

# INSERT GRADES

# A

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Turning

Workpiece Material	Steel (Carbon Steel / Alloy Steel)					Stainless Steel & Cast Steel					Cast Iron (Gray Cast Iron / Nodular Cast Iron)				
	Cutting Range					Cutting Range					Cutting Range				
	Classification	P01	P10	P20	P30	P40	M01	M10	M20	M30	M40	K01	K10	K20	K30
Cermets	TN Series	TN610 TN6010 TN620 TN6020 TN60	TN90				TN610 TN6010 TN620 TN6020 TN60 TN90					TN60			
	TC Series		TC60				TC60								
	CCX (CVD Coated)	CCX										CCX			
	PV Series	PV7020 PV90					PV7020 PV90								
	MEGACOAT (PV Series)	PV7010 PV7025					PV7010 PV7025					PV7005			
	MEGACOAT NANO (PV Series)	PV710 PV720 PV730					PV710 PV720 PV730								
Coated Carbide	CA Series	CA510 CA515 CA025P CA525 CA530 CA5505 CA5515 CA5525 CA5535					CA6515 CA6525					CA310 CA315 CA320 CA4010 CA4115 CA4120 CA4505 CA4515			
	PR Series	PR930 PR1005 PR1025					PR930 PR1025 PR1125								
	MEGACOAT (PR Series)		PR1225				PR1225								
	MEGACOAT NANO (PR Series)		PR1425 PR1535				PR1425 PR1535								
	MEGACOAT NANO Plus (PR Series)	PR1705 PR1725					PR1725								
	Ceramic											KA30 KT66 A66N PT600M KS6015 KS6050 CS7050			
Carbide											KW10 GW15				
CBN											KBN475 KBN60M KBN900				

• White bars indicate old grades



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INSERT  
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**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	MEGACOAT (PV Series)	PV7040										PV7040			
	TN Series	TN620 TN6020 TN60 TN90					TN620 TN6020 TN60 TN90					TN60			
	TC Series	TC40 TC60					TC60					TC40			
Coated Carbide	CR Series	CR9025					CR9025								
	PR Series	PR630 PR660					PR630 PR660					PR905			
		PR915 PR930 PR1025 PR1115					PR915 PR930 PR1025								
		PR1215 PR1225					PR1215 PR1225					PR1215			
	MEGACOAT NANO (PR Series)	PR1535 PR1625					PR1515 PR1535 PR1625								
Ceramic											A65 A66N PT600M				
Carbide											KW10 GW15				

Workpiece Material		Non-Ferrous (Aluminum / Non-Ferrous Metals / Non-Metals)				Difficult-to-Cut Materials (Titanium)				Hard Materials (Hardened Steel / Chilled Cast Iron)				Powdered 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 GW05 GW15				KW10 GW15											
DLC Coating		PDL025															
CBN										KBN510 KBN525				KBN570			
PCD		KPD001 KPD010				KPD001 KPD010											

• White bars indicate old grades

**Drilling**

Workpiece Material		Steel (Carbon Steel / Alloy Steel)					Stainless Steel & Nickel-based Alloys					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	CA Series			CA520D					CA6535			CA415D			
	PR Series			PR660					PR660						
	MEGACOAT (PR Series)			PR830					PR830						
				PR1225					PR1225			PR1210			
MEGACOAT NANO (PR Series)			PR1230												
			PR1535					PR1535					PR1525		
Carbide												KW10			
												GW15			

Workpiece Material		Non-Ferrous (Aluminum / Non-Ferrous Metals / Non-Metals)				Difficult-to-Cut Materials (Inconel / Titanium)				Hard Materials (Hardened Steel / Chilled Cast Iron)			
Cutting Range		Finishing ←→ Roughing				Finishing ←→ Roughing				Finishing ←→ Roughing			
Classification		N01	N10	N20	N30	S01	S10	S20	S30	H01	H10	H20	H30
Coated Carbide	MEGACOAT (PR Series)									PR1230			
Carbide			KW10				KW10						
			GW15				GW15						

**Milling**

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			TN620M					TN60						
				TN60					TN100M						
	TC Series			TC60					TC60						
Carbide	CA Series								CA6535			CA420M			
	PR Series			PR830					PR830						
	MEGACOAT (PR Series)			PR1225					PR1225			PR1210			
				PR1230											
MEGACOAT NANO (PR Series)			PR1525					PR1525			PR1510				
								PR1535					KW10		
Carbide														GW25	

Workpiece Material		Non-Ferrous (Aluminum / Non-Ferrous Metals / Non-Metals)				Difficult-to-Cut Materials (HRSA / Ni-base HRSA)				Difficult-to-Cut Materials (Titanium)				Hard Materials (Hardened Steel / Chilled Cast Iron)			
Cutting Range		Finishing ←→ Roughing				Finishing ←→ Roughing				Finishing ←→ Roughing				Finishing ←→ Roughing			
Classification		N01	N10	N20	N30	S01	S10	S20	S30	S01	S10	S20	S30	H01	H10	H20	H30
Coated Carbide	CA Series					CA6535				CA6535							
	MEGACOAT (PR Series)									PR1210							
	MEGACOAT HARD (PR Series)													PR015S			
	MEGACOAT NANO (PR Series)					PR1535				PR1535							
Carbide			KW10														
			GW25														
DLC Coated Carbide			PDL025														
PCD			KPD001							KPD001							
			KPD010							KPD010							
			KPD230														
			KPD250														

• White bars indicate old grades

INSERT GRADES	A
TURNING INSERTS	B
GEN/PCD INSERTS	C
TURNING HOLDERS	D
SMALL TOOLS	E
BORING	F
GROOVING	G
CUT-OFF	H
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# CERMET & COATED CERMET



## CERMET

KYOCERA is known as one of the leading manufacturers of cermets. Cermet is a composite material combining 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.

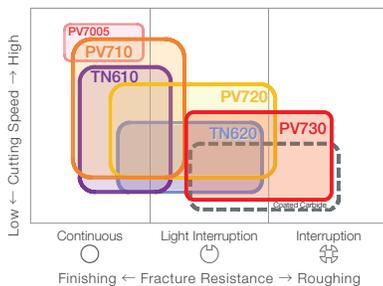
## PVD & CVD COATED CERMET

PVD Coated Cermet is a cermet substrate with a thin coating offering high wear resistance and high adhesion resistance. The coating is applied by PVD (Physical Vapor Deposition) technology. CVD Coated Cermet is a cermet substrate with a thin coating offering high-speed wear resistance. The coating is applied by CVD (Chemical Vapor Deposition) technology.

### FEATURES OF CERMET & COATED CERMET

Material	Description	Color	Main Component (Coating Composition)	Advantages		
P Steel	Cermet	TN610	Gray	TiCN	· Three hybrid technology attributes maintain superior surface finish and machining stability · Application: Stable machining of steel	
		TN620	Gray	TiCN	· High wear resistance and chipping resistance cermet due to three hybrid technology attributes · Application: Cermet for steel machining, long tool life in high speed and continuous applications	
		TN60	Gray	TiCN+NbC	· Application: Machining of steel, continuous to interruption	
		TN6020 (Super Micro-Grain)	Gray	TiCN	· Application: Uncoated cermet for steel	
		TN620M	Gray	TiCN	· Tough cermet for milling with excellent balance of wear resistance and toughness	
		TN100M	Gray	TiCN+NbC	· Tough cermet with improved oxidation resistance and thermal shock resistance · Application: Milling of steel at high speed	
	CVD Cermet	CCX	Gold	TiCN	· Good balance of wear resistance and toughness · Application: Grooving and threading of steel · Ultra-fine grain, high-strength cermet base material with thick film CVD coating for excellent wear resistance and chipping resistance, achieving a long life in high-speed machining · Application: High-speed finishing of steel to light interrupted cutting	
		MEGACOAT NANO Cermet	PV710	Gold	TiCN (MEGACOAT NANO)	· Superior wear and adhesion resistant MEGACOAT NANO on wear resistant cermet · Application: Long tool life and stability in high speed continuous machining of steel, excellent surface finish
			PV720	Gold	TiCN (MEGACOAT NANO)	· Superior wear and adhesion resistant MEGACOAT NANO on wear resistant, tough cermet · Application: First recommendation PVD coated cermet for steel machining and high quality surface finish
			PV730	Gold	TiCN (MEGACOAT NANO)	· Fracture resistant grade with MEGACOAT NANO on wear resistant, tough cermet · Application: Wear resistant PVD coated cermet for steel machining and high quality surface finish
PV60M			Gold	TiCN+NbC (MEGACOAT NANO)	· Milling grade with improved stability using MEGACOAT NANO coating technology · Application: Stable steel milling and high-quality surface finish	
MEGACOAT Cermet	PV7040	Blackish Red	TiC+TiN (MEGACOAT)	· MEGACOAT cermet for grooving · Application: Excellent surface finish and longer tool life in steel grooving		
	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		
K Cast Iron						

### Application Map (PVD and Uncoated Cermet)



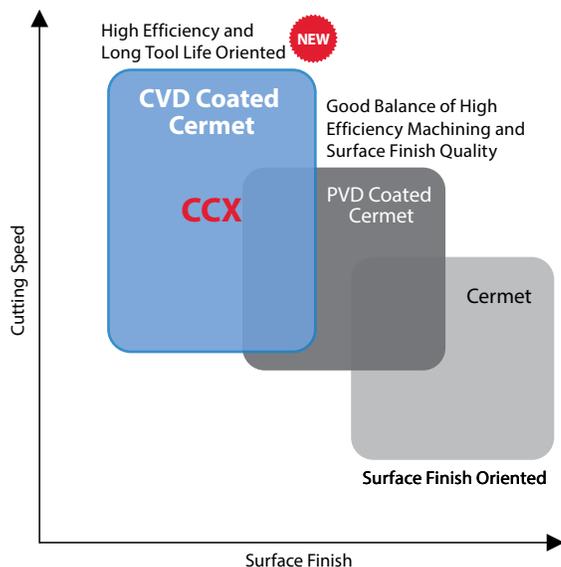
#### TN-Series (Uncoated Cermet)

