

1 Grades

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Grade selection for rotating

ISO	Coated grades CVD	Coated grades PVD	Cermets	Ceramics	PCBN & PCD	Uncoated cemented carbides
P01						
P05						
P10						
P15						
P20						
P25						
P30	T3130					
P35		AH725				
P40		AH120				
P45		AH130				
P50		AH140				
M01		AH3035				
M05		AH9030				
M10		GH130				
M15		AH330				
M20		GH330				
M25		AH730				
M30		NS740				
M35		NS530				
M40		N308				
M45		X407				
M50						
K01						
K05						
K10						
K15						
K20						
K25						
K30						
K35						
K40						
K45						
K50						
N01						
N05						
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S01						
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S20						
S25						
S30						
S35						
S40						
S45						
S50						
H01						
H05						
H10						
H15						
H20						
H25						
H30						
H35						
H40						
H45						
H50						

Coated grades / CVD

Chemical Vapour Deposition

For Turning

	P Steel	M Stainless	K Cast Iron
05			
10	T9105		
15	NEW T9115		
20	NEW T9125	T6020	
25	NEW T9135	NEW T6120	
30		T6030	NEW T5105
35		NEW T6130	NEW T5115
40			NEW T5125

PREMIUMTEC

NEW T9100 series for steels

The T9115 & T9125 are CVD coated grades for general purpose steel turning. The grades guarantee high reliability and quality by applying the new Tungaloy triple technologies. With the effect of "Adhesion reinforcement technology" and "Columnar stabilization technology", the grades ensure excellent chipping resistance and stable tool life. The special "PremiumTec" surface smoothing technology further stabilizes tool life.

PREMIUMTEC

NEW T6100 series for stainless steels

CVD coated grades for turning stainless steels

Ideal combination of exclusive substrate and newly developed coating layer provides stable and long tool life when machining stainless steels due to the high adhesion strength, wear and plastic deformation resistance. New SF and SH chipbreakers expands the application area for stainless steel machining.

PREMIUMTEC

NEW T5100 series for cast irons

This series features high carbon and fine grained coating structure that has improved wear and impact resistance. Three grades together with three chipbreaker types ensure excellent cutting performance when turning grey and ductile cast irons.

PREMIUMTEC

NEW T3130 for steels

CVD coated grades for milling steels

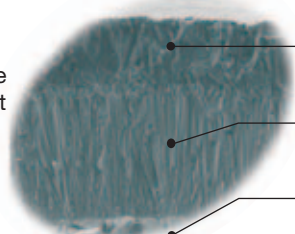
For Milling

	P Steel	M Stainless	K Cast Iron
05			
10			
15			
20			
25			
30	NEW T3130		
35		NEW T3130	
40			NEW T1115

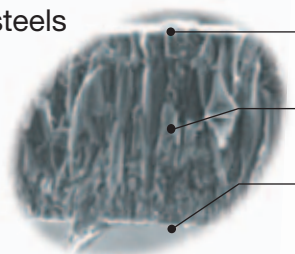
CVD coated carbide grades consist of a cemented carbide substrate such as TiCN, TiN, Al₂O₃ or additional alternatives. These are deposited to 3 to 16 µm thick by means of a chemical vapour deposition method. The coating layer is hard and improves heat and oxidation resistance to make it chemically stable. With these advantages the coated grades prolong tool life and increase machining efficiency.

The newly developed Tungaloy technology - "PremiumTec" is a specialized surface smoothing technology that reduces the friction coefficient and prevents the concentration of micro stresses. This improves adhesion performance and increases chip and wear resistance.

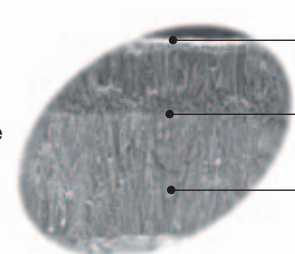
CVD coated grades for turning steels



- PREMIUMTEC** → Reduces adhesion & Improves chip flow
- Continuously formed columnar crystal TiCN → Long & stable tool life even in rough cutting
- Newly developed carbide substrate by special sintering process → Improvement in toughness and wear resistance

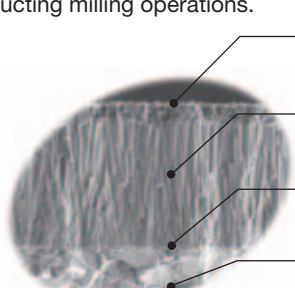


- PREMIUMTEC** → Reduces adhesion & Improves chip flow
- Columnar Stabilization Technology → Improves chipping resistance and provides long and stable tool life
- Improves chipping resistance and provides long and stable tool life → Improves chipping resistance due to the high adhesion strength between coating and substrate.



