

A

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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					Stainless steel / Cast steel					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					TN60			
		TN620					TN620								
		TN60					TN60								
		TN90					TN90								
	TC series	TC60M					TC60M								
Coated carbide	CCX (CVD coated)	CCX										CCX			
	MEGACOAT											PV7005			
	MEGACOAT NANO	PV710					PV710								
		PV720					PV720								
		PV730					PV730								
	CA series	CA115P					CA6515					CA310			
		CA125P					CA6525					CA315			
		CA510										CA320			
		CA515										CA4505			
		CA025P										CA4515			
		CA525													
	PR series	PR930					PR930								
		PR1025					PR1025								
	MEGACOAT	PR1225					PR1225								
	MEGACOAT NANO	PR1535					PR1535								
Ceramic	MEGACOAT NANO PLUS	PR1705					PR1725								
		PR1725					PR1725								
	MEGACOAT TOUGH						PR1205								
	Ceramic											KA30			
												KT66			
												AG6N			
												PT600M			
												KS6015			
												KS6050			
	Carbide											CS7050			
												KW10			
CBN	CBN											KBN475			
												KBN60M			
												KBN900			



Turning

Workpiece material		Non-ferrous metals				Difficult-to-cut materials Heat-resistant alloys / Ni-base heat-resistant alloys				Hard materials				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										
	MEGACOAT HARD					PR005S		CA6525									
	MEGACOAT TOUGH					PR115S		PR120S									
	MEGACOAT NANO							PR1535									
Cermet														TN610			
														TN60			
Ceramic							KS6030			KT66							
							KS6040			A66N							
										PT600M							
CBN										KBN510							
										KBN525							
										KBN900							
										KBN05M							
MEGACOAT										KBN10M							
										KBN25M							
										KBN35M							
										KBN010							
MEGACOAT TOUGH										KBN020							

Workpiece material		Non-ferrous metals				Difficult-to-cut materials Titanium / Titanium alloys				Hard materials				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
MEGACOAT NANO Coated carbide								PR1535									
Carbide						SW05											
						SW10											
						SW25											
DLC coated carbide		GW05				KW10											
		KW10															
PCD		PDL010															
		PDL025															
PCD		KPD001				KPD001											
		KPD010				KPD010											
		KPD230															
		KPD250															

Small parts machining

Workpiece material		Steel					Stainless steel / Cast steel					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									
		PR1025					PR1025									
	MEGACOAT	PR1225					PR1225									
	MEGACOAT NANO	PR1535					PR1535									
	MEGACOAT NANO PLUS	PR1705														
PR1725					PR1725											

Workpiece material		Non-ferrous metals				Difficult-to-cut materials Heat-resistant alloys / Ni-base heat-resistant alloys				Hard materials				Sintered steel			
Cutting range		Finishing	↔		Roughing	Finishing	↔		Roughing	Finishing	↔		Roughing	Finishing	↔		Roughing
Classification		N01	N10	N20	N30	S01	S10	S20	S30	H01	H10	H20	H30	01	10	20	30
Carbide		GW05															
DLC coated carbide		PDL010															
		PDL025															

Grooving / Cut-Off / Threading

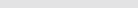
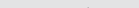
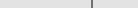
Workpiece material		Steel					Stainless steel / Cast steel					Cast iron			
Cutting range		Finishing ← → Roughing					Finishing ← → Roughing					Finishing ← → Roughing			
Classification		P01	P10	P20	P30	P40	M01	M10	M20	M30	M40	K01	K10	K20	K30
Cermet	MEGACOAT	PV7040										PV7040			
	TN series	TN620					TN620								
		TN6020					TN6020								
		TN60					TN60					TN60			
		TN90					TN90								
TC series	TC40N										TC40N				
	TC60M					TC60M									
Coated carbide	CR series	CR9025					CR9025								
	PR series	PR915					PR915					PR905			
		PR930					PR930								
		PR1025					PR1025								
		PR1115													
	MEGACOAT	PR1215					PR1215					PR1215			
		PR1225					PR1225								
	MEGACOAT NANO	PR1535					PR1535								
		PR1625					PR1625								
	MEGACOAT NANO EX	PR2015					PR2015					PR2015			
PR2025					PR2025										
Ceramic												A65 A66N PT600M			
Carbide												KW10 GW15			

Workpiece material		Non-ferrous metals				Difficult-to-cut materials Titanium / Titanium alloys				Hard materials				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
MEGACOAT Coated carbide														PR1215 PR1225			
Cermets														TN60			
Ceramic										A65 A66N PT600M							
Carbide		KW10 GW05 GW15				KW10 GW15											
DLC coated carbide		PDL015 PDL025															
CBN										KBN510 KBN525				KBN570			
PCD		KPD001 KPD010				KPD001 KPD010											



Drilling

Workpiece material		Steel					Stainless steel / Cast steel					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			
	MEGACOAT		PR1225					PR1225				PR1210			
			PR1230												
	MEGACOAT NANO		PR1535					PR1535							
Carbide												KW10			
												GW15			

Workpiece material	Non-ferrous metals				Difficult-to-cut materials Titanium / Titanium alloys				Hard materials			
Cutting range	Finishing  Roughing				Finishing  Roughing				Finishing  Roughing			
Classification	N01	N10	N20	N30	S01	S10	S20	S30	H01	H10	H20	H30
MEGACOAT Coated carbide												
Carbide												
												

Milling

Workpiece material		Steel					Stainless steel / Cast steel					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								
		TN100M													
	MEGACOAT NANO	PV60M													
Coated carbide	CA series							CA6535				CA420M			
	MEGACOAT	PR1225					PR1225					PR1210			
		PR1230													
	MEGACOAT NANO	PR1525					PR1525					PR1510			
							PR1535								
	MEGACOAT NANO EX	PR1825					PR1835					PR1810			
		PR1835													
Carbide												KW10			
												GW25			

Workpiece material		Non-ferrous metals				Difficult-to-cut materials Heat-resistant alloys / Ni-base heat-resistant alloys				Difficult-to-cut materials Titanium / Titanium alloys				Hard materials			
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									PR1210							
	MEGACOAT HARD													PR015S			
	MEGACOAT NANO					PR1535				PR1535							
Carbide		KW10								KW10							
		GW25								GW25							
DLC coated carbide		PDL025															
PCD	KPD001									KPD001							
	KPD010									KPD010							
	KPD230																
	KPD250																

Cermets

Cermets

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)