- TN610: High Wear Resistance
- TN620: Chipping Resistance

#### PV-Series (MEGACOAT NANO Cermet)

- PV710: Long Tool Life and Stable Machining for High Speed Continuous Cuts
- PV720: First Recommendation for Efficiency and High Quality Surface Finish
- PV730: Tough Cermet for High Stability and High Quality Surface Finish

### Application Map (CVD Coated Cermet)



# Uncoated CERMET TN610 / TN620

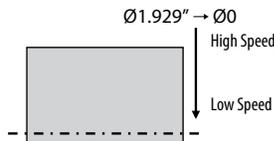
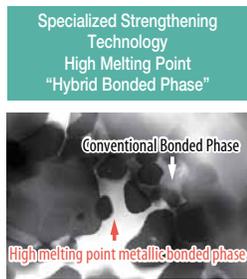
# MEGACOAT NANO CERMET PV710 / PV720 / PV730

3 Hybrid Technology Attributes Maintain Superior Surface Finish and Machining Stability

## Excellent Surface Finish

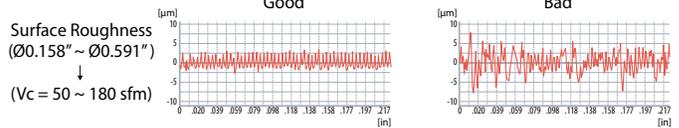
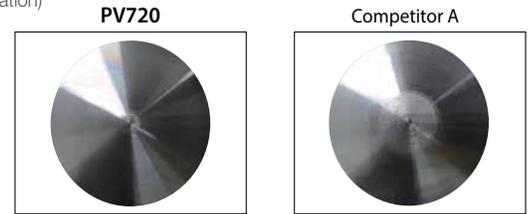
Combining the conventional cermet bonded phase (nickel, cobalt) and the special high melting point metallic bonded phase.

Provides high adhesion resistance to eliminate galling of the work piece.



### Surface Finish Comparison (In-house Evaluation)

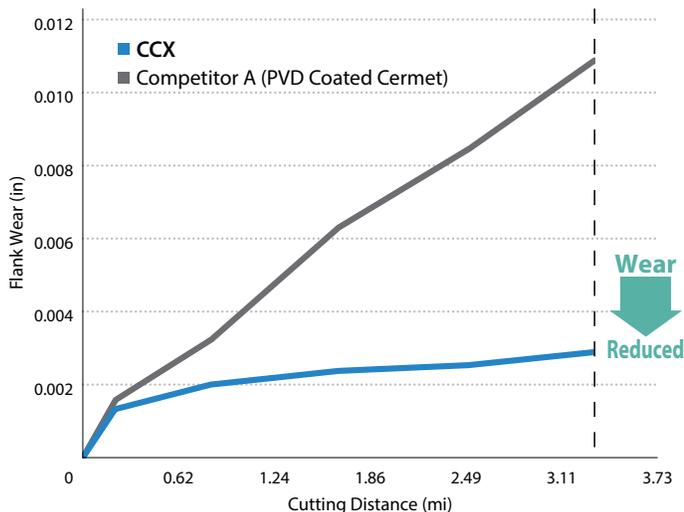
Cutting Conditions:  $V_c = 590 \sim 0$  sfm (Constant Rate), D.O.C. = 0.020"  
 $f = 0.004$  ipr, Wet, CNMG431 type Workpiece: 1010



## CVD Coated Cermet for Finishing CCX

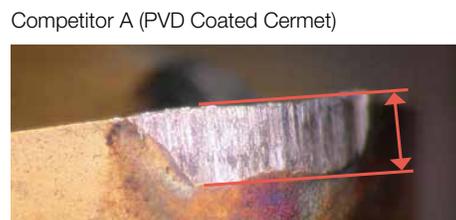
- Combination of cermet with a CVD coating provides high-speed machining for better productivity
- Applicable to a wide range of cutting conditions from general to high-speed applications
- Maintains long tool life in soft steel, general steel and cast iron machining

### Wear Resistance Comparison (Internal Evaluation)



Cutting Conditions :  $V_c = 3,280$  sfm, D.O.C. = 0.010",  $f = 0.006$  ipr, Wet  
CNMG432 Type Facing

### Cutting Edge (As of 3.29 mi of machining)

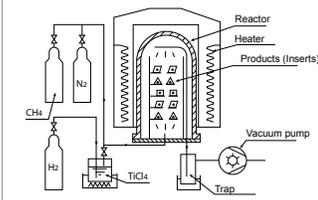


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# CVD COATED CARBIDE



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

## 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 heavily interrupted applications.

- 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

### FEATURES OF CVD COATED CARBIDE

Material	Description	Color	Main Component (Coating Composition)	Advantages
<b>P</b> Steel	<b>CA510</b>	Gold	TiCN+Al <sub>2</sub> O <sub>3</sub> +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
	<b>CA515</b>	Gold	TiCN+Al <sub>2</sub> O <sub>3</sub> +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
	<b>CA025P</b>	Gold	TiCN+Al <sub>2</sub> O <sub>3</sub> +TiN	· Thickened alumina with good thermal resistance (twice as thick as conventional coating) and specialized post-coating process prevents adhesion. · Application: General to interrupted machining of steel
	<b>CA525</b>	Gold	TiCN+Al <sub>2</sub> O <sub>3</sub> +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
	<b>CA530</b>	Gold	TiCN+Al <sub>2</sub> O <sub>3</sub> +TiN	· Special tough substrate and tough coating layer providing high stability and wear resistance · Application: General to heavy interrupted machining (stability oriented)
	<b>CA5505</b>	Gold	TiCN+Al <sub>2</sub> O <sub>3</sub> +TiN	· Application: High speed continuous machining of steel, continuous to light interrupted machining of cast iron
	<b>CA5515</b>	Gold	TiCN+Al <sub>2</sub> O <sub>3</sub> +TiN	· Application: Machining of steel, continuous to light interruption
	<b>CA5525</b>	Gold	TiCN+Al <sub>2</sub> O <sub>3</sub> +TiN	· Application: For general machining of steel, roughing to interruption
	<b>CA5535</b>	Gold	TiCN+Al <sub>2</sub> O <sub>3</sub> +TiN	· Application: Roughing to heavily interrupted machining of steel
	<b>CR9025</b>	Gold	TiCN+TiN	· Application: For general machining of steel, roughing to interruption
<b>M</b> Stainless Steel	<b>CA6515</b>	Gold	TiCN+Al <sub>2</sub> O <sub>3</sub> +TiN	· Specialized carbide substrate for machining stainless steel, excellent wear resistance · Application: Continuous machining of stainless steel
	<b>CA6525</b>	Gold	TiCN+Al <sub>2</sub> O <sub>3</sub> +TiN	· Specialized carbide substrate for machining stainless steel with excellent notching resistance and toughness · Application: First choice for general machining of stainless steel, from finishing to roughing, continuous to interruption
<b>K</b> Cast Iron	<b>CA310</b>	Rose Gold	TiCN+Al <sub>2</sub> O <sub>3</sub> +Ti Base	· Grade for high-speed continuous machining and improved tool life through the deposition of a thickened Al <sub>2</sub> O <sub>3</sub> coating layer · Application: For finishing to roughing of gray cast iron
	<b>CA315</b>	Rose Gold	TiCN+Al <sub>2</sub> O <sub>3</sub> +Ti Base	· High efficiency and long tool life for continuous to interrupted machining with a good balance of wear resistance and stability · Excellent performance for machining gray and nodular cast iron
	<b>CA320</b>	Rose Gold	TiCN+Al <sub>2</sub> O <sub>3</sub> +Ti Base	· Improved stability with CVD layer structure with high adhesion · Application: Roughing to heavy interrupted cutting of nodular cast iron
	<b>CA4010</b>	Gold	TiCN+Al <sub>2</sub> O <sub>3</sub> +TiN	· Application: Continuous to light interrupted high speed machining of cast iron
	<b>CA4115</b>	Gold	TiCN+Al <sub>2</sub> O <sub>3</sub> +TiN	· Application: Continuous to light interrupted machining of nodular cast iron
	<b>CA4120</b>	Gold	TiCN+Al <sub>2</sub> O <sub>3</sub> +TiN	· Application: Roughing to heavy interrupted machining of nodular cast iron
	<b>CA4505</b>	Blackish Gray	TiCN+Al <sub>2</sub> O <sub>3</sub>	· 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
	<b>CA4515</b>	Blackish Gray	TiCN+Al <sub>2</sub> O <sub>3</sub>	· 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

# CVD Coated Carbide for Steel CA025P

Next Generation CVD Coating for Longer Tool Life

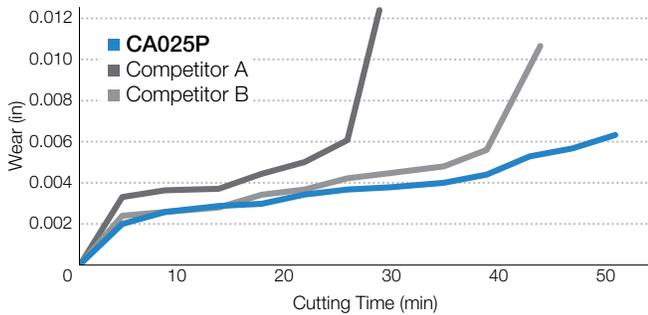


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## 1 Improved Wear Resistance with New CVD Grade for Steel

Thickened Alumina with Good Thermal Resistance (Twice as thick as conventional coating)  
Improved Plastic Deformation Resistance by Increased Temperature Strength

Wear Resistance Comparison (Internal Evaluation)



CA025P (50.4 min)



Good Surface Condition

Competitor A (29.4 min)



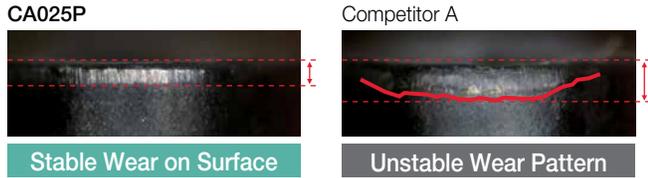
Competitor B (42 min)



Cutting Conditions : Vc = 980 sfm, D.O.C. = 0.059", f = 0.012 ipr, Wet Workpiece : 4137