- PREMIUMTEC** → Reduces adhesion & Improves chip flow
- Improved adhesion between coating layers → Fine grained and high density intermediate layer
- High carbon continuously formed columnar crystal TiCN → Improved wear & chipping resistance

The T3130 provides dramatic improvements in chipping and impact resistance due to its "Adhesion reinforcement technology" and "Columnar stabilization technology". The "PremiumTec" surface smoothing technology also contributes to the insert stabilization when conducting milling operations.



- PREMIUMTEC** → Reduces adhesion
- Continuously formed columnar crystal TiCN → Long tool life and even in hardness work materials
- Improved adhesion between coating layers → Improvement for peeling-off resistance
- Extremely tough & dedicated substrate → Improvement for impact resistance dramatically

For Turning

Application	Grades		Substrate			Coating layer		Features
	Application code		Specific gravity	Hardness (HRA)	Transverse rupture strength (GPa)	Main composition	Thickness (µm)	
P Steel	PREMIUMTEC NEW T9105	P01 - P10	14.2	91.5	2.4	Continuously formed columnar crystal TiCN + Al ₂ O ₃	16	For steels The "PremiumTec" surface smoothing technology enhances the performance of tools. The new coating layer consists of continuously formed columnar crystals that are integrated into crystal size and direction. This new coating layer creates the adhesion for each coating layer and dramatically prevents the micro cracking and chipping effect. T9105: T9105 shows excellent performance during high speed cutting. T9115: Well-balanced grade enhances chipping and wear resistance. T9125: The versatile grade that dramatically improves chipping resistance. T9115: Well-balanced grade enhances chipping and wear resistance. T9135: T9135 shows excellent impact resistance during heavy interrupted cutting.
	PREMIUMTEC NEW T9115							
	PREMIUMTEC NEW T9125	P20 - P30	13.7	90.0	2.6			
	PREMIUMTEC NEW T9135							
M Stainless	PREMIUMTEC NEW T6120	M10 - M20	13.9	91.0	2.5	Continuously formed columnar crystal TiCN + Al ₂ O ₃	8	For stainless steels The combination of exclusive substrate and new coating layer with high chipping resistance significantly improves wear and fracture resistance. T6120: Offers excellent wear resistance for high speed cutting. T6130: Provides exceptional wear resistance at medium to high cutting speed.
	PREMIUMTEC NEW T6130							
	T6020	M15 - M25	14.1	90.0	2.5	Special Titanium compound (columnar)	6	For stainless steels The T6000 series has improved notch wear and chipping resistance with its combination of special substrates and extremely high coating adhesion. T6020: Applicable for medium to high speed machining and continuous to light interrupted cutting. T6030: Applicable for low to medium speed cutting and has extremely excellent impact resistance. For interrupted cutting.
	T6030							
K Cast Iron	PREMIUMTEC NEW T5105	K05 - K15	15.0	92.5	2.4	High carbon and fine columnar crystal TiCN + Al ₂ O ₃	16	For grey and ductile cast irons The "PremiumTec" surface smoothing technology delivers high performance with stability. The coating layer of the T5100 series features fine grained and hard columnar crystals of TiCN and this drastically improves wear resistance. When combined with the dedicated cemented carbide substrate that has a fine structure and high-strength, the three grades of the T5100 series promotes excellent cutting performance in a wide range of cast iron turning applications. T5105: Excels in wear and deformation resistance in high-speed, continuous turning. T5115: General purpose grade that achieves stable machining in a wide range of machining conditions from continuous to interrupted cutting. T5125: This grade excels when conducting heavy interrupted cutting. The very tough grade has a high resistance to unpredicted tool breakages.
	PREMIUMTEC NEW T5115							
	PREMIUMTEC NEW T5125	K15 - K30	14.0	90.5	2.8			
Threading	T313V	-	14.5	90.5	2.3	Special Titanium compound (columnar) + Al ₂ O ₃	3	For threading Features specially engineered substrate with excellent resistance to impact and plastic deformation. This is credit to a well controlled coating composition and layer thickness.

