiC+TiN	-	6.0	1,650	16.2	9.0	1,570
TC60M	Gray	NbC	-	8.1	1,500	14.7	10.5	1,670

PVD Coated Cermet

Symbol	Color	Coated Composition	Coating Layer	Ratio	Hardness of Substrate		Fracture Toughness (MPa · m ^{1/2})	Transverse Strength (MPa)
					(HV)	(GPa)		
PV710	Gold	MEGACOAT NANO	Thin coating	6.6	1,750	17.2	6.0	2,100
PV720	Gold	MEGACOAT NANO	Thin coating	6.9	1,550	15.2	9.0	2,500
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
PV7040	Blackish red	MEGACOAT	Thin coating	6.0	1,650	16.2	9.0	1,570
PV7020	Gold	TiAlN+TiN	Thin coating	6.4	1,500	14.7	10.0	2,500
PV90	Gold	TiN	Thin coating	6.4	1,450	14.2	10.0	1,960

CVD Coated Carbide

Symbol	Color	Coated Composition	Coating Layer	Ratio	Hardness of Substrate		Fracture Toughness (MPa · m ^{1/2})	Transverse Strength (MPa)
					(HV)	(GPa)		
CA420M	Gold	Micro columnar TiCN+Al ₂ O ₃ +TiN	Thick coating	14.5	1,600	15.8	13.0	3,400
CA4010	Gold	Columnar TiCN+Al ₂ O ₃ +TiN	Thick coating	14.8	1,720	16.8	9.0	2,450
CA4115	Gold	Micro columnar TiCN+Al ₂ O ₃ +TiN	Thick coating	14.7	1,550	15.2	12.0	2,750
CA4120	Gold	Micro columnar TiCN+Al ₂ O ₃ +TiN	Thick coating	14.7	1,550	15.2	12.0	2,750
CA4505	Blackish gray	Micro columnar TiCN+Al ₂ O ₃	Thick coating	15.0	1,790	17.5	9.5	2,350
CA4515	Blackish gray	Micro columnar TiCN+Al ₂ O ₃	Thick coating	15.0	1,570	15.4	12.0	2,780
CA510	Gold	Micro columnar TiCN+Al ₂ O ₃ +TiN	Thick coating	14.5	1,470	14.4	11.5	2,500
CA515	Gold	Micro columnar TiCN+Al ₂ O ₃ +TiN	Thick coating	14.4	1,440	14.1	12.5	2,650
CA525	Gold	Micro columnar TiCN+Al ₂ O ₃ +TiN	Thick coating	14.2	1,360	13.3	13.5	2,750
CA530	Gold	Micro columnar TiCN+Al ₂ O ₃ +TiN	Thick coating	13.9	1,340	13.1	14.5	2,850
CA5505	Gold	Micro columnar TiCN+Al ₂ O ₃ +TiN	Thick coating	14.7	1,730	17.0	10.0	2,540
CA5515	Gold	Micro columnar TiCN+Al ₂ O ₃ +TiN	Thick coating	14.7	1,550	15.2	12.0	2,750
CA5525	Gold	Micro columnar TiCN+Al ₂ O ₃ +TiN	Thick coating	14.5	1,400	13.7	12.0	2,780
CA5535	Gold	Micro columnar TiCN+Al ₂ O ₃ +TiN	Thick coating	14.1	1,340	13.1	16.5	2,970
CA6515	Gold	Micro columnar TiCN+Al ₂ O ₃ +TiN	Thin coating	14.7	1,530	15.0	12.0	2,780
CA6525	Gold	Micro columnar TiCN+Al ₂ O ₃ +TiN	Thin coating	14.7	1,370	13.4	16.0	3,100
CA6535	Gold	Micro columnar TiCN+Al ₂ O ₃ +TiN	Thin coating	14.3	1,320	12.9	16.0	3,700
CR9025	Gold	Columnar TiCN+TiN	Thick coating	14.5	1,400	13.7	12.0	2,780

PVD Coated Carbide

Symbol	Color	Coated Composition	Coating Layer	Ratio	Hardness of Substrate		Fracture Toughness (MPa · m ^{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	13.0	2,250
PR830	Gold	TiAlN+TiN	Thin coating	13.7	1,450	14.2	13.0	2,250
PR905	Bluish violet	TiAlN	Thin coating	14.8	1,720	16.8	9.0	2,450
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	1,720	16.8	9.0	2,450
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	13.0	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	1,720	16.8	9.0	2,450
PR1325	Blackish red	MEGACOAT	Thin coating	14.7	1,370	13.4	16.0	3,100
PR1425	Blackish red	MEGACOAT NANO	Thin coating	14.5	1,600	15.8	13.0	3,400
PR1510	Reddish green	MEGACOAT NANO	Thin coating	14.8	1,720	16.8	9.0	2,450
PR1525	Reddish green	MEGACOAT NANO	Thin coating	14.5	1,600	15.8	13.0	3,400
PR1535	Reddish green	MEGACOAT NANO	Thin coating	14.3	1,320	12.9	16.0	3,700

Carbide

Symbol	Color	Main Component	Ratio	Hardness of Substrate		Fracture Toughness (MPa · m ^{1/2})	Transverse Strength (MPa)
				(HV)	(GPa)		
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	1,720	16.8	9.0	2,450
SW25	Gray	WC+Co	14.7	1,370	13.4	16.0	3,100