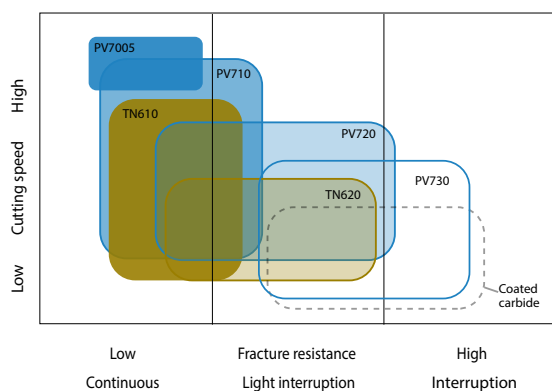
PVD coated cermet is coated on cermet substrate with a thin layer of high wear resistance and high adhesion resistance by PVD (Physical Vapor Deposition) technology. Generally because of the low processing temperature of PVD compared with CVD, PVD coated cermet features less deterioration and more bending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



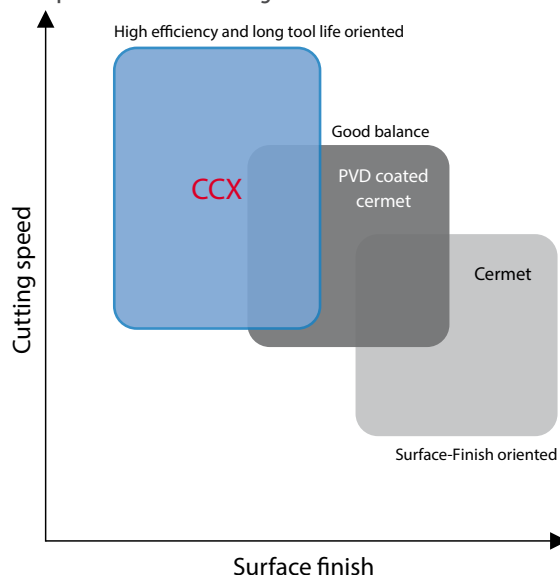
Features of cermet and PVD coated cermet

Classification	Grade	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
		TN60	TiCN+NbC	Application: Machining of steel, continuous to interruption
		TN6020	TiCN	Application: Uncoated cermet for grooving of steel
		TN620M	TiCN	- Tough cermet for milling with excellent balance of wear resistance and toughness - Application: Milling of steel with high quality surface finish and long tool life
		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
	CVD Coated Cermet	CCX	TiCN (TiCN+Al ₂ O ₃ +TiN)	- Specialized high-strength micro grain cermet base material with superior wear-resistant thick CVD coating - Excellent wear resistance leads long tool life in high speed machining - Application: High speed finishing to light interrupted machining 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
		PV60M	TiCN+NbC (MEGACOAT NANO)	- Improved stable grade for milling by MEGACOAT NANO coating technology - Application: Milling of steel with high quality surface finish and stable machining
K Cast iron	MEGACOAT Cermet	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



Properties of PVD coating



Uncoated CERMET

TN610/TN620

Special reinforcement technology (hybrid technology)
Superior surface finish and machining stability.

MEGACOAT NANO CERMET

PV710/PV720/PV730

A

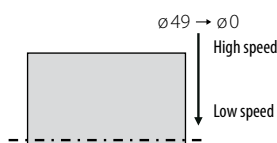
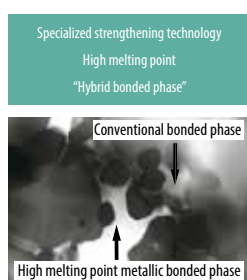
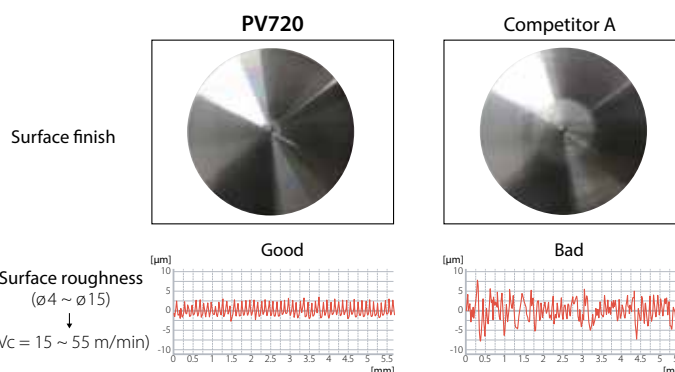


Insert grades

1

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 workpiece

Surface finish comparison
(In-house evaluation)Cutting conditions: $V_c = 180 \sim 0$ m/min (Constant rotational speed),
 $a_p = 0.5$ mm, $f = 0.1$ mm/rev, wet, CNMG120404 type, workpiece: S10C

CVD coated cermet for finishing

CCX

Excellent high speed finishing leads to greater productivity. Applicable to a wide range of cutting conditions from general to high speed machining. Maintains long tool life in soft steel, general steel and cast iron machining

1

Superior wear resistance to PVD coated cermets

2

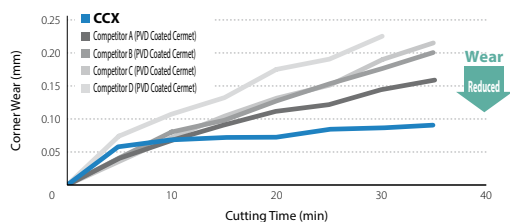
Unique cermet base material with thick CVD coating

Alloy Steel - SCM435

High speed comparison: $V_c = 400$ m/min

CCX provided better tool life than competitor's PVD cermets by greatly reducing the amount of wear

Wear resistance comparison (Internal evaluation)



Cutting edge (After machining 35 min)

CCX



Competitor A (PVD coated cermet)



Competitor B (PVD coated cermet)



Competitor C (PVD coated cermet)



Competitor D (PVD coated cermet)



* Picture shows 30 min after machining due to a large amount of wear

Cutting conditions: $V_c = 400$ m/min, $a_p = 0.3$ mm, $f = 0.12$ mm/rev, Wet, CNMG120408 type, external turning