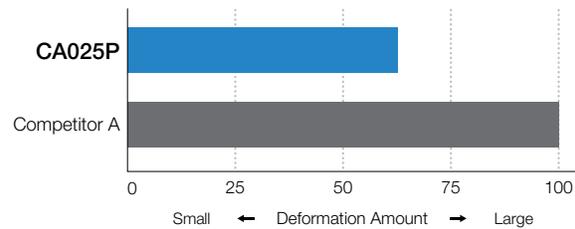
## CA025P Maintains Smooth and Flat Surface with Stable Tool Life

Wear Comparison (Internal Evaluation) Cutting Time 25.2 min



Cutting Conditions : Vc = 980 sfm, D.O.C. = 0.059", f = 0.012 ipr, Wet Workpiece : 4137

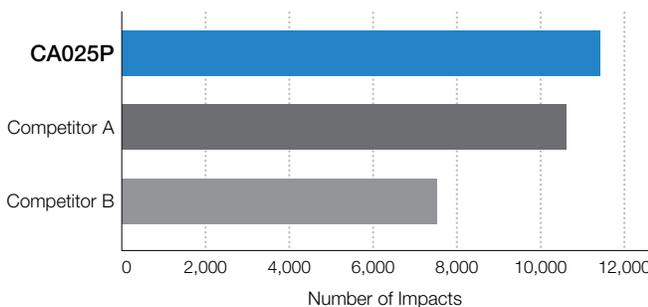
Plastic Deformation Comparison under High Temperature (Internal Evaluation) Comparison with Competitor A



## 2 Excellent Fracture Resistance

New Substrate with High Stability Provides Excellent Chipping Resistance

Fracture Resistance Comparison (Internal Evaluation) Average of 5 times



Cutting Conditions : Vc = 820 sfm, D.O.C. = 0.059", f = 0.014 ipr, Wet Workpiece : 4140 (with 4 Slots)

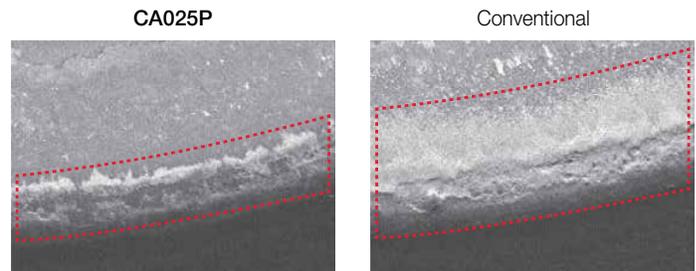
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## 3 Excellent Adhesion Resistance and Chipping Resistance

Specialized Post-coating Process Prevents Adhesion

Adhesion on the Edge after Cutting (Internal Evaluation)

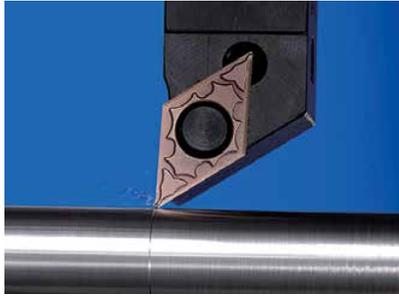


Less Adhesion

Wide Area of Adhesion  
\* Adhesion area appears white

Cutting Conditions : Vc = 890 sfm, D.O.C. = 0.039", f = 0.004 ipr, Wet Workpiece : 4140 (with 4 Slots)

# PVD COATED CARBIDE FOR TURNING



## PVD COATED CARBIDE

KYOCERA's PVD coated carbides for turning utilize very tough carbide substrates. The low processing temperature, compared with CVD, leads to improved bending strength, less deterioration of the coating and superior tool life with stable machining.

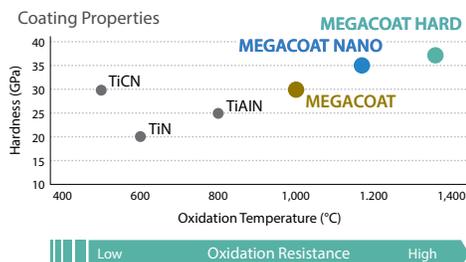
## PVD COATED SUPER MICRO-GRAIN CARBIDE

- 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 FOR TURNING

Material	Description	Color	Main Component (Coating Composition)	Advantages
<b>P</b> Steel	<b>PR915</b> (Super Micro-Grain)	Bluish Violet	TiAlN	· Application: Stable and reliable high precision machining of steel
	<b>PR930</b> (Super Micro-Grain)	Reddish Gray	TiCN	· Application: Low machining speed, precise machining with sharp edge
	<b>PR1005</b>	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
	<b>PR1025</b>	Reddish Gray	TiCN	· Application: General machining of steel and stainless steel, stable and longer tool life
	<b>PR1115</b>	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
	<b>PR1215</b>	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
	<b>PR1425</b>	Blackish Red	MEGACOAT NANO	· Nano thin multi-layer coating MEGACOAT NANO for superior wear resistance and high oxidation resistance · Application: Variety of steels, high speed machining of stainless steel with extended tool life
	<b>PR1625</b>	Blackish Red	MEGACOAT NANO	· Nano thin multi-layer coating MEGACOAT NANO for superior wear resistance and high oxidation resistance · Application: Stable machining and long tool life when grooving steel and stainless steel
	<b>PR1705</b>	Silver	MEGACOAT NANO PLUS	· Special MEGA COAT NANO PLUS nano-laminated coating for excellent wear resistance and welding resistance · Application: Excellent wear resistance and high-precision machining of free-cutting steel
	<b>PR1725</b>	Silver	MEGACOAT NANO PLUS	· Special MEGA COAT NANO PLUS nano-laminated coating for excellent wear resistance and welding resistance · Application: General purpose grade for stable machining and long tool life when turning steel and stainless steel
<b>M</b> Stainless Steel	<b>PR1125</b>	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
	<b>PR1225</b>	Blackish Red	MEGACOAT	· Superior wear and oxidation resistant MEGACOAT on micro grain carbide substrate · Application: Light interrupted to interrupted cutting of stainless steel
	<b>PR1515</b>	Blackish Red	MEGACOAT NANO	· Nano thin multi-layer coating on micro-grain carbide substrate for improved wear resistance and stability · Application: Threading of stainless steel
	<b>PR1535</b>	Blackish Red	MEGACOAT NANO	· Nano thin multi-layer coating on micro-grain carbide substrate for improved wear resistance and stability · Application: Medium to roughing of stainless steel and heat-resistant alloys, cut-off of stainless steel
<b>K</b> Cast Iron	<b>PR905</b>	Bluish Violet	TiAlN	· Smooth fine surface PVD coated hard carbide with plastic deformation resistance · Application: Suitable for machining gray and nodular cast iron
<b>S</b> Heat-Resistant Alloys	<b>PR005S</b>	Blackish Gray	MEGACOAT HARD	· MEGACOAT on hard and superior heat resistant carbide, superior wear resistance · Application: Finishing of heat-resistant alloys
	<b>PR015S</b>	Blackish Gray	MEGACOAT HARD	· High temperature properties of special carbide substrate and excellent heat-resistance of MEGACOAT HARD for high wear resistance · Application: Finishing and high speed application of heat-resistant alloys
	<b>PR1305</b>	Blackish Red	MEGACOAT	· MEGACOAT on hard and superior heat-resistant carbide, superior wear resistance · Application: Finishing of heat-resistant alloys
	<b>PR1310</b>	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
	<b>PR1325</b>	Blackish Red	MEGACOAT	· MEGACOAT on tough carbide · Application: Light interrupted machining and roughing of heat-resistant alloys

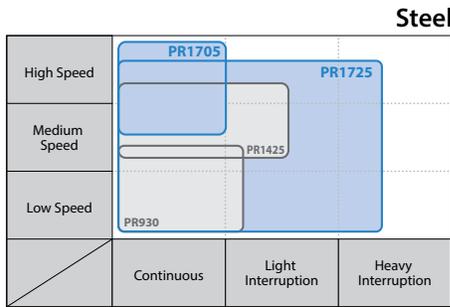
### PVD Coating Properties



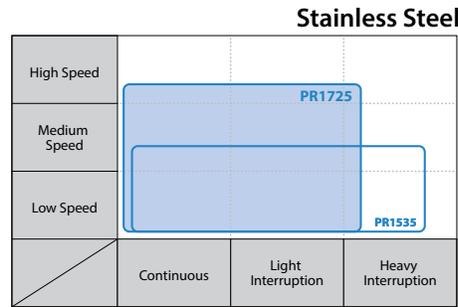
PVD Coated Carbide

# PR1725 / PR1705

Excellent Surface Finish and Long Tool Life  
Great Performance in Small Parts Machining Applications



PR1725 : 1st Recommendation for Steel



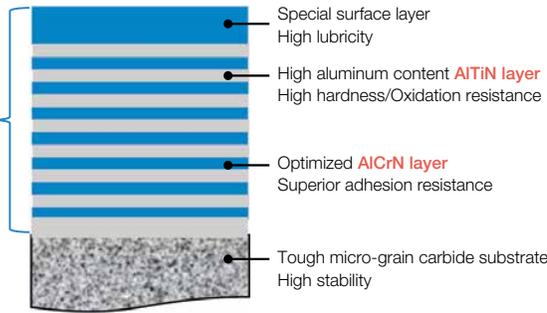
PR1725 : For general purpose high-speed machining  
PR1535 : 1st Recommendation for stainless steel machining with long tool life and high-quality surface finish

## MEGACOAT NANO PLUS

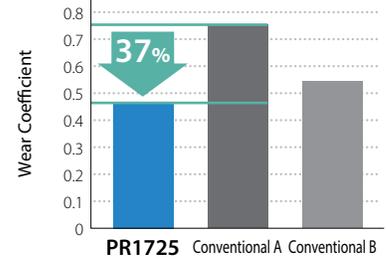
AlTiN/AlCrN Nano laminated film with superior wear resistance and adhesion resistance. Excellent surface finish and long tool life.