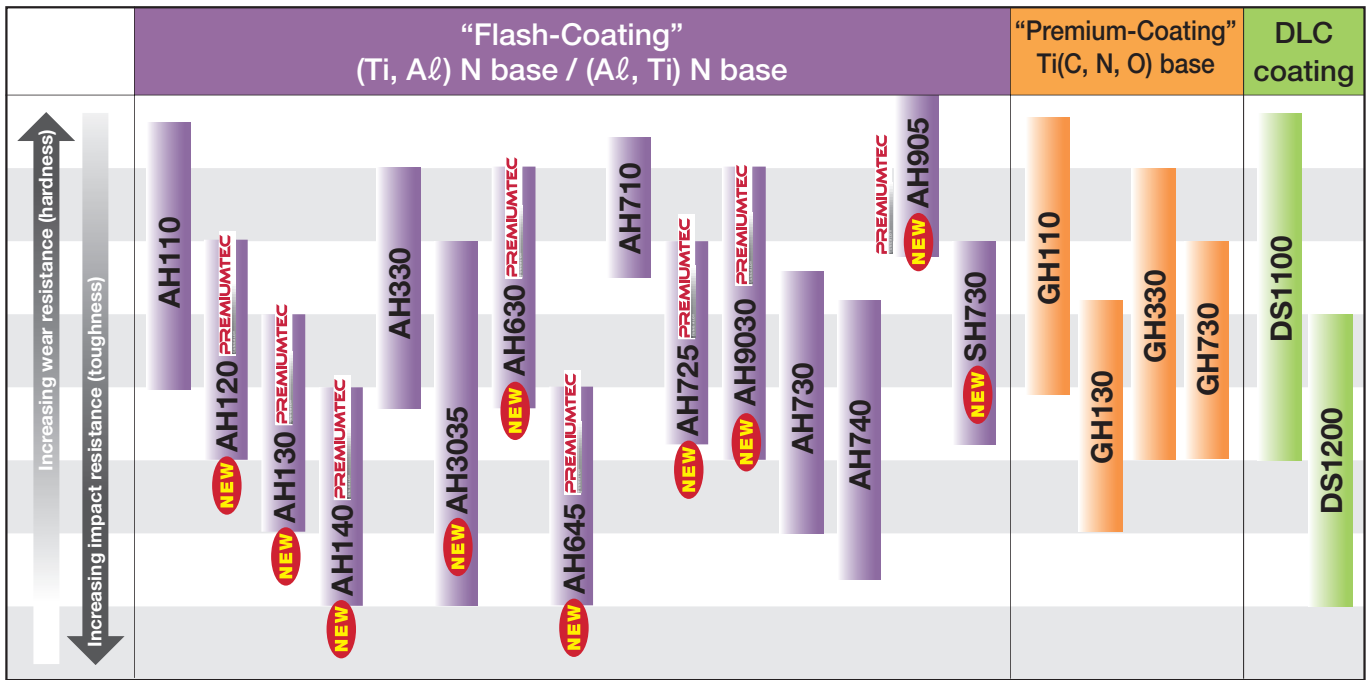
For Milling

Application	Grades		Substrate			Coating layer		Features
	Application code		Specific gravity	Hardness (HRA)	Transverse rupture strength (GPa)	Main composition	Thickness (µm)	
P Steel	PREMIUMTEC NEW T3130	P20 - P40	14.0	89.5	2.8	Continuously formed columnar crystal TiCN + Al ₂ O ₃	6	For steels, stainless steels The "PremiumTec" surface smoothing technology improves performance with stability. "Adhesion reinforcement technology" and "Columnar stabilization technology" create stable long tool life. This enhances performance with increased wear and chipping resistance when conducting milling operations.
M Stainless	PREMIUMTEC NEW T3130	M20 - M40	14.0	89.5	2.8	Continuously formed columnar crystal TiCN + Al ₂ O ₃	6	For steels, stainless steels The "PremiumTec" surface smoothing technology improves performance with stability. "Adhesion reinforcement technology" and "Columnar stabilization technology" create stable long tool life. This enhances performance with increased wear and chipping resistance when conducting milling operations.
K Cast Iron	PREMIUMTEC NEW T1115	K10 - K25	14.9	91.5	2.7	Continuously formed columnar crystal TiCN + Al ₂ O ₃	11	For grey and ductile cast irons The "PremiumTec" surface smoothing technology improves performance with stability. "Adhesion reinforcement technology" and "Columnar stabilization technology" create stable and long tool life. This improves the performance for impact and chipping resistance. It combines with a thick aluminium layer that improves wear resistance.