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



Features of CVD coated carbide

Classification	Grade	Color	Coated composition	Advantages and applications
P Steel	CA115P	Black and gold	TiCN+Al ₂ O ₃ +TiN	• Thick CVD coating with superior wear and fracture resistance using special carbide substrate with high hardness and thermal deformation and crystal forming technology • Application: Continuous to light interrupted machining of steel
	CA125P		TiCN+Al ₂ O ₃ +TiN	• Thick CVD coating with superior wear and fracture resistance using special carbide substrate with high hardness and thermal deformation and crystal forming technology • Application: First choice for general machining of steel
	CA510	Gold	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		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
	CA025P		TiCN+Al ₂ O ₃ +TiN	• CVD coating with improved wear resistance. Adopted base material, excellent chipping resistance, resistance to wear and resistance to improve chip performance • Application: Continuous to interrupted machining of steel
	CA525		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		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)
	CR9025		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		TiCN+Al ₂ O ₃ +TiN	• Specialized carbide substrate for machining stainless steel, excellent wear resistance • Application: Continuous machining of stainless steel
	CA6525		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	CA310	Rose Gold	TiCN+Al ₂ O ₃ +Ti base	• Grade for high-speed continuous machining and improved tool life through the deposition of a thickened Al₂O₃ coating layer • Application: For finishing to roughing of gray cast iron
	CA315		TiCN+Al ₂ O ₃ +Ti base	• Both high abrasion resistance and stability are compatible, high efficiency and long life performance are demonstrated. Can be adapted to both continuous machining and interrupted machining. • Application: Compatible with a wide machining area for cast iron and gray cast iron. First recommendation for cast iron
	CA320		TiCN+Al ₂ O ₃ +Ti base	• Improved stability with CVD layer structure with high adhesion • Application: Heavily interrupted or High-speed machining for Nodular Cast Iron. The 1st Recommendation for the FCD500 or higher application
	CA4505	Blackish gray	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		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



New CVD coated carbide grade for steel

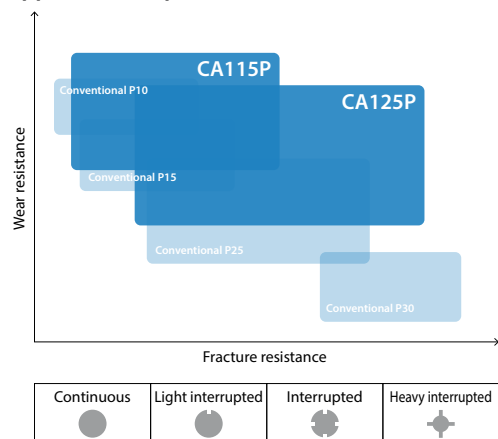
CA115P/CA125P

The new standard for steel machining. Longer tool life in a wide range of machining environments.

1

Extended tool life in a wide variety of applications

Application map



CA115P

Continuous-light interrupted machining of steel
For high-efficient machining
with wear and chipping resistance

CA125P

Continuous-heavy interrupted steel machining
First recommendation for steel machining
High versatility

2

Newly developed proprietary coating and carbide substrate with superior wear and fracture resistance.

Optimized coating properties on rake and flank faces provides wear resistance and fracture resistance
The industry's most uniform alumina film* reduces crater wear

*March 2023, by Kyocera research

Flank face Improved wear resistance

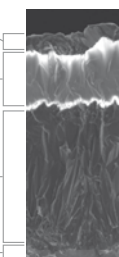
- High hardness surface layer suppresses abrasion
- Uniform alumina layer reduces wear
- Easy to see edge defects with golden surface

High hardness surface layer

Highly uniform alumina layer

Unique TiCN layer

New carbide substrate



Rake face Suppresses crater wear and fracturing

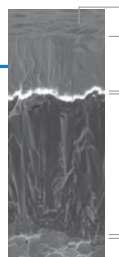
- New surface treatment technology improves fracture resistance
- Highly uniform alumina layer reduces wear

Surface treatment

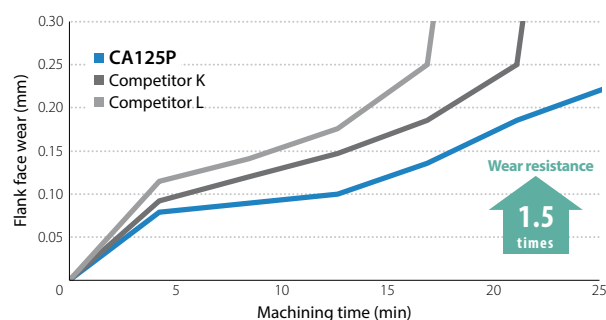
Highly uniform alumina layer

Unique TiCN layer

New carbide substrate

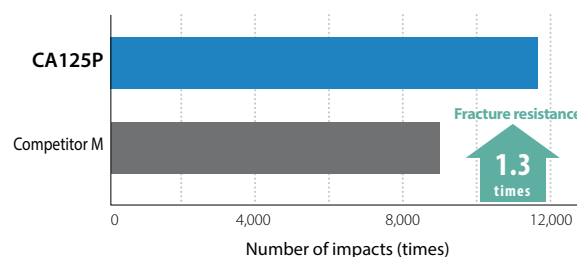


Wear resistance comparison (Internal evaluation)



Cutting Conditions : $V_c = 300$ m/min, $a_p = 1.5$ mm, $f = 0.3$ mm/rev, Wet
Workpiece material : SCM435

Fracture resistance comparison (Internal evaluation) Interrupted machining $n = 3$ mean



Cutting Conditions : $V_c = 300$ m/min, $a_p = 1.5$ mm, $f = 0.35$ mm/rev, Wet
Workpiece material : S45C (4 grooves)