### REDUCES CRACKING

Reduces abnormal damage such as chipping because of increased lamination layer with a thinner gap than conventional coatings



### Wear Coefficient Comparison (Internal evaluation)



**Superior Wear and Chipping Resistance**

High Strength with nano laminated film layer properties  
Internal stress optimization reduces chipping

**Excellent Surface Finish**

Special surface layer with great lubricity reduces adhesion

**Applicable to Various Workpiece Materials**

Superior high temperature properties and oxidation resistance make for great performance in steel, stainless steel and free-cutting steel

**High Machining Stability**

Tough micro-grain carbide substrate provides stable machining

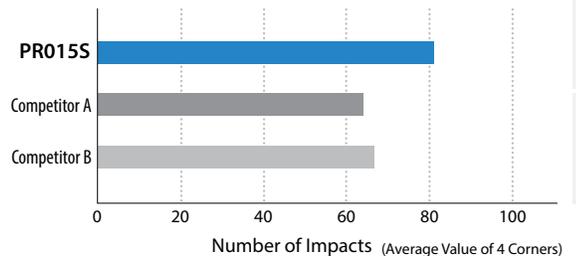
## PR005S / PR015S for Heat-Resistant Alloy

PR005S : Hard, Wear-resistant Grade for High-speed Machining

PR015S : General Purpose Grade with Excellent Wear Resistance and Stability

- Improved thermal conductivity by optimum distribution of WC coarse grains
- Resists heat concentration at the cutting edge to promote stable machining
- Improved wear resistance with MEGACOAT HARD coating with high-hardness to resist boundary damage with improved thermal properties

### Fracture Resistance Comparison (Internal Evaluation)



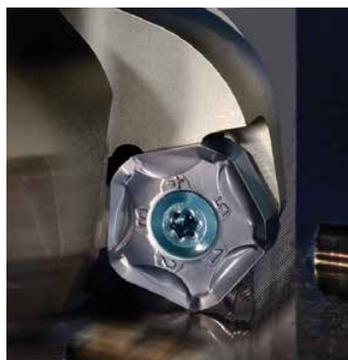
Cutting Conditions: Vc = 80 sfm, D.O.C. = 0.039", f = 0.004 ipr, Wet  
CNMG432 Type Workpiece: Nickel-based Superalloy  
Cylindrical Workpiece with 1 Flat Face

- INSERT GRADES **A**
- TURNING INSERTS **B**
- GEN/PCD INSERTS **C**
- TURNING HOLDERS **D**
- SMALL TOOLS **E**
- BORING **F**
- GROOVING **G**
- CUT-OFF **H**
- THREADING **J**
- DRILLING **K**
- MILLING **M**
- QUICK-CHANGE TOOLING **N**
- SPARE PARTS **P**
- TECHNICAL **R**
- INDEX **T**

# PVD / CVD COATED CARBIDE FOR MILLING & DRILLING

A

INSERT GRADES



## PVD Coated Carbide (MEGACOAT / MEGACOAT NANO)

KYOCERA's PVD coated carbides for milling and drilling utilize very tough carbide substrates. The low processing temperature, compared with CVD, leads to improved bending strength, less deterioration of the coating and superior tool life with stable machining.

## 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<sub>2</sub>O<sub>3</sub>) coating with high-thermal stability is applied on a tough carbide substrate. Superior fracture and wear resistance.

### FEATURES OF PVD / CVD COATED CARBIDE FOR MILLING & DRILLING

Material	Description	Color	Main Component (Coating Composition)	Advantages
<div style="background-color: #0070C0; color: white; padding: 5px; text-align: center; width: 30px; margin: 0 auto;">P</div> <div style="background-color: #0070C0; color: white; padding: 2px; text-align: center; width: 30px; margin: 0 auto;">Steel</div>	PR830	Gold	TiAlN+TiN	<ul style="list-style-type: none"> <li>Improved high temperature stability and wear resistance with TiAlN base PVD coating</li> <li>Application: Milling of steel</li> </ul>
	PR1230	Blackish Red	MEGACOAT	<ul style="list-style-type: none"> <li>Superior wear and oxidation-resistant MEGACOAT on a special tough carbide substrate</li> <li>Application: Stable and high feed milling and drilling of steel</li> </ul>
	PR1525	Blackish Red	MEGACOAT NANO	<ul style="list-style-type: none"> <li>MEGACOAT NANO coating technology with a nano thin multi-layer coating performs with superior wear resistance and high oxidation resistance</li> <li>Application: Stable and longer tool life for milling of steel and stainless steel</li> </ul>
	CA520D	Gold	TiCN+Al <sub>2</sub> O <sub>3</sub> +TiN (CVD)	<ul style="list-style-type: none"> <li>Combination of tough substrate, coating crystal control technology, and advanced layer adhesion coating ensures exceptional wear and fracture resistance</li> <li>Application: 1st recommendation for drilling of steel (high speed applications)</li> </ul>
<div style="background-color: #FFD700; color: black; padding: 5px; text-align: center; width: 30px; margin: 0 auto;">M</div> <div style="background-color: #FFD700; color: black; padding: 2px; text-align: center; width: 30px; margin: 0 auto;">Stainless Steel</div>	PR1225	Blackish Red	MEGACOAT	<ul style="list-style-type: none"> <li>Superior wear and oxidation-resistant MEGACOAT on micro-grain carbide substrate</li> <li>Application: General high feed milling and drilling of steel and stainless steel</li> </ul>
<div style="background-color: #D9534F; color: white; padding: 5px; text-align: center; width: 30px; margin: 0 auto;">K</div> <div style="background-color: #D9534F; color: white; padding: 2px; text-align: center; width: 30px; margin: 0 auto;">Cast Iron</div>	PR1210	Blackish Red	MEGACOAT	<ul style="list-style-type: none"> <li>Superior wear and oxidation-resistant MEGACOAT coated on specialized carbide substrate</li> <li>Application: Highly efficient stable milling and drilling of gray and nodular cast iron</li> </ul>
	PR1510	Blackish Red	MEGACOAT NANO	<ul style="list-style-type: none"> <li>New coating technology [MEGACOAT NANO] is applied. Nano thin multi-layer coating performs superior wear resistance and high oxidation resistance.</li> <li>Application: For gray and nodular cast iron, stable wear resistance and toughness</li> </ul>
	CA415D	Gold	TiCN+Al <sub>2</sub> O <sub>3</sub> +TiN (CVD)	<ul style="list-style-type: none"> <li>Combination of tough substrate for cast iron, coating crystal control technology, and advanced layer adhesion coating ensures exceptional wear resistance</li> <li>Application: 1st recommendation for drilling of gray and nodular cast iron</li> </ul>
	CA420M	Gold	TiCN+Al <sub>2</sub> O <sub>3</sub> +TiN (CVD)	<ul style="list-style-type: none"> <li>Kyocera's unique crystal control technology and advanced layer adhesion CVD coating with superior wear resistance and toughness</li> <li>Application: Milling of gray and nodular cast iron</li> </ul>
<div style="background-color: #8B4513; color: white; padding: 5px; text-align: center; width: 30px; margin: 0 auto;">S</div> <div style="background-color: #8B4513; color: white; padding: 2px; text-align: center; width: 30px; margin: 0 auto;">Heat-Resistant Alloys</div>	PR1535	Blackish Red	MEGACOAT NANO	<ul style="list-style-type: none"> <li>Nano thin multi-layer coating MEGACOAT NANO improves wear resistance and stability</li> <li>Application: For milling of Ni-base heat-resistant alloys, titanium alloys and precipitation hardened stainless steel</li> </ul>
	CA6535	Gold	TiCN+Al <sub>2</sub> O <sub>3</sub> +TiN (CVD)	<ul style="list-style-type: none"> <li>High heat-resistance and wear resistance with CVD coating</li> <li>Application: For milling of Ni-base heat-resistant alloys and martensitic stainless steel</li> </ul>
<div style="background-color: #333; color: white; padding: 5px; text-align: center; width: 30px; margin: 0 auto;">H</div> <div style="background-color: #333; color: white; padding: 2px; text-align: center; width: 30px; margin: 0 auto;">Hardened Materials</div>	PR015S	Blackish Gray	MEGACOAT HARD	<ul style="list-style-type: none"> <li>MEGACOAT NANO HARD coating technology achieves stable machining in hardened materials with excellent wear resistance and chipping resistance</li> <li>Application: Suitable for machining hardened materials of 60 HRC or less and difficult-to-cut materials</li> </ul>

# Grades for Heat-resistant Alloys and Difficult-to-cut materials

## CA6535 <sup>CVD</sup>

for Ni-base Heat Resistant Alloy and Martensitic Stainless Steels

## PR1535 <sup>PVD</sup>

for Titanium Alloy and Precipitation Hardened Stainless Steels

### New grades for difficult-to-cut material

Stable cutting prevents insert fracturing for highly efficient machining



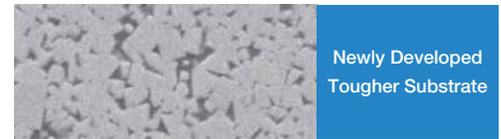
CA6535

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

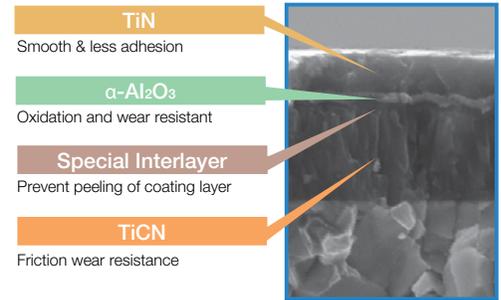


PR1535

- For titanium alloys and precipitation hardened stainless steel
- Stabilized milling operation and long tool life with Kyocera's MEGACOAT NANO coating technology
- Improved stability due to thin film coating technology