Coated grades / PVD

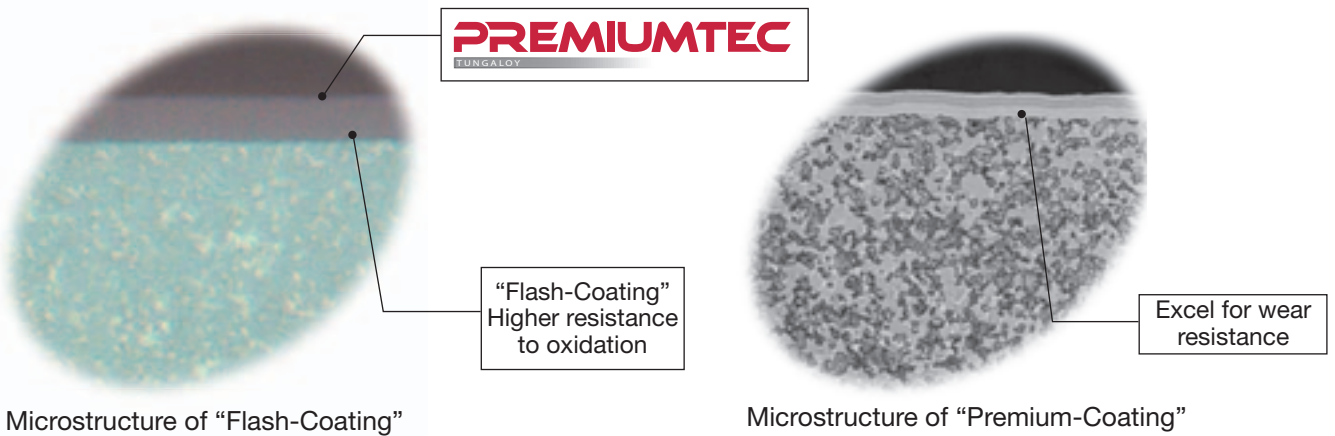
Grades

Physical Vapour Deposition

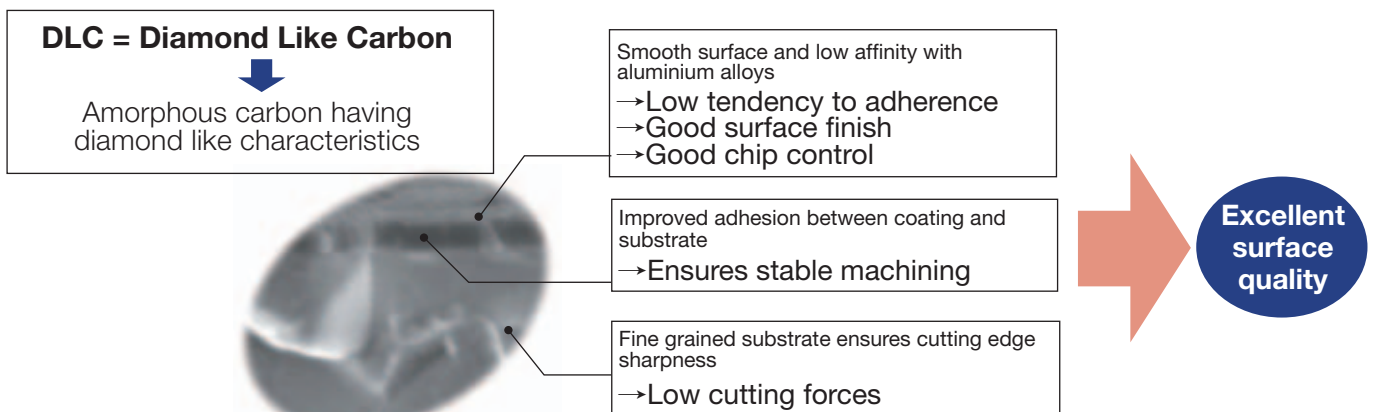


PVD coated carbides consist of a cemented carbide substrate that contains a Titanium compound such as (Ti, Al)N that is coated to about 1 to 3 µm thick by means of the physical deposition (PVD) method. The lower coating temperature ensures the substrate does not form any brittle harmful layer and can maintain the original shape and dimensions. The Ti(C, N, O) base coating is superior to TiN coatings in regard to wear resistance. Whereas a (Ti, Al)N base coat

has a higher resistance to oxidation. The excellent toughness of both the coating and substrate make these grades suitable for interrupted cutting. Their sharp cutting edge allows the grades to be used for cutting difficult-to-cut materials that tend to be work hardened. "PremiumTec" is treated with a CVD coating and also a PVD coated layer that reduces adhesion and enhances chip flow.



DS1100, DS1200 DLC coating grades for milling aluminium alloys

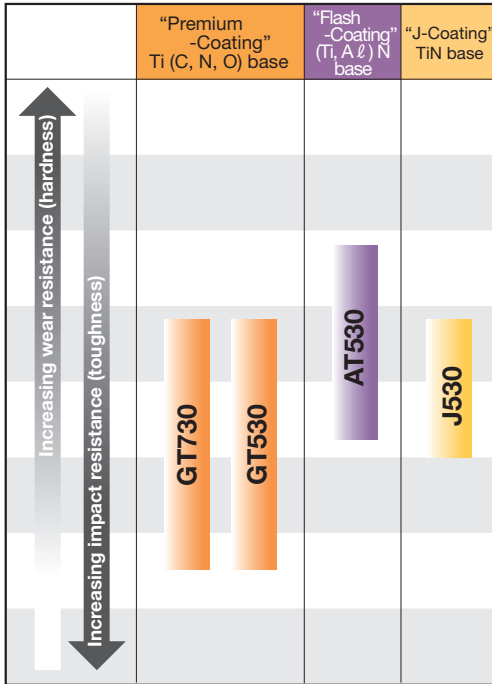


Application	Grades		Substrate		Coating layer		Features	
	Application code	Specific gravity	Hardness (HRA)	Transverse rupture strength (GPa)	Main composition	Thickness (µm)		
P Steel	<small>PREMIUMTEC</small> <small>NEW</small> AH120	14.5	90.8	2.8	"Flash -Coating" (Ti, Al)N base	3	General grade Both wear resistance and impact resistance are well-balanced in all general grades.	
	P20 - P35							
	<small>PREMIUMTEC</small> <small>NEW</small> AH130	14.1	90.5	3.0		3	For steels & stainless steels / very tough grade Excellent performance and reliability for tough machining applications.	
	P25 - P40							
	AH330	12.6	91.1	2.3		3	For steels and stainless steels Substrate is highly reliable P30 carbide. This grade incorporates high temperature strength.	
	P15 - P30							
	<small>PREMIUMTEC</small> <small>NEW</small> AH3035	14.0	89.5	3.2		5	For steels AH3035 demonstrates incredible toughness in cutting of steels.	
	P20 - P45							
	AH710	15.0	93.0	2.9		3	For grooving Excellent wear resistance and toughness.	
	P10 - P20							
	<small>PREMIUMTEC</small> <small>NEW</small> AH725	14.4	91.5	3.0		2	General grade PVD coated "Flash-Coating" fine grain cemented carbides.	
	P20 - P35							
	<small>PREMIUMTEC</small> <small>NEW</small> AH730	14.4	91.5	3.0		3	For steels Combined with fine grained carbide substrate, this grade provides both wear resistance and toughness.	
	P25 - P40							
	AH740	13.9	91.5	3.5		3	For steels Excels in high temperature strength and chipping resistance.	
	P25 - P40							
<small>PREMIUMTEC</small> <small>NEW</small> AH9030	14.5	90.8	2.8	5	For steels With excellent wear and chipping resistance.			
P15 - P35								
<small>PREMIUMTEC</small> <small>NEW</small> SH730	14.4	91.5	3.0	1	For steels, stainless steels and superalloys (thin PVD) The extremely wear resistant cutting edge maintains exceptional sharpness.			
P20 - P35								
AH730	14.4	91.5	3.0	3	For grooving and parting off at low speed The "Premium-Coating" is treated with fine grained cemented carbide that has high transverse rupture strength.			
P20 - P35								
AH330	12.6	91.1	2.3	3	For steels and stainless steels Substrate is highly reliable P30 grade. Excels in wear and impact resistance.			
P15 - P30								
M Stainless	<small>PREMIUMTEC</small> <small>NEW</small> AH120	14.5	90.8	2.8	"Flash -Coating" (Ti, Al)N base	3	General grade For continuous to medium interrupted cutting of stainless steels.	
	M20 - M35							
	<small>PREMIUMTEC</small> <small>NEW</small> AH130	14.1	90.5	3.0		3	For steels & stainless steels Excellent performance and reliability when applied to tough machining applications.	
	M25 - M40							
	<small>PREMIUMTEC</small> <small>NEW</small> AH140	14.4	89.5	2.6		3	For stainless steels For milling of stainless steels at low speeds.	
	M30 - M45							
	<small>PREMIUMTEC</small> <small>NEW</small> AH630	14.4	91.5	3.0		5	For stainless steels (AH600 series) Versatile grade for stainless steels. With excellent wear and chipping resistance, AH630 grade is suitable for stainless steel machining at low to medium cutting speed.	