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	Grade	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
	PR1025			• 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
	PR1625	Reddish green	MEGACOAT NANO	• Adopted special nano multi-layer coating "MEGACOAT NANO" excellent in wear resistance and lubricity • Stable processing with steel and stainless steel grooving - Long tool life
	PR1705	Silver	MEGACOAT NANO PLUS	• High-hardness ultrafine particle carbide substrates with special multilayer nano coating MEGACOAT NANO PLUS offer excellent wear resistance and high precision machining. • Application: For free-cutting steel turning. Long tool life with excellent wear resistance and high-precision machining.
	PR1725			• New coating technology "MEGACOAT NANO PLUS" with superior wear resistance and adhesion resistance • Application: General grade for steel and stainless steel machining provides stability and longer tool life
	PR2025	Dark blackish red	MEGACOAT NANO EX	• Nano layer coating "MEGACOAT NANO EX" with superior wear- and fracture resistance • Application: 1st recommendation for grooving and cut-off of steel. Excellent balance between wear and fracture resistance.
M 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
	PR1515	Reddish green	MEGACOAT NANO	• Improved wear resistance and stability by using fine granite carbide base metal and special nano multi-layer coating "MEGACOAT NANO" • Application: For thread cutting of stainless steel
	PR1535			• 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
	PR2035	Dark blackish red	MEGACOAT NANO EX	• Nano layer coating "MEGACOAT NANO EX" with superior wear- and fracture resistance • Application: 1st recommendation for grooving and cut-off of stainless steel. Excellent fracture resistance.
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
	PR2015	Dark blackish red	MEGACOAT NANO EX	• Nano layer coating "MEGACOAT NANO EX" with superior wear- and fracture resistance • Application: 1st recommendation for grooving and cut-off of cast iron. Excellent wear resistance and applicable for high speed machining.
S Heat-resistant alloys	PR005S	Grey black	MEGACOAT HARD	• Superior high temperature properties of special carbide substrate and excellent heat-resistance of MEGACOAT HARD enables high wear resistance • Application: Finish processing of heat-resistant alloys, also for high speed machining
	PR115S	Dark grey black	MEGACOAT TOUGH	• Special carbide substrate with excellent heat resistance and "MEGACOAT TOUGH" with excellent adhesion enables high wear resistance. • Application: Continuous finishing of heat-resistant alloys
	PR120S			• Special carbide substrate with excellent heat resistance and stability and "MEGACOAT TOUGH" with excellent adhesion for improved wear resistance and stability. • Application: Continuous finishing of stainless steel, continuous to light-interrupted machining of heat-resistant alloy



PVD coated carbide for small parts machining

PR1725

1st recommendation for steel machining

Excellent surface finish and long tool life

Great performance in small parts machining applications

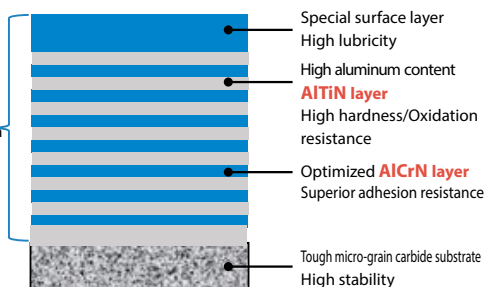


MEGACOAT NANO PLUS

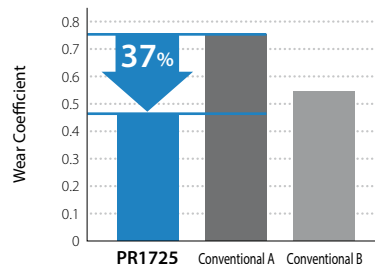
AlTiN/AlCrN Nano laminated film with superior wear resistance and adhesion resistance. Excellent surface finish and long tool life

Reduces cracking

Reduces abnormal damages 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 hardness with nano laminated film layer properties
Internal stress optimization reduces chipping

Excellent surface finish

Special surface layer with great lubricity reduces adhesion

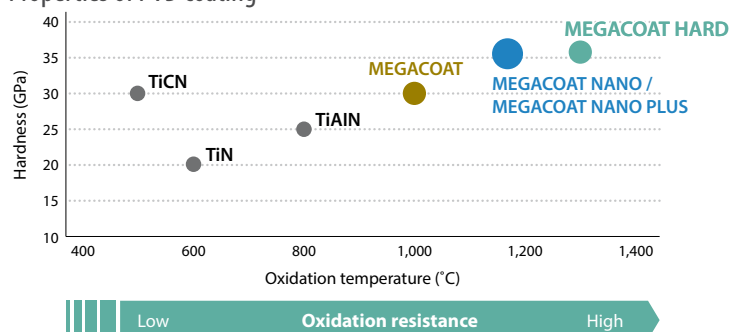
Applicable to various workpiece materials

Excellent oxidation resistance. Superior high temperature properties maintains good performance in steel, stainless steel and free-cutting steel

High machining stability

Tough micro-grain carbide substrate provides stable machining

Properties of PVD coating



Application map

		Steel		
Speed	High speed	PR1705	PR1725	
	Medium			
	Low speed	PR930		
		Continuous	Light interruption	Heavy interruption

		Stainless Steel		
Speed	High speed	PR1725		
	Medium			
	Low speed	PR1535		
		Continuous	Light interruption	Heavy 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 (Al₂O₃) coating with high-thermal stability is applied on a tough carbide substrate. Superior fracture resistance and wear resistance.

**Features of PVD / CVD coated carbide**

Classification	Grade	Color	Coated composition	Advantages and applications
P 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
	PR1825	Light reddish green	MEGACOAT NANO EX	"MEGACOAT NANO EX" with excellent wear, oxidation and chipping resistance - Application: Stable machining of steel and stainless steel with extended tool life
	CA520D	Gold	TiCN+Al ₂ O ₃ +TiN (CVD)	- Improved abrasion resistance and fracture resistance by improving high toughness - Combination of high toughness substrate, toughened coating and enhanced interface allow both wear and fracture resistance - Application: Drilling of steel - first recommended grade (for high speed machining)
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
	PR1835	Light reddish green	MEGACOAT NANO EX	"MEGACOAT NANO EX" with excellent wear, oxidation and chipping resistance - Application: Milling of steel and stainless steel achieves stable long tool life of heavy interrupted and high-load machining
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
	PR1810	Light reddish green	MEGACOAT NANO EX	"MEGACOAT NANO EX" with excellent wear, oxidation and chipping resistance - Application: High efficiency stable milling of gray and nodular cast iron
	CA415D	Gold	TiCN+Al ₂ O ₃ +TiN	- Special carbide substrate for cast iron, toughened coating and enhanced interface allow both wear and fracture resistance - Application: Drilling of cast iron - 1st recommended material for high speed processing
	CA420M		TiCN+Al ₂ O 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	TiCN+Al ₂ O 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
H Hard material	PR015S	Blackish Gray	MEGACOAT HARD	- Substrate with improved thermal properties reduces sudden fracture and decrease edge wear. MEGACOAT HARD coating technology delivers the high hardness and superior wear resistance - Excellent wear and chipping resistance maintains stable machining for high hard materials - Application: Difficult-to-cut materials and high hard (less than 60HRC) machining

Next-generation PVD coating for milling

PR18 Series

Double lamination technology with special nano layer

MEGACOAT NANO EX provides longer tool life

Features 3 grades: PR1825/PR1835/PR1810. Available for various machining environments