Newly Developed Tougher Substrate



**TiN**

Smooth & less adhesion

**$\alpha$ -Al<sub>2</sub>O<sub>3</sub>**

Oxidation and wear resistant

**Special Interlayer**

Prevent peeling of coating layer

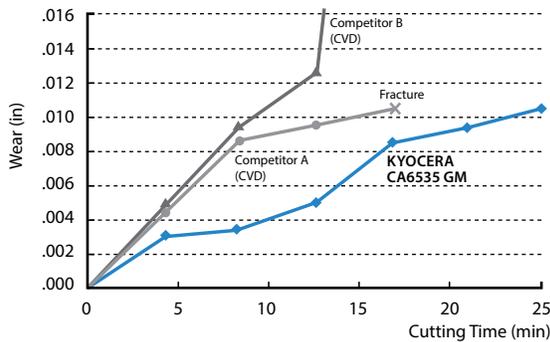
**TiCN**

Friction wear resistance

MEGACOAT NANO Layer structure



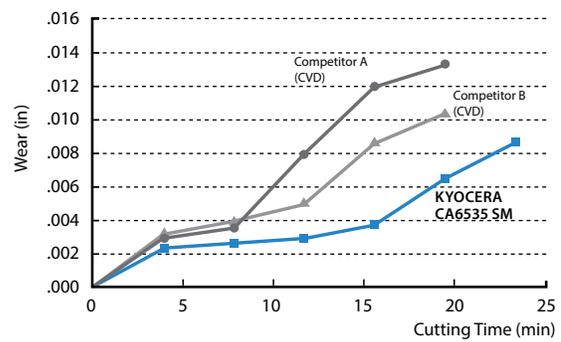
#### • Ni-base Heat Resistant Alloy



Cutting Conditions: 165 sfm, 0.006 ipt, 0.039° D.O.C., Coolant

(Internal Evaluation)

#### • Martensitic Stainless Steel



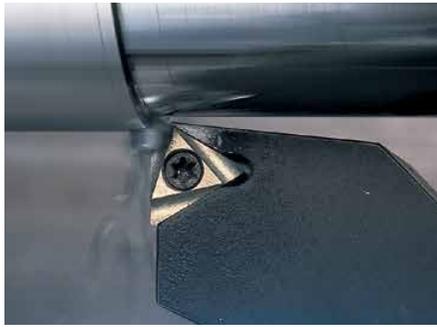
Cutting Conditions: 980 sfm, 0.008 ipt, 0.079° D.O.C., Coolant

(Internal Evaluation)

INSERT GRADES	A
TURNING INSERTS	B
GEN/PCD INSERTS	C
TURNING HOLDERS	D
SMALL TOOLS	E
BORING	F
GROOVING	G
CUT-OFF	H
THREADING	J
DRILLING	K
MILLING	M
QUICK CHANGE TOOLING	N
SPARE PARTS	P
TECHNICAL	R
INDEX	T

# CARBIDE

A  
INSERT  
GRADES



## CARBIDE

Due to its superior mechanical features 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

Material	Description	Color	Main Component (Coating Composition)	Advantages
	<b>KW10</b>	Gray	WC+Co	<ul style="list-style-type: none"> <li>• ISO identification symbol K carbide (K10 class)</li> <li>• Application: Machining cast iron, non-ferrous materials and non-metals</li> </ul>
	<b>GW05</b>	Gray	WC+Co	<ul style="list-style-type: none"> <li>• ISO identification symbol K carbide (K05 class)</li> <li>• Application: Excellent wear resistance against cast iron and non-ferrous metals</li> </ul>
	<b>GW15</b>	Gray	WC+Co	<ul style="list-style-type: none"> <li>• ISO identification symbol K carbide (K10 class), tough micro-grain carbide</li> <li>• Application: Machining cast iron, non-ferrous materials and non-metals</li> </ul>
	<b>GW25</b>	Gray	WC+Co	<ul style="list-style-type: none"> <li>• ISO identification symbol K carbide (K30 class)</li> <li>• Application: Milling operations of aluminum</li> </ul>
	<b>SW05</b>	Gray	WC+Co	<ul style="list-style-type: none"> <li>• ISO identification symbol K carbide (K05 class)</li> <li>• Application: Continuous machining and finishing of titanium alloys</li> </ul>
	<b>SW10</b> (Made to Order)	Gray	WC+Co	<ul style="list-style-type: none"> <li>• ISO identification symbol K carbide (K10 class)</li> <li>• Application: Continuous to light interrupted machining of titanium alloys</li> </ul>
	<b>SW25</b> (Made to Order)	Gray	WC+Co	<ul style="list-style-type: none"> <li>• ISO identification symbol K carbide (K25 class)</li> <li>• Application: Interrupted and light interrupted machining of titanium alloys</li> </ul>

# DLC COATING



## DLC COATING

High quality and long tool life when machining aluminum. Achieves long tool life with hardness close to that of diamond and maintains an excellent surface finish with aluminum welding resistance.

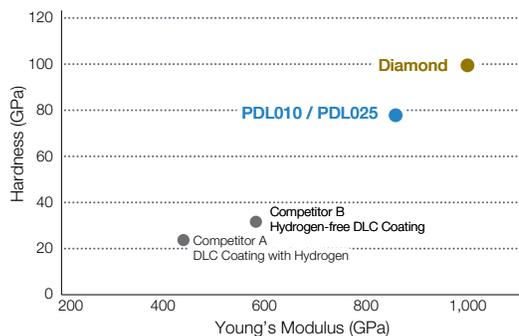
### FEATURES

- Excellent surface finish
- Stable machining with excellent peeling resistance
- Improved chip evacuation due to high lubricity

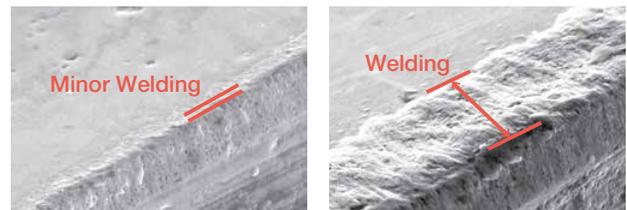
### FEATURES OF CARBIDE

Material	Description	Color	Main Component (Coating Composition)	Advantages
	<b>PDL010</b>	Iridescent	C	<ul style="list-style-type: none"> <li>• High Hardness with Kyocera's Proprietary Hydrogen-free DLC Coating</li> <li>• Application: Long tool life and stable machining of aluminum alloys</li> </ul>
	<b>PDL025</b>	Iridescent	C	<ul style="list-style-type: none"> <li>• High Hardness with Kyocera's Proprietary Hydrogen-free DLC Coating</li> <li>• Application: Excellent machining stability in interrupted aluminum machining</li> </ul>

### DLC Coating Properties



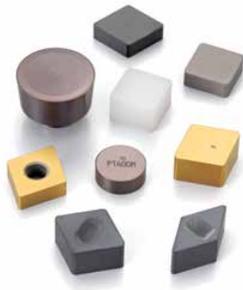
### Welding Resistance Comparison



**PDL025**                      **Competitor A**

Cutting Conditions:  $V_c = 2,630$  sfm,  $f_z = 0.004$  ipt, D.O.C.  $\times$  ae =  $0.118'' \times 0.197''$ , Dry  
Cutter Dia.  $\varnothing 1.000''$  Workpiece: 5052 Cutting Length: 187ft

# CERAMIC



## CERAMIC

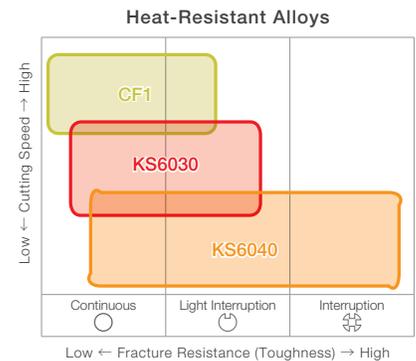
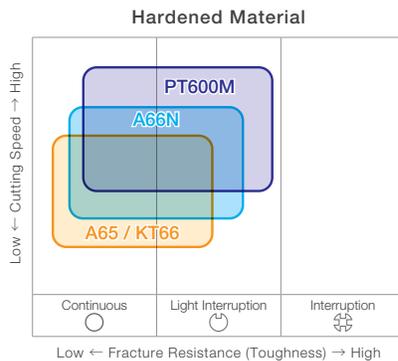
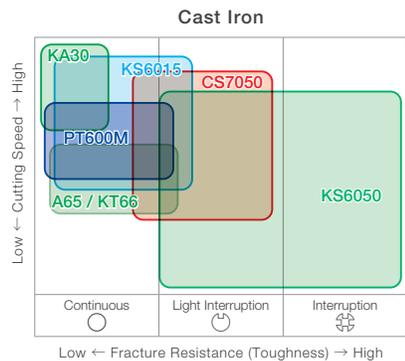
Ceramic inserts are capable of running at high speeds, thus reducing expensive machining time. Hard turning of 38HRC to 64HRC hardened steel, or rough to finish turning of cast iron are recommended applications for ceramic inserts. KYOCERA's ceramic grades are designed to resist oxidation and maintain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

## FEATURES

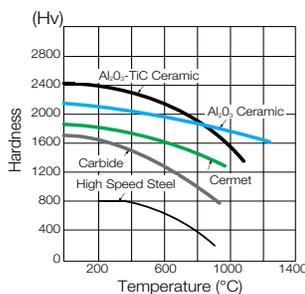
- Excellent wear resistance for high cutting speeds
- Ceramic maintains good surface finishes due to the low affinity to workpiece materials
- Silicon nitride ceramic has improved thermal shock resistance allowing cast iron cutting using coolants