	M15 - M30							
	<small>PREMIUMTEC</small> <small>NEW</small> AH645	14.0	89.5	3.2		5	For stainless steels (AH600 series) AH645 demonstrates incredible toughness in cutting of stainless steels.	
	M30 - M40							
	<small>PREMIUMTEC</small> <small>NEW</small> AH725	14.4	91.5	3.0		2	General grade General grade that is "Flash-Coating" with a fine grain cemented carbide.	
	M20 - M35							
	<small>PREMIUMTEC</small> <small>NEW</small> SH730	14.4	91.5	3.0		1	For steels, stainless steels and superalloys (thin PVD) Cutting edge with sharpness is maintained with excellent wear resistance characteristics that are ideal for stainless steel machining.	
	M20 - M35							
AH730	14.4	91.5	3.0	3	For grooving and parting off at low speed PVD coated "Premium-Coating" fine grain cemented carbides. This grade improves wear resistance.			
M20 - M35								
AH330	12.6	91.1	2.3	3	For steels and stainless steels For continuous to medium interrupted cutting of stainless steels.			
M15 - M30								
K Cast Iron	AH110	14.7	92.0	2.4	"Flash -Coating" (Ti, Al)N base	3	For cast irons and heat resisting alloys For continuous to medium interrupted cutting of cast irons at high speeds.	
	K10 - K25							
	<small>PREMIUMTEC</small> <small>NEW</small> AH120	14.5	90.8	2.8		3	General grade General grade for cast irons. For various cutting conditions.	
	K15 - K30							
AH110	14.7	92.0	2.4	3	For cast irons and non-ferrous metals Excels in wear resistance.			
K10 - K25								
N Non-ferrous	DS1100	15.0	93.0	2.9	DLC coating	Thin layer	For aluminium alloys Can suppress chips welding to cutting edges, producing consistently high quality surface and realizing long tool life.	
	N05 - N20							
	DS1200	14.7	92.0	2.4	DLC coating	Thin layer	For aluminium alloys Can prevent chips welding to cutting edges, producing a consistently high quality surface finish and extending tool life.	
	N10 - N25							
AH110	14.7	92.0	2.4	"Premium -Coating" Ti(C, N, O) base	3	For cast irons and non-ferrous metals Improves wear resistance.		
N05 - N15								
S Superalloys	AH110	14.7	92.0	2.4	"Flash -Coating" (Ti, Al)N base	3	For cast irons and heat resisting alloys Excellent plastic deformation resistance.	
	S05 - S15							
	<small>PREMIUMTEC</small> <small>NEW</small> AH120	14.5	90.8	2.8		3	General grade Excels in both plastic deformation and chipping resistance.	
	S10 - S25							
	<small>PREMIUMTEC</small> <small>NEW</small> AH905	15.0	93.0	2.9		(Al, Ti)N base	1.5	For superalloys Excels in both cutting edge sharpness and wear resistance.
	S01 - S10							
	<small>PREMIUMTEC</small> <small>NEW</small> AH725	14.4	91.5	3.0		"Flash -Coating" (Ti, Al)N base	2	For grooving Tough grade that is ideal for super alloys.
S20 - S30								
<small>PREMIUMTEC</small> <small>NEW</small> SH730	14.4	91.5	3.0	1	For steels, stainless steels and superalloys (thin PVD) Excels in both cutting edge sharpness and wear resistance.			
S05 - S15								
For small lathes	J740	13.9	91.5	3.5	"J-Coating" TiN base	1	For small lathes Ultra fine grain cemented carbides coated with TiN based compounds.	