Insert grades



Double lamination technology
maintains longer tool life

Multi-layer structure with two unique nano layers
Superior abrasion resistance and fracture resistance

Special nano layer x Multilayer lamination

Nano-Layer

AlCr-based coating
with excellent abrasion resistance

High toughness
suppresses crack growth

Nano-Layer

AlTi-based coating
with excellent heat resistance

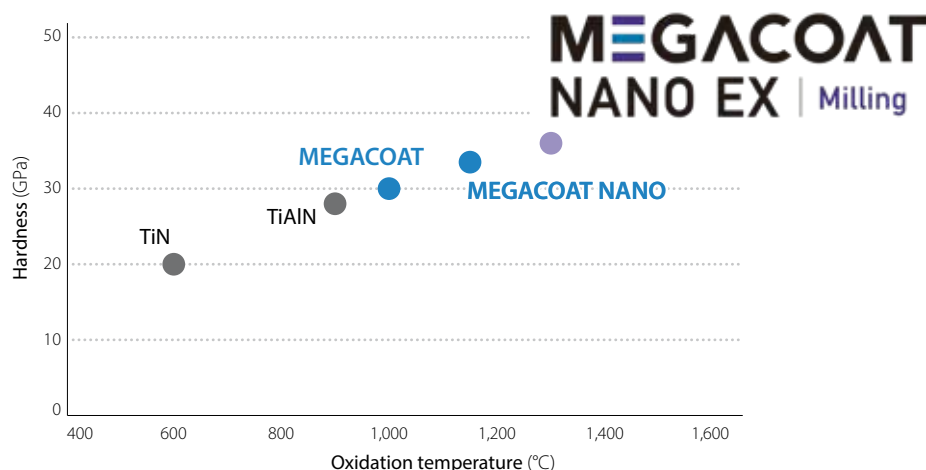
High toughness
suppresses crack growth

Multi-layering of high-performance nano layers

Increases toughness with the suppression of crack growth and optimization of internal stress

CG Image

Coating characteristics (Internal evaluation)





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
- GW05, GW15, GW25: Suitable for machining cast iron, non-ferrous metals and non-metals
- SW series: Suitable for machining of titanium and titanium alloy



Features of carbide

Classification	Grade	Color	Main component	Advantages and applications
	KW10	Gray	WC+Co	• ISO identification symbol K carbide (K10 relevant) • Application: Machining cast iron, non-ferrous materials and non-metals
	GW05			• ISO identification symbol K carbide (K05 relevant) • Application : Excellent wear resistance for machining of cast iron and non-ferrous metal
	GW15			• ISO identification symbol K carbide (K10 relevant), tough micro-grain carbide • Application: Machining cast iron, non-ferrous materials and non-metals
	GW25			• ISO identification symbol K carbide (K30 relevant) • Application: Milling operations of aluminum
	SW05			• ISO identification symbol K carbide (K05 relevant) • Application: Titanium alloys for continuous machining and finishing
	SW10 (Made to order)			• ISO identification symbol K carbide (K10 relevant) • Application: Titanium alloys for continuous and light interrupted machining
	SW25 (Made to order)			• 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

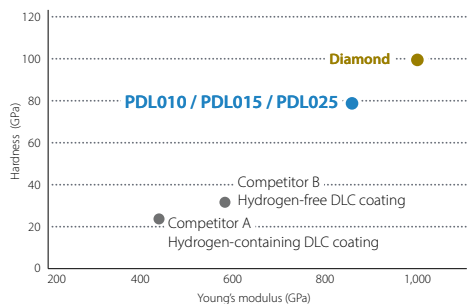
- High Hardness with Kyocera's proprietary hydrogen-free DLC coating
- Excellent surface finish achieved through anti-adhesion performance



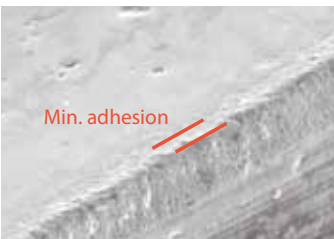
Features of DLC coated carbide

Classification	Grade	Color	Coated composition	Advantages and applications
	PDL010	Rainbow color	C	• DLC coating of original technology has high hardness, excellent adhesion resistance and film peeling resistance • Application: Excellent finished surface processing and long service life of aluminum alloy
	PDL015			• High Hardness with Kyocera's Proprietary Hydrogen-free DLC Coating • Application: Grooving of aluminum alloys
	PDL025			• High Hardness with Kyocera's Proprietary Hydrogen-free DLC Coating • Application: Long tool life and stable machining of aluminum alloys

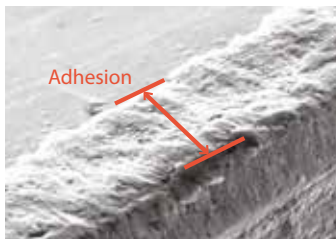
Coating properties



Adhesion resistance comparison



PDL025



Competitor A

Cutting conditions: Vc = 800 m/min, fz = 0.1 mm/t, ap x ae = 3x5 mm
Dry, cutter dia. ø 25 mm, workpiece material: A5052 cutting length: 57 m (Internal evaluation)



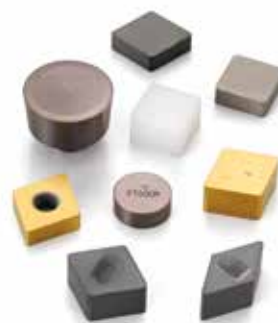
Ceramic

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

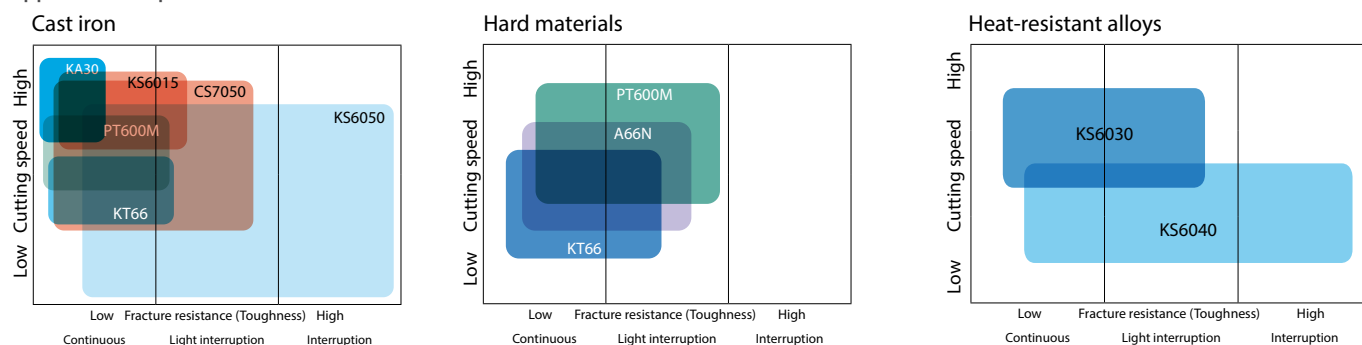
- Excellent wear resistance enables high speeds machining of cast iron
- Ceramic maintains good surface finishes due to the low affinity to workpiece materials
- Silicon nitride ceramic can machine cast iron with coolant due to its superior thermal shock resistance