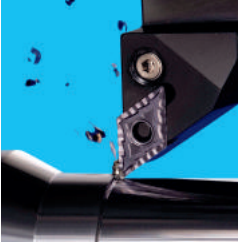
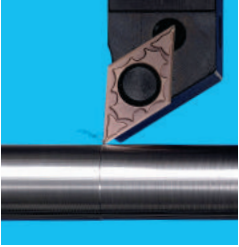
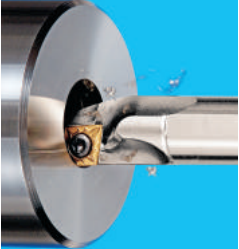
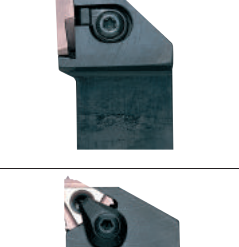
DLC Coated Carbide

Symbol	Color	Coated Composition	Coating Layer	Ratio	Hardness of Substrate		Fracture Toughness (MPa · m ^{1/2})	Transverse Strength (MPa)
					(HV)	(GPa)		
PDL025	Rainbow color	C	Thin coating	14.5	1,600	15.8	13.0	3,400

Insert Grades

A

Insert Material Selection Table

Applications		Cutting Range	P Steel	M Stainless steel	K Gray Cast Iron	N Nodular Cast Iron	S Non-ferrous Metals	H Heat-resistant alloys	Titanium alloys	Hard Materials	Sintered Steel
Turning		Finishing ↑ ↓	TN610		KBN475						
			TN6010		KBN60M						
			TN620	TN620				CF1		KT66	
			TN60	TN60	KA30	TN60		KS6040		A66N	TN610
			PV710	PV720	PV7005	PV7005	KPD001	KW10		PT600M	TN60
			PV7010	CA6515	CA5505	CA5505	KPD010	CA6515	KPD001	KBN05M	
			PV720	CA6525	CA4505	CA4505	PDL025	CA6525	KPD010	KBN10M	KBN570
			CA510	PR1125	CA4515	CA4515	KW10	PR1305	SW05	KBN25M	KBN70M
			CA515	PR1535				PR1310	SW10	KBN30M	
			CA525					PR1325	SW25	KBN35M	
Small Tools		Finishing ↑ ↓	CA530					PR1535		KBN900	
			TN610								
			TN6010								
			TN620								
			PV710	TN620							
			PV7010	PV720	CA4505	CA4505	KPD001	CA6515	KPD001	KBN05M	TN610
			PV720	PR930	CA4515	CA4515	KPD010	PR1125	KPD010	KBN10M	TN60
			PR930	PR1025	KW10	KW10	PDL025	PR1225	KW10	KBN25M	KBN570
			PR1005	PR1225			KW10			KBN30M	KBN70M
			PR1025	PR1535							
Boring		Large Bore Dia. ↑ ↓	PR1425								
			PR1535								
			TN610								
			TN6010								
			TN620								
			PV710	TN60	KBN475						
			PV7010	CA6515	KBN60M					PT600M	TN610
			PV720	CA6525	PV7005	PV7005	KPD001	CA6515	KPD001	KBN05M	TN60
			CA515	PR1025	CA4505	CA4505	KPD010	CA6525	KPD010	KBN10M	
			CA525	PR1125	CA4515	CA4515	PDL025	PR1125	KW10	KBN25M	KBN570
Cut-Off		Small Cutting Dia. ↑ ↓	CA530	PR1225	KW10	KW10	KW10	PR1225	SW05	KBN30M	KBN70M
			PR1025	PR930							
			PR1025	PR930							
			PR1025	PR930							
			PR1025	PR930							
			PR1025	PR930							
			PR1025	PR930							
			PR1025	PR930							
			PR1025	PR930							
			PR1025	PR930							
Cut-Off		(Depends on the workpiece material)	PR1025	PR1025	KW10	KW10	PDL025	KW10	KW10		
			PR1225	PR1225			KW10				
			PR1535	PR1535							
			PR1535	PR1535							
			PR1535	PR1535							
			PR1535	PR1535							
			PR1535	PR1535							
			PR1535	PR1535							
			PR1535	PR1535							
			PR1535	PR1535							
Grooving		Glossy finish ↑ ↓	PR1025	PR1025	KW10	KW10	PDL025	KW10	KW10		
			PR1225	PR1225			KW10				
			PR1535	PR1535							
			PR1535	PR1535							
			PR1535	PR1535							
			PR1535	PR1535							
			PR1535	PR1535							
			PR1535	PR1535							
			PR1535	PR1535							
			PR1535	PR1535							
Threading		Stable Glossy finish ↑ ↓	PR1025	PR1025	KW10	KW10	PDL025	KW10	KW10		
			PR1225	PR1225			KW10				
			PR1535	PR1535							
			PR1535	PR1535							
			PR1535	PR1535							
			PR1535	PR1535							
			PR1535	PR1535							
			PR1535	PR1535							
			PR1535	PR1535							
			PR1535	PR1535							
Drilling		Wear Resistance ↑ ↓	PR1025	PR1025	KW10	KW10	PDL025	KW10	KW10		
			PR1225	PR1225			KW10				
			PR1535	PR1535							
			PR1535	PR1535							
			PR1535	PR1535							
			PR1535	PR1535							
			PR1535	PR1535							
			PR1535	PR1535							
			PR1535	PR1535							
			PR1535	PR1535							
Milling		Toughness ↑ ↓	PR1025	PR1025	KW10	KW10	PDL025	KW10	KW10		
			PR1225	PR1225			KW10				
			PR1535	PR1535							
			PR1535	PR1535							
			PR1535	PR1535							
			PR1535	PR1535							
			PR1535	PR1535							
			PR1535	PR1535							
			PR1535	PR1535							
			PR1535	PR1535							

* Highlighted materials are recommended choice.