FEATURES OF CERAMIC								
Material	Description	Color	Main Component (Coating Composition)	Coating Layer	Hardness of Substrate (GPa)	Fracture Toughness (MPa·m <sup>1/2</sup> )	Transverse Strength (MPa)	Advantages
<b>K</b> Cast Iron	<b>KA30</b>	White	Al <sub>2</sub> O <sub>3</sub>	-	17.5	4.0	750	• Aluminum oxide ceramic (Al <sub>2</sub> O <sub>3</sub> ) • Application: Finishing of cast iron at high cutting speeds without coolant
	<b>KS6015</b>	Black	Si <sub>3</sub> N <sub>4</sub>	-	15.2	7.8	1,000	• Silicon nitride ceramic (Si <sub>3</sub> N <sub>4</sub> ) • Application: High-speed continuous machining of cast iron. Focus on wear resistance. (with or without coolant)
	<b>KS6050</b>	Gray	Si <sub>3</sub> N <sub>4</sub>	-	15.6	8.0	1,200	• Silicon nitride ceramic (Si <sub>3</sub> N <sub>4</sub> ) • Application: General purpose and interrupted machining of cast iron. Focus on stability. (with or without coolant)
	<b>CS7050</b>	Grayish White	Si <sub>3</sub> N <sub>4</sub> (Special Al <sub>2</sub> O <sub>3</sub> Coat)	Thin Coating	15.6	8.0	1,200	• Silicon nitride ceramic (Si <sub>3</sub> N <sub>4</sub> ) CVD Coated Carbide (Special Al <sub>2</sub> O <sub>3</sub> COAT) • Application: Finishing and continuous machining, high speed and high efficient machining (with or without coolant)
<b>K</b> Cast Iron	<b>KT66</b>	Black	Al <sub>2</sub> O <sub>3</sub> +TiC	-	20.1	4.1	980	• Aluminum Oxide and Titanium Carbide ceramic (Al <sub>2</sub> O <sub>3</sub> +TiC) • Application: Hard materials and hardened roll materials
	<b>A65</b>	Black	Al <sub>2</sub> O <sub>3</sub> +TiC	-	20.1	4.1	980	• Aluminum Oxide and Titanium Carbide ceramic (Al <sub>2</sub> O <sub>3</sub> +TiC) • Application: Semi-roughing to finishing of cast iron, and hard materials
<b>H</b> Hardened Materials	<b>A66N</b>	Gold	Al <sub>2</sub> O <sub>3</sub> +TiC (TiN Coat)	Thin Coating	20.1	4.1	980	• TiN PVD coated Aluminum Oxide and Titanium Carbide ceramic (TiN coated Al <sub>2</sub> O <sub>3</sub> +TiC) • Application: Semi-roughing to finishing of hard materials
	<b>PT600M</b>	Blackish Red	Al <sub>2</sub> O <sub>3</sub> +TiC (MEGACOAT)	Thin Coating	20.1	4.1	980	• Heat-resistant MEGACOAT on Aluminum Oxide and Titanium Carbide ceramic (MEGACOAT Al <sub>2</sub> O <sub>3</sub> +TiC) • Application: Semi-roughing to finishing of cast iron, hard materials and hardened roll materials
<b>S</b> Heat-Resistant Alloys	<b>KS6030</b>	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
	<b>KS6040</b>	Brown	SiAlON	-	16.7	7.0	900	• High stability SiAlON ceramic with wear resistance and fracture resistance • Application: Roughing of heat-resistant alloys

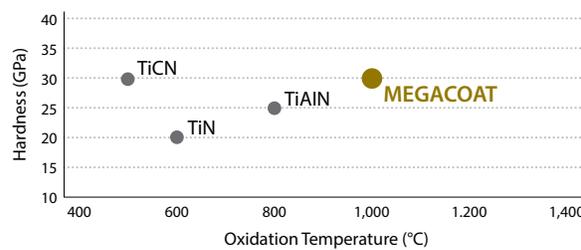
## Application Maps



## High Temperature Hardness



## PVD Coating Properties



INSERT GRADES **A**

TURNING INSERTS **B**

GEM/PCD INSERTS **C**

TURNING HOLDERS **D**

SMALL TOOLS **E**

BORING **F**

GROOVING **G**

CUT-OFF **H**

THREADING **J**

DRILLING **K**

MILLING **M**

QUICK CHANGE TOOLING **N**

SPARE PARTS **P**

TECHNICAL **R**

INDEX **T**

## 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

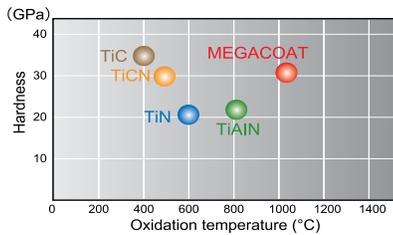
- Superior wear resistance when cutting hardened materials
- Suitable for high speed cutting of cast iron and sintered steel
- High thermal conductivity provides stable cutting

### FEATURES OF CBN

Material	Description	Color	Av. Grain Size (µm)	Hardness of Substrate (GPa)	Transverse Strength (MPa)	Advantages
<b>H</b> Hardened Materials	<b>KBN510</b>	Black	2	28	1,000	<ul style="list-style-type: none"> <li>• Excellent wear resistance and crack resistance, non-coated CBN</li> <li>• Application: Finishing and continuous cutting of hardened die steel</li> </ul>
	<b>KBN525</b>	Black	1 and Under	25	1,250	<ul style="list-style-type: none"> <li>• Good balance of toughness and wear resistance, non-coated CBN</li> <li>• Application: General grade for hardened steel, high stability at high speed and high feed cutting</li> </ul>
	<b>KBN05M (MEGACOAT)</b>	Blackish Red	0.5-1.5	27	1,000	<ul style="list-style-type: none"> <li>• Heat-resistant MEGACOAT on highly heat-resistant CBN substrate</li> <li>• Application: High speed finishing of hardened steel</li> </ul>
	<b>KBN10M (MEGACOAT)</b>	Blackish Red	2	28	1,000	<ul style="list-style-type: none"> <li>• Heat-resistant MEGACOAT on CBN with hard binder phase, superior anti-crater wear resistance</li> <li>• Application: High speed finishing of hardened die steel</li> </ul>
	<b>KBN25M (MEGACOAT)</b>	Blackish Red	1 and Under	25	1,250	<ul style="list-style-type: none"> <li>• Heat-resistant MEGACOAT on micro-grain CBN with heat resistant binder phase</li> <li>• Application: Stable cutting of hardened steel at high speed</li> </ul>
Sintered Steel	<b>KBN570</b>	Black	2-4	34	1,350	<ul style="list-style-type: none"> <li>• High CBN content ratio</li> <li>• Application: Machining of sintered steel (preventing burr formation)</li> </ul>
	<b>KBN70M (MEGACOAT)</b>	Blackish Red	2-4	34	1,350	<ul style="list-style-type: none"> <li>• Heat-resistant MEGACOAT on CBN rich substrate</li> <li>• Application: General cutting of sintered steel (ferrous sintered alloy) at high speed</li> </ul>
<b>K</b> Cast Iron	<b>KBN475</b>	Black	2	39	1,400	<ul style="list-style-type: none"> <li>• Excellent wear resistance due to high CBN content and special binder</li> <li>• Application: High speed machining of gray cast iron</li> </ul>
	<b>KBN60M (MEGACOAT)</b>	Blackish Red	0.5-6	33	1,250	<ul style="list-style-type: none"> <li>• Heat-resistant MEGACOAT on CBN rich substrate with hard binder phase</li> <li>• Application: High speed finishing of gray cast iron</li> </ul>
	<b>KBN900 (TIN COAT)</b>	Gold	9	31	630	<ul style="list-style-type: none"> <li>• TiN coated solid CBN</li> <li>• Application: Heavy duty, interrupted cutting and finishing of hardened steel, hardened roll steel and cast iron</li> </ul>

### MEGACOAT CBN

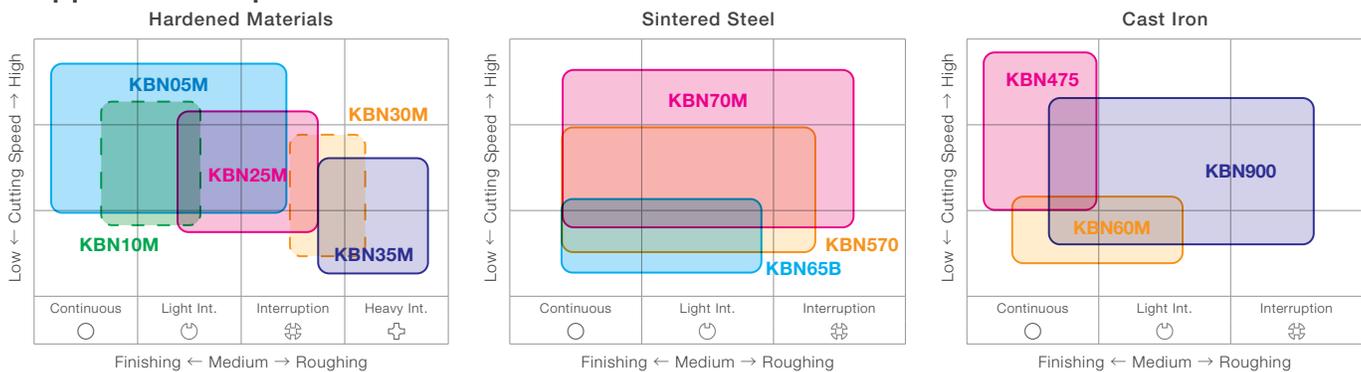
#### ● Properties of PVD Coated Layer



#### ● Advantages of MEGACOAT

- Long tool life and stable cutting due to superior heat-resistance and hardness
- Improvement of crater wear (oxidation, diffusional wear) resistance
- High thermal stability and surface smoothness provide excellent surface finish

### Application Map



# PCD



## PCD (Polycrystalline Diamond)

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 as when single crystal diamond is used.)

INSERT GRADES	A
TURNING INSERTS	B
GEN/PCD INSERTS	C
TURNING HOLDERS	D
SMALL TOOLS	E
BORING	F
GROOVING	G
CUT-OFF	H
THREADING	J
DRILLING	K
MILLING	M
QUICK CHANGE TOOLING	N
SPARE PARTS	P
TECHNICAL	R
INDEX	T

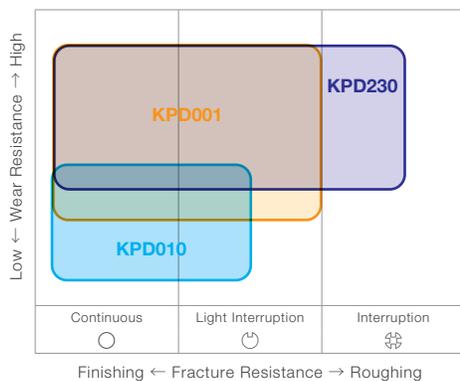
### FEATURES OF PCD

Material	Description	Av. Grain Size (µm)	Advantages
	KPD001	0.5	<ul style="list-style-type: none"> <li>• Super Micro-Grain PCD features cutting edge strength, wear resistance, fracture resistance, good edge-sharpening performance and long, stable tool life.</li> <li>• Application: High speed cutting of aluminum alloys, brass, non-ferrous metals and non-metals including plastics, fiberglass, carbide and ceramics.</li> </ul>
	KPD010	10	<ul style="list-style-type: none"> <li>• Good wear resistance and toughness, good grindability</li> <li>• Application: General purpose, high speed cutting of aluminum alloys, non-ferrous metals and non-metals including plastics, fiberglass, carbide and ceramics.</li> </ul>
	KPD230	2-30	<ul style="list-style-type: none"> <li>• Superior abrasive wear resistance and toughness due to high density PCD with mixed rough and fine grains</li> <li>• Application: High speed milling of aluminum alloys, non-ferrous metals, plastics and fiberglass</li> </ul>
	KPD250	25	<ul style="list-style-type: none"> <li>• Excellent wear resistance due to coarse-grained PCD (25 µm)</li> <li>• Application: High-speed processing of high-silicon aluminum alloy, processing of cemented carbide</li> </ul>

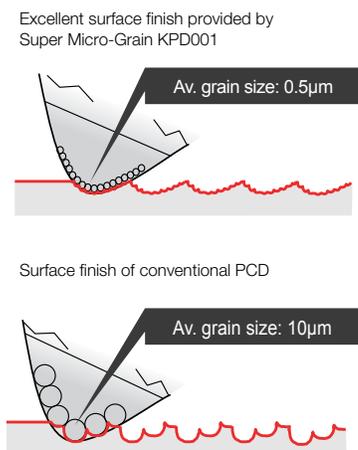
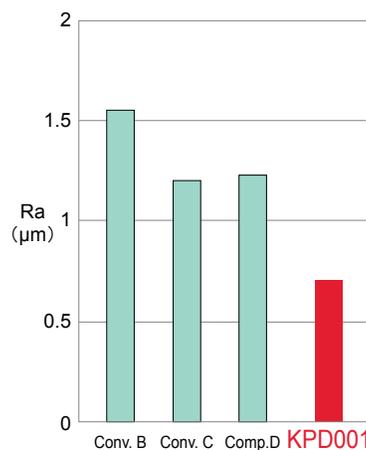
### Applications

Workpiece Material	Non-ferrous materials (Aluminum / Non-ferrous metals / Non-metals)				Difficult-to-Cut Materials Titanium / Titanium alloys				
	Finishing ← → Roughing				Finishing ← → Roughing				
Cutting Range									
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 Cutting



(Grain size affects surface finish quality)

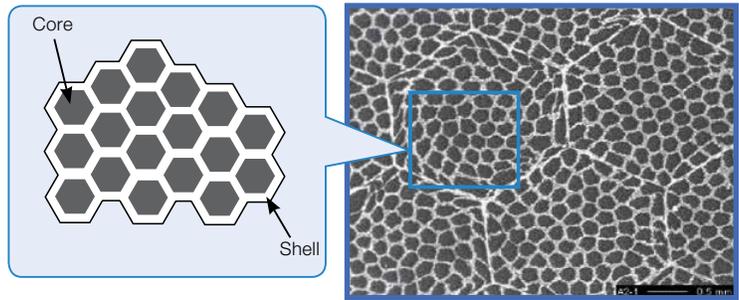
# Honeycomb Structure CBN / CERAMIC

## Honeycomb Structure CBN / CERAMIC

Honeycomb structure is a composite material consisting of a hard and superior wear-resistant core (gray portion) and a tough shell (white portion) with a precisely controlled grain structure.

### FEATURES

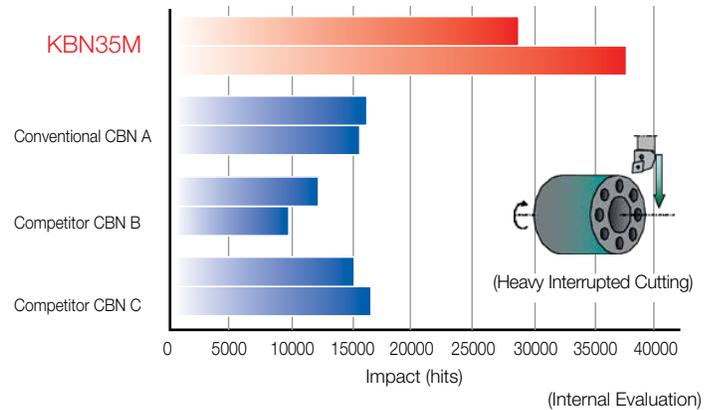
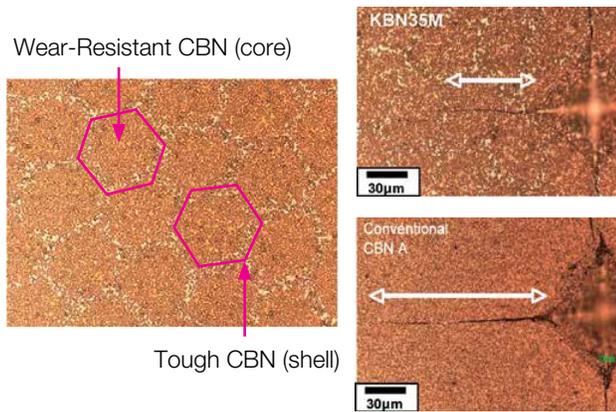
- Cell Fibers combine a hard, wear-resistant core and a tough shell into one insert.
- The tough shell stops cracks that form in the core.
- CBN is good for interrupted machining of exceptionally hard material and ceramic is good for heat-resistant alloys



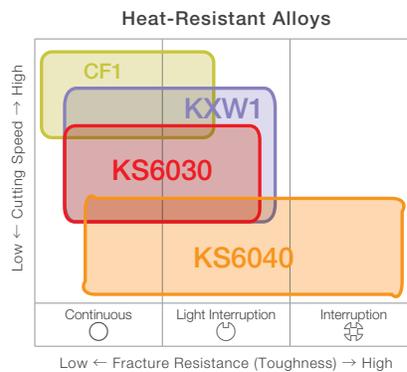
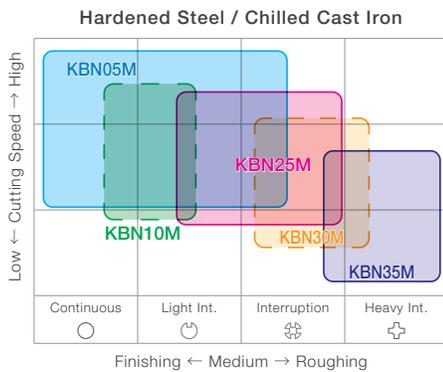
FEATURES OF CBN				
Material	Description	Color	Main Component (Coating Composition)	Advantages
<b>H</b> Hardened Materials	<b>KBN35M</b> (MEGACOAT)	Blackish Red	CBN	<ul style="list-style-type: none"> <li>• Honeycomb structure CBN composite material consisting of wear resistant CBN (core) and tough CBN (shell)</li> <li>• Heat-resistant MEGACOAT on tough Honeycomb structure CBN</li> <li>• Application: Stable machining of hardened steel at interrupted machining</li> </ul>
<b>S</b> Heat-Resistant Alloys	<b>CF1</b>	Gray	Ceramic	<ul style="list-style-type: none"> <li>• Honeycomb structure ceramic composite material consisting of wear resistant ceramic (core) and tough ceramic (shell)</li> <li>• Application: Machining of heat-resistant alloys like Ni-base heat-resistant alloys</li> </ul>

### ■ KBN35M (MEGACOAT Honeycomb Structure CBN)

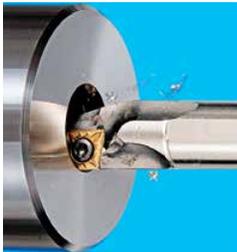
#### ● Tough CBN (Shell) Prevents Crack Growth



### ■ Application Map



## Insert Material Selection Table

Applications		Cutting Range	P	M	K	N	S	H	Powdered Metal	
			Steel	Stainless Steel	Gray Cast Iron	Nodular Cast Iron	Non-Ferrous Metals	Heat-Resistant Alloys		Titanium Alloys
Turning		Finishing ↑ ↓ Roughing	TN610	TN610	KBN475					
			CCX	TN620	KBN60M			CF1	KT66	
			TN620	TN60	KA30	TN60		KS6040	A66N	TN610
			TN60	PV720	PV7005	PV7005	KPD001	KW10	PT600M	TN60
			PV710	CA6515	CA5505	CA5505	KPD010	CA6515	KPD001	KBN05M
			PV720	CA6525	CA310	CA310	PDL010	CA6525	KPD010	KBN10M
			PV730	PR1535	CA315	CA315	PDL025	PR005S	SW05	KBN25M
			CA510			CA320	KW10	PR015S	SW10	KBN35M
			CA515					PR1535	SW25	KBN900
			CA025P							
CA530										
Small Tools		Finishing ↑ ↓ Roughing	TN610	TN610						
			TN620	TN620						
			PV710	PV720	CA310	CA310	KPD001	CA6515	KPD001	KBN05M
			PV720	PR1725	CA315	CA315	KPD010	PR1125	KPD010	KBN10M
			PR1705	PR930	KW10	CA320	PDL010	PR1225	KW10	KBN25M
			PR1725	PR1025		KW10	PDL025	PR1535	PR1535	KBN30M
			PR930	PR1225			GW05			
			PR1025	PR1535			KW10			
			PR1535							
Boring		Large ↑ ↓ Small	TN610	TN60	KBN475					
			TN620	CA6515	KBN60M				PT600M	TN610
			PV710	CA6525	PV7005	PV7005	KPD001	CA6515	KPD001	KBN05M
			PV720	PR1725	CA310	CA310	KPD010	CA6525	KPD010	KBN10M
			PV730	PR1025	CA315	CA315	PDL010	PR1125	KW10	KBN25M
			CA515	PR1225	KW10	CA320	PDL025	PR1225	SW05	
			CA525	PR930		KW10	GW05	PR1535	PR1535	
			CA530	PR1705			KW10			
			PR1705	PR1725						
			PR1725	PR1025						
General Cut-Off		Large ↑ ↓ Small	CR9025	CR9025						
			PR930	PR930						
			PR915	PR915	KW10	KW10	PDL025	KW10	KW10	
			PR1215	PR1215	PR1215	PR1215	KW10	PR1225		
			PR1225	PR1225				PR660		
			PR1535	PR1535						
Small Dia. Cut-Off		Depends on Workpiece Material	PR1025	PR1025	KW10	KW10	PDL025	KW10	KW10	
			PR1225	PR1225			KW10	PR1025		
			PR1535	PR1535				PR1225		
			TC40	TC40						
Grooving		Glossy Finish ↑ ↓ Stable	TN620	TN620						
			TN90	TN90	PR905	PR905	KPD001	PR915	KPD001	KBN510
			PV7040	PV7040	PR1215	PR1215	PDL025	KW10	KW10	KBN525
			PR930	PR930	KW10	KW10	GW15	PR1215	GW15	PT600M
			PR1115	PR1115	GW15	GW15	GW15	PR1225	PR1535	
			PR1215	PR1215				PR1535	PR1535	
			PR1225	PR1225						
			PR1625	PR1625						
Threading		Glossy Finish ↑ ↓ Stable	TC60	TC60	KW10	KW10	KW10	KW10	KW10	PR1515
			PR1215	PR1515	GW15	GW15	GW15	GW15	GW15	PR1115
			PR1115	PR1115						
			PR930	PR930						
Drilling		Wear Resistance ↑ ↓ Toughness	CA520D		CA415D					
			PR1225	PR1225	PR1210	PR1210	KW10	PR1225	KW10	
			PR1230	PR1535	KW10	KW10	GW15	KW10		
			PR1535				GW15	GW15		
Milling		Toughness ↑ ↓ Finishing ↑ ↓ Roughing	TN100M	CA6535			KPD230	CA6535	KPD230	
			TN620M	PR1225	PR1210	PR1210	KPD001	PR1225	KPD001	
			PV60M	PR1525	PR1510	PR1510	KPD010	PR1535	KW10	PR015S
			PR1225	PR1535	KW10	KW10	PDL025		PR905	
			PR1230				KW10		PR1210	

· Highlighted Items are Recommended Grades

INSERT GRADES	A
TURNING INSERTS	B
GEN/PCD INSERTS	C
TURNING HOLDERS	D
SMALL TOOLS	E
BORING	F
GROOVING	G
CUT-OFF	H
THREADING	J
DRILLING	K
MILLING	M
QUICK CHANGE TOOLING	N
SPARE PARTS	P
TECHNICAL	R
INDEX	T

# GRADE PROPERTIES

A  
INSERT  
GRADES

Cermet								
Grade Name	Color	Coating / Main Component	Coating Layer	Density	Hardness of Substrate		Fracture Toughness (MPam <sup>1/2</sup> )	Flexural Toughness (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
TN620M	Gray	TiCN	-	6.9	1,550	15.2	9.0	2,500
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

CVD Coated Cermet								
Grade Name	Color	Coating / Main Component	Coating Layer	Density	Hardness of Substrate		Fracture Toughness (MPam <sup>1/2</sup> )	Flexural Toughness (MPa)
					(HV)	(GPa)		
CCX	Gold	TiCN+Al <sub>2</sub> O <sub>3</sub> +TiN	Thick Coating	7	1,500	14.7	10.0	2,600

PVD Coated Cermet								
Grade Name	Color	Coating / Main Component	Coating Layer	Density	Hardness of Substrate		Fracture Toughness (MPam <sup>1/2</sup> )	Flexural Toughness (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
PV730	Gold	MEGACOAT NANO	Thin Coating	7.0	1,450	14.2	10.0	2,500
PV7005	Blackish Red	MEGACOAT	Thin Coating	6.0	1,650	16.2	8.5	1,470
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
PV60M	Gold	MEGACOAT NANO	Thin Coating	6.6	1,600	15.7	9.0	1,760

CVD Coated Carbide								
Grade Name	Color	Coating / Main Component	Coating Layer	Density	Hardness of Substrate		Fracture Toughness (MPam <sup>1/2</sup> )	Flexural Toughness (MPa)
					(HV)	(GPa)		
CA310	Rose Gold	TiCN+Al <sub>2</sub> O <sub>3</sub> +Ti Base	Thick Coating	15.0	1,570	15.4	12.0	2,780
CA315	Rose Gold	TiCN+Al <sub>2</sub> O <sub>3</sub> +Ti Base	Thick Coating	15.0	1,570	15.4	12.0	2,780
CA320	Rose Gold	TiCN+Al <sub>2</sub> O <sub>3</sub> +Ti Base	Thick Coating	15.0	1,570	15.4	12.0	2,780
CA415D	Gold	TiCN+Al <sub>2</sub> O <sub>3</sub> +TiN	Thick Coating	15.0	1,570	15.4	12.0	2,780
CA420M	Gold	TiCN+Al <sub>2</sub> O <sub>3</sub> +TiN	Thick Coating	14.5	1,600	15.8	13.0	3,400
CA4505	Blackish Gray	TiCN+Al <sub>2</sub> O <sub>3</sub>	Thick Coating	15.0	1,790	17.5	9.5	2,350
CA4515	Blackish Gray	TiCN+Al <sub>2</sub> O <sub>3</sub>	Thick Coating	15.0	1,570	15.4	12.0	2,780
CA510	Gold	TiCN+Al <sub>2</sub> O <sub>3</sub> +TiN	Thick Coating	14.5	1,470	14.4	11.5	2,500
CA515	Gold	TiCN+Al <sub>2</sub> O <sub>3</sub> +TiN	Thick Coating	14.4	1,440	14.1	12.5	2,650
CA520D	Gold	TiCN+Al <sub>2</sub> O <sub>3</sub> +TiN	Thick Coating	14.7	1,370	13.4	16.0	3,100
CA025P	Gold	TiCN+Al <sub>2</sub> O <sub>3</sub> +TiN	Thick Coating	14.2	1,400	13.7	13.5	2,800
CA525	Gold	TiCN+Al <sub>2</sub> O <sub>3</sub> +TiN	Thick Coating	14.2	1,360	13.3	13.5	2,750
CA530	Gold	TiCN+Al <sub>2</sub> O <sub>3</sub> +TiN	Thick Coating	13.9	1,340	13.1	14.5	2,850
CA5505	Gold	TiCN+Al <sub>2</sub> O <sub>3</sub> +TiN	Thick Coating	14.7	1,730	17.0	10.0	2,540
CA5515	Gold	TiCN+Al <sub>2</sub> O <sub>3</sub> +TiN	Thick Coating	14.7	1,550	15.2	12.0	2,750
CA5525	Gold	TiCN+Al <sub>2</sub> O <sub>3</sub> +TiN	Thick Coating	14.5	1,400	13.7	12.0	2,780
CA5535	Gold	TiCN+Al <sub>2</sub> O <sub>3</sub> +TiN	Thick Coating	14.1	1,340	13.1	16.5	2,970
CA6515	Gold	TiCN+Al <sub>2</sub> O <sub>3</sub> +TiN	Thin Coating	14.7	1,530	15.0	12.0	2,780
CA6525	Gold	TiCN+Al <sub>2</sub> O <sub>3</sub> +TiN	Thin Coating	14.7	1,370	13.4	16.0	3,100
CA6535	Gold	TiCN+Al <sub>2</sub> O <sub>3</sub> +TiN	Thin Coating	14.3	1,320	12.9	16.0	3,700
CR9025	Gold	TiCN+TiN	Thick Coating	14.5	1,400	13.7	12.0	2,780

PVD Coated Carbide								
Grade Name	Color	Coating / Main Component	Coating Layer	Density	Hardness of Substrate		Fracture Toughness (MPam <sup>1/2</sup> )	Flexural Toughness (MPa)
					(HV)	(GPa)		
PR005S	Blackish Gray	MEGACOAT HARD	Thin Coating	15.0	1,750	17.2	8.0	2,000
PR015S	Blackish Gray	MEGACOAT HARD	Thin Coating	14.9	1,680	16.5	9.0	2,400
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	Blackish Red	MEGACOAT NANO	Thin Coating	14.8	1,720	16.8	9.0	2,450
PR1515	Blackish Red	MEGACOAT NANO	Thin Coating	14.7	1,700	16.7	11.0	3,000
PR1525	Blackish Red	MEGACOAT NANO	Thin Coating	14.5	1,600	15.8	13.0	3,400
PR1535	Blackish Red	MEGACOAT NANO	Thin Coating	14.3	1,320	12.9	16.0	3,700
PR1625	Blackish Red	MEGACOAT NANO	Thin Coating	14.5	1,600	15.8	13.0	3,400
PR1705	Silver	MEGACOAT NANO PLUS	Thin Coating	14.9	1,800	17.6	10.0	3,300
PR1725	Silver	MEGACOAT NANO PLUS	Thin Coating	14.5	1,600	15.8	13.0	3,400

Carbide								
Grade Name	Color	Coating / Main Component	Coating Layer	Density	Hardness of Substrate		Fracture Toughness (MPam <sup>1/2</sup> )	Flexural Toughness (MPa)
					(HV)	(GPa)		
KW10	Gray	WC+Co	-	15.0	1,650	16.2	10.0	1,470
GW05	Gray	WC+Co	-	14.9	1,800	17.6	10.0	3,300
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								
Grade Name	Color	Coating / Main Component	Coating Layer	Density	Hardness of Substrate		Fracture Toughness (MPam <sup>1/2</sup> )	Flexural Toughness (MPa)
					(HV)	(GPa)		
PDL010	Iridescent	C	Thin Coating	15.0	1,650	16.2	10.0	1,470
PDL025	Iridescent	C	Thin Coating	14.5	1,600	15.8	13.0	3,400

INSERT GRADES	A
TURNING INSERTS	B
GEN/PCD INSERTS	C
TURNING HOLDERS	D
SMALL TOOLS	E
BORING	F
GROOVING	G
CUT-OFF	H
THREADING	J
DRILLING	K
MILLING	M
QUICK CHANGE TOOLING	N
SPARE PARTS	P
TECHNICAL	R
INDEX	T