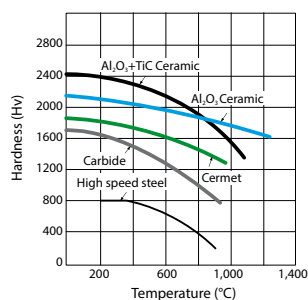
Features of ceramic

Classification	Grade	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
	KS6015	Gray	Si ₃ N ₄		15.2	7.8	1,000	• Silicon nitride ceramic with superior wear resistance reduces heat at the cutting edge. • Application: Roughing and high speed machining of cast iron (with or 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)					• Silicon nitride ceramic (Si ₃ N ₄) + CVD Coating (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 material	KT66	Black	Al ₂ O ₃ +TiC	Thin coating	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)					• TiN PVD coated aluminum oxide and titanium carbide ceramic (TiN coated Al ₂ O ₃ +TiN) • Application: Semi-roughing to finishing of hard materials
	PT600M	Blackish red	Al ₂ O ₃ +TiC (MEGACOAT)					• 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			16.7	7.0	900	• High stability SiAlON ceramic with wear resistance and fracture resistance • Application: Roughing of heat-resistant alloys

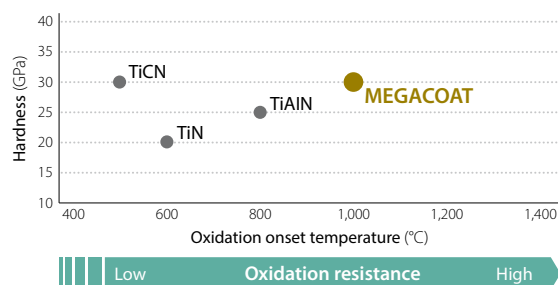
Application map



High-Temperature hardness



Properties of PVD coating



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	Grade	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		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)		2	28		• Application: High speed finishing of hardened die steel
	KBN25M (MEGACOAT)		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
	KBN010 (MEGACOAT TOUGH)		0.5-1.5	27	1,000	• Chipping resistant "MEGACOAT TOUGH" on heat resistant CBN substrate • Application: High speed finishing of hardened steel
	KBN020 (MEGACOAT TOUGH)		3	31-32	1,300	• High toughness CBN coated with high wear resistance enables machining in a wide range of cutting areas • Application: Continuous to interrupted machining of hardened steel
Sintered steel	KBN570	Black	2-4	34	1,350	• High content CBN • Application: Processing of sintered steel (burr suppression)
	KBN70M (MEGACOAT)	Blackish red				• 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

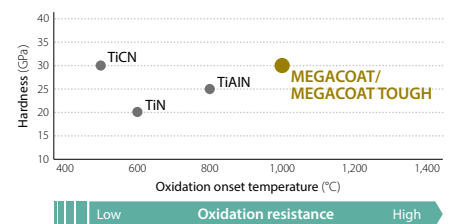
For KBN35M, see page A18.

Advantages of MEGACOAT TOUGH

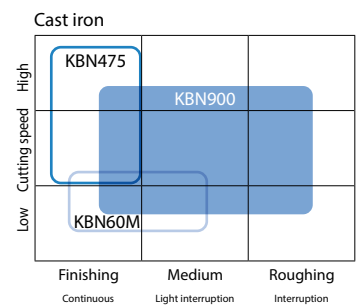
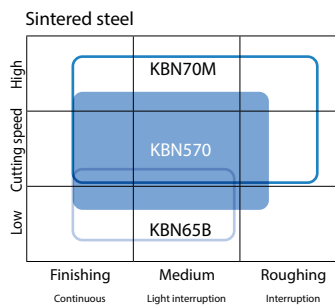
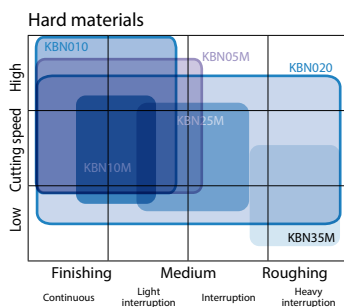
An adhesion layer is laminated between the high wear resistance layer and the CBN. Reduces layer peeling to achieve long tool life and stable machining.



Properties of PVD coating



Application map





PCD (Polycrystalline diamond)

PCD

PCD 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 (A mirror-like finished surface will not be obtained)



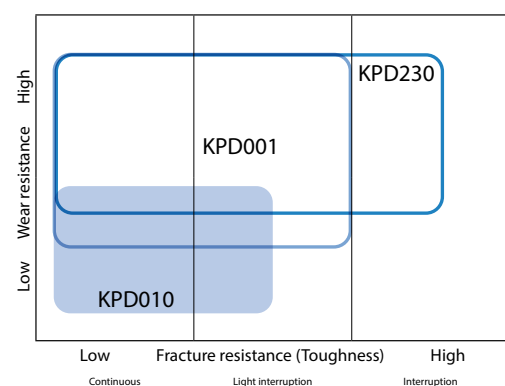
Features of PCD

Classification	Grade	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

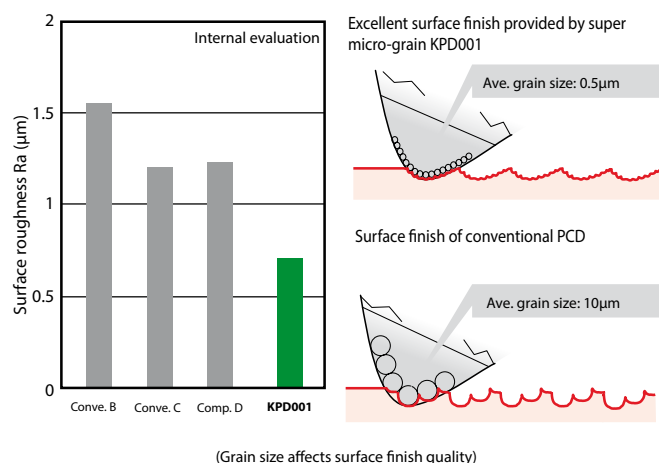
Applications

Workpiece material		Non-ferrous metals				Difficult-to-cut materials			
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



Honeycomb structure CBN



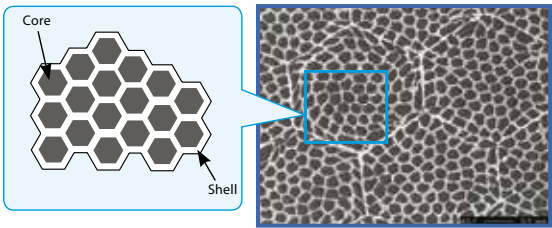
Insert grades

Honeycomb structure CBN

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 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

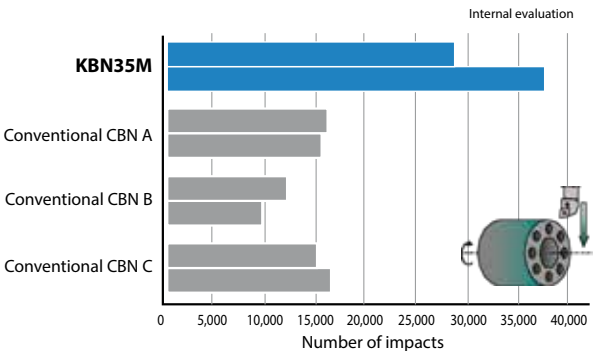
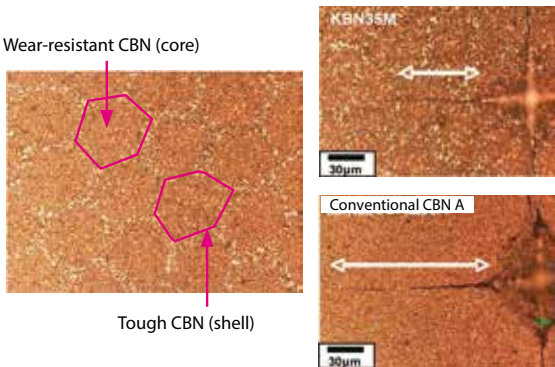


Features of honeycomb structure CBN

Classification	Grade	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

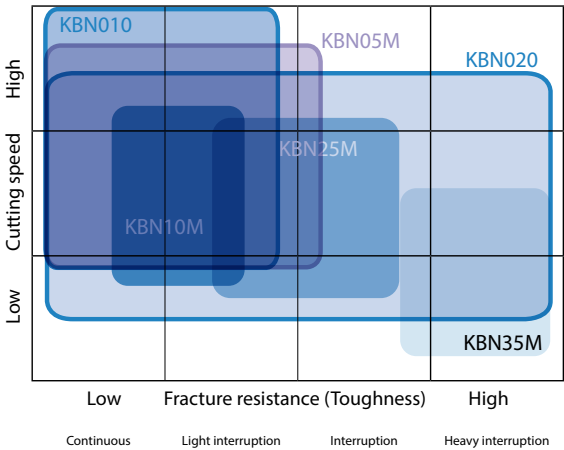
KBN35M (MEGACOAT honeycomb structure CBN)

Tough CBN (shell) prevents crack growth



Application map

Hard materials





Insert material selection table

Applications	Cutting range	Steel	Stainless steel	Gray cast iron	Nodular cast iron	Non-ferrous metals	Heat-resistant alloys	Titanium alloys	Hard materials	Sintered steel
Turning 	Finishing ↑ ↓	TN610 CCX TN620 TN60 PV710	TN610 TN620 TN60 PV720	KBN475 KBN60M KA30	TN60		KS6040		KT66 A66N PT600M	TN610 TN60
		PV720	CA6515	PV7005	PV7005	KPD001	KW10		KBN010	
		PV730	CA6525	CA310	CA310	PDL010	CA6525	KPD010	KBN05M	KBN570
		CA510	PR1535	CA315	CA315	PDL025	PR0055	SW05	KBN020	KBN70M
		CA115P			CA320	KW10	PR1155 PR1205	SW10 SW25	KBN25M KBN35M	
		CA125P					PR1535		KBN900	
	Roughing ↑ ↓	CA530								
Boring 	Large ↑ Bore dia. ↓	TN610 TN620 PV710	TN610 TN620 PV720							TN610 TN60
		PV720	PR1725	CA310	CA310	KPD001	CA6515	KPD001	KBN010	
		PV730	CA6525	KBN475						
		CA115P	PR1725	KBN60M						
		CA125P	PR1025	PV7005	PV7005	KPD001	CA6515	KPD001	PT600M KBN010	TN610 TN60
	Small ↑ Cutting dia. ↓	CA530	PR1225	CA315	CA315	PDL010	PR1125	KW10	KBN020	KBN570
		PR1705	PR930	KW10	CA320	PDL025	PR1225	SW05	KBN25M	KBN70M
		PR1725	PR1535		KW10	GW05	PR1535	PR1535		
		PR1025				KW10				
		PR930								
Cut-Off 	Large ↑ Cutting dia. ↓	CR9025 PR930	CR9025 PR930							
		PR915	PR915	KW10	KW10	PDL025	KW10	KW10		
Cut-Off 	Small ↑ Cutting dia. ↓	PR1215	PR1215	PR1215	PR1215	KW10	PR1225			
		PR1225	PR1225				PR660			
Grooving 	Glossy finish ↑ ↓ Stable	TC40N	TC40N							TC40N
		TN620	TN620							
Threading 	Glossy finish ↑ ↓ Stable	TN90	TN90	KW10	KW10	KPD001	PR915	KPD001	KBN510	
		PV7040	PV7040	GW15	GW15	PDL025	KW10	KW10	KBN525	KBN570
Drilling 	Wear resistance ↑ ↓ Toughness	PR930	PR930	PR905	PR905	KW10	PR1215		PT600M	
		PR1115	PR1115	PR2015	PR2015	GW15	PR1225			
Milling 	Finishing ↑ ↓ Roughing	PR2015	PR2015	PR1215	PR1215		PR1535	PR1535		
		PR1225	PR1225							
		PR2025	PR2025							

Highlighted materials are recommended choice.