Cermet

Cermet

Coated Cermet



Cermet consists of a hard phase and a binding phase, which is the case with cemented carbides. The hard phase consists mainly of Titanium carbide TiC and Titanium nitride TiN. These carbides and nitrides have superior strength and oxidation resistance when working at high temperatures when compared with Tungsten carbide WC.

Furthermore, there is little tendency to react with the work material and this ensures high crater resistance. Finally, Cermet grades are applicable to high and low speed cutting ranges whilst delivering excellent surface roughness.

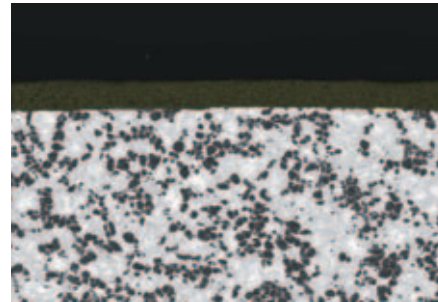
For Turning "Super fine Cermet" GT730, NS730

Cermet creates a high quality surface finish due to the combination of "Fine-grain reinforcement technology" and "Surface smoothing technology". This improves the impact resistance, which is generally a weak point of Cermet.

- "Fine-grain reinforcement technology"

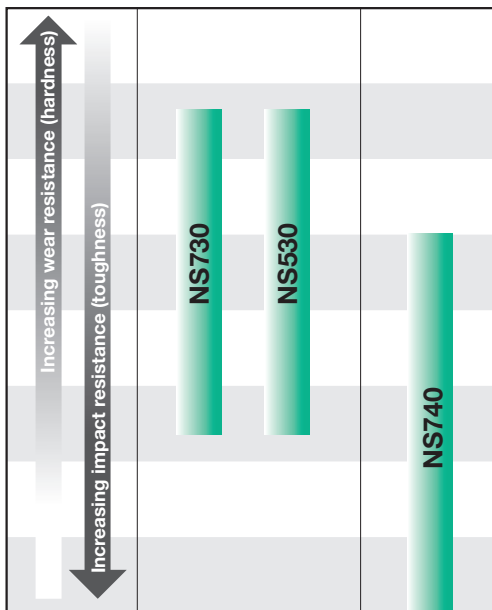
This technology enhances the reliability and performance of the grade. It offers improved wear and impact resistance with its high bonding strength, heat resistant Titanium compound and fine bonding grain Titanium compound that prevents crack propagation and improves toughness.
- "Surface smoothing technology"

The cutting edge remains smooth at all times by means of the fine grain heat resistant Titanium compound and specialized sintering technology.



Microstructure of GT730

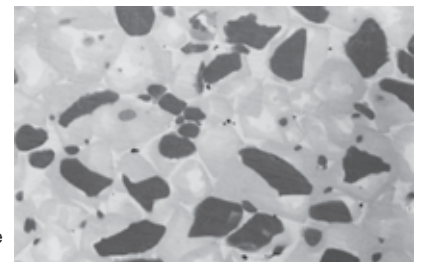
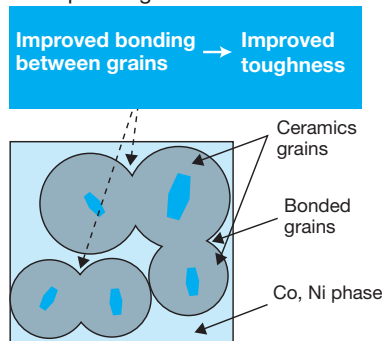
Uncoated



For Milling "Skeleton Reinforced Cermet" NS740



- "Skeleton reinforced technology"

"Skeleton reinforced technology" enhances toughness whilst keeping hardness by means of improvement of bonding strength among ceramic compound grain.





Microstructure of NS740

Coated Cermet

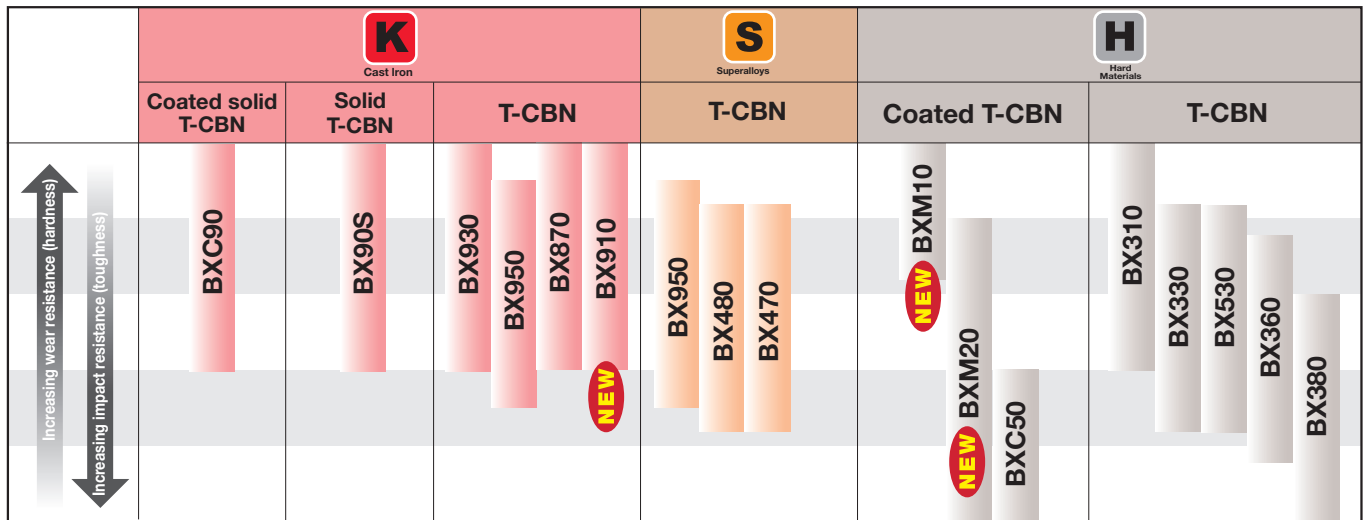
Application	Grades	Substrate			Coating layer		Features
		Specific gravity	Hardness (HRA)	Transverse rupture strength (GPa)	Main composition	Thickness (μm)	
 Steel	GT730	6.8	92.0	2.2	"Premium -Coating" Ti(C, N, O) base	3	First choice Covering a wide range of cutting speeds. Well balanced surface quality and wear resistance.
	GT530	7.2	91.7	2.0		3	For steels PVD coated grade for finish to medium cutting of steel.
	AT530	7.2	91.7	2.0		3	For steels High wear resistance and toughness that is combined by a flash-coated layer.
 Cast Iron	GT520	6.6	92.1	1.7	"Premium -Coating" Ti(C, N, O) base	3	For steel and cast iron machining at high speed Increased wear resistance without decreasing the toughness of the substrates.
For small lathes	J530	7.2	91.5	2.0	"J-Coating" TiN base	1	For small lathes Cermet coated PVD-TiN based compounds.

Uncoated

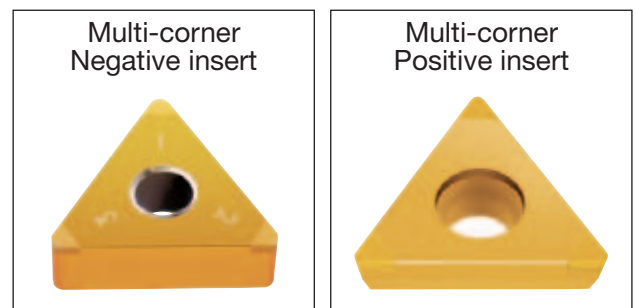
Application	Grades	Substrate			Features
		Specific gravity	Hardness (HRA)	Transverse rupture strength (GPa)	
 Steel	NS730	6.8	92.0	2.2	Priority on impact resistance Superior resistance to thermal and mechanical fracture. Reduces machining costs.
	NS740	6.8	91.7	2.2	For steels Very tough grade for milling. Excellent thermal crack resistance. This grade also provides good wear and impact resistance.
	NS530	7.2	91.7	2.0	For steels and cast iron Excellent wear resistance and toughness.
 Cast Iron	NS530	7.2	91.7	2.0	For steels and cast iron Excellent wear resistance and toughness.

PCBN (T-CBN)


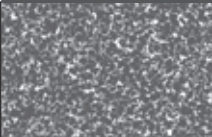
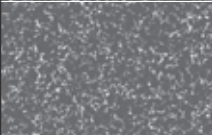
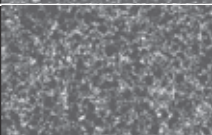


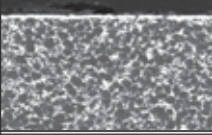
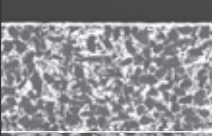
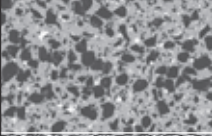

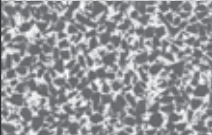
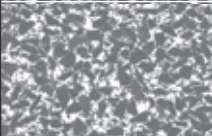

Polycrystalline Cubic Boron Nitride Compacts (PCBN), T-CBN



The PCBN material is sintered under ultra high-pressure and temperature with cubic boron nitride particles and a special binder. The hardness is more than twice that of cemented carbide, with the hardness at high temperature exceeding that of cemented carbide. CBN has no tendency to react with ferrous materials (different to diamonds). This makes it suitable for high speed cutting of cast iron, the finishing of hardened steel, ferrous sintered metals (valve seats) etc. This material is also suited to finish machining of super heat resistant alloys. The use of CBN sintered materials improve the surface finish and accuracy, making finishes comparable to grinding.



Application	Grades	Microstructure	Hardness (Hv)	Transverse rupture strength (GPa)	Features
K Cast Iron	BXC90 Coated solid T-CBN (BX90S) Solid T-CBN		3900 ~ 4100	1.80 ~ 1.90	Coated grade for high speed continuous or interrupted machining Medium grained CBN particles are bound with special binder. The surface is coated with dedicated coating material.
	BX850		3300 ~ 3500	0.75 ~ 0.85	PCBN grade for machining cast irons General purpose, cast iron machining grade featuring excellent impact resistance.
	BX870		3000 ~ 3200	0.95 ~ 1.20	For machining cast iron Cylinder liners Excellent wear resistance and tool life when machining cast iron liners.
	NEW BX910		2600 ~ 2800	0.80 ~ 0.90	CBN grade for centrifugally cast iron machining With excellent wear resistance, BX910 provides long and stable tool life while machining centrifugally cast iron, like cylinder liner, at high cutting speed.
	BX930		3000 ~ 3200	0.95 ~ 1.20	PCBN grade for machining grey