Grade properties

Cermet

Grade	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				6.9	1,550	15.2	9.0	2,500
TN620M				6.9	1,550	15.2	9.0	2,500
TN6020				6.4	1,500	14.7	10.0	2,500
TN60		TiCN+NbC		6.6	1,600	15.7	9.0	1,760
TN90				6.4	1,450	14.2	10.0	1,960
TN100M				6.7	1,520	14.9	10.5	1,860
TC40N		TiC+TiN		6.0	1,650	16.2	9.0	1,570
TC60M		NbC		8.1	1,500	14.7	10.5	1,670

CVD coated cermet

Grade	Color	Coated composition	Coating layer	Ratio	Hardness of substrate		Fracture toughness (MPa·m ^{1/2})	Transverse strength (MPa)
					(HV)	(GPa)		
CCX	Gold	TiCN+Al ₂ O ₃ +TiN	Thin coating	7.0	1,500	14.7	10.0	2,600

PVD coated cermet

Grade	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				6.9	1,550	15.2	9.0	2,500
PV730				7.0	1,550	14.2	10.0	2,500
PV7005	Blackish red	MEGACOAT		6.0	1,650	16.2	8.5	1,470
PV7040				6.0	1,650	16.2	9.0	1,570
PV60M	Gold	MEGACOAT NANO		6.6	1,600	15.7	9.0	1,760

CVD coated carbide

Grade	Color	Coated composition	Coating layer	Ratio	Hardness of substrate		Fracture toughness (MPa·m ^{1/2})	Transverse strength (MPa)
					(HV)	(GPa)		
CA02SP	Gold	TiCN+Al ₂ O ₃ +TiN	Thick coating	14.2	1,400	13.7	13.5	2,800
CA115P	Black and gold	TiCN+Al ₂ O ₃ +TiN		13.9	1,440	14.1	13.0	2,250
CA125P				13.8	1,400	13.7	14.5	2,300
CA310	Rose Gold	TiCN+Al ₂ O ₃ +Ti base		15.0	1,570	15.4	12.0	2,780
CA315				15.0	1,570	15.4	12.0	2,780
CA320				15.0	1,570	15.4	12.0	2,780
CA415D	Gold	TiCN+Al ₂ O ₃ +TiN		15.0	1,570	15.4	12.0	2,780
CA420M				14.5	1,600	15.8	13.0	3,400
CA450S	Blackish gray	TiCN+Al ₂ O ₃		15.0	1,790	17.5	9.5	2,350
CA451S				15.0	1,570	15.4	12.0	2,780
CA510	Gold	TiCN+Al ₂ O ₃ +TiN		14.5	1,470	14.4	11.5	2,500
CA515				14.4	1,440	14.1	12.5	2,650
CA520D				14.7	1,370	13.4	16.0	3,100
CA525				14.2	1,360	13.3	13.5	2,750
CA530				13.9	1,340	13.1	14.5	2,850
CA651S			Thin coating	14.7	1,530	15.0	12.0	2,780
CA652S		14.7		1,370	13.4	16.0	3,100	
CA653S		14.3		1,320	12.9	16.0	3,700	
CR902S			TiCN+TiN	Thick coating	14.5	1,400	13.7	12.0



Grade properties

PVD coated carbide

Grade	Color	Coated composition	Coating layer	Ratio	Hardness of substrate		Fracture toughness (MPa·m ^{1/2})	Transverse strength (MPa)
					(HV)	(GPa)		
PR005S	Gray black	MEGACOAT HARD	Thin coating	15.0	1,750	17.2	8.0	2,000
PR015S				14.9	1,680	16.5	9.0	2,400
PR115S	Dark grey black	MEGACOAT TOUGH		14.9	1,680	16.5	9.0	2,400
PR120S				14.6	1,500	14.7	14.0	2,700
PR90S	Bluish violet	TiAlN		14.8	1,720	16.8	9.0	2,450
PR91S				14.1	1,700	16.7	11.0	4,140
PR930	Reddish gray	TiCN		14.1	1,700	16.7	11.0	4,140
PR102S				14.5	1,600	15.8	13.0	3,400
PR111S	Purple red	TiAlN		14.7	1,700	16.7	11.0	3,000
PR1210	Blackish red	MEGACOAT		14.8	1,720	16.8	9.0	2,450
PR121S				14.7	1,700	16.7	11.0	3,000
PR122S				14.5	1,600	15.8	13.0	3,400
PR1230				13.7	1,450	14.2	13.0	2,250
PR1510	Reddish green	MEGACOAT NANO		14.8	1,720	16.8	9.0	2,450
PR151S				14,7	1,700	16.7	11.0	3,000
PR152S				14.5	1,600	15.8	13.0	3,400
PR153S				14.3	1,320	12.9	16.0	3,700
PR162S				14,5	1,600	15.8	13.0	3,400
PR170S	Silver	MEGACOAT NANO PLUS		14.9	1,800	17.6	10.0	3,300
PR172S				14.5	1,600	15.8	13.0	3,400
PR1810	Light reddish green	MEGACOAT NANO EX		14.9	1,680	16.5	9.0	2,400
PR182S				14.5	1,600	15.8	13.0	3,400
PR183S				14.3	1,320	12.9	16.0	3,700
PR201S	Dark blackish red			14.7	1,700	16.7	11.0	3,000
PR202S				14.5	1,600	15.8	13.0	3,400
PR203S				14.3	1,320	12.9	16.0	3,700

Carbide

Grade	Color	Main component	Coating layer	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
GW0S				14.9	1,800	17.6	10.0	3,300
GW1S				14.7	1,700	16.7	11.0	3,000
GW2S				14.5	1,600	15.8	13.0	3,400
SW0S				15.0	1,790	17.5	9.5	2,350
SW10				14.8	1,720	16.8	9.0	2,450
SW2S				14.7	1,370	13.4	16.0	3,100

DLC coated carbide

Grade	Color	Coated composition	Coating layer	Ratio	Hardness of substrate		Fracture toughness (MPa·m ^{1/2})	Transverse strength (MPa)
					(HV)	(GPa)		
PDL010	Rainbow color	C	Thin coating	15.0	1,650	16.2	10.0	1,470
PDL01S				14.7	1,700	16.7	11.0	3,000
PDL02S				14.5	1,600	15.8	13.0	3,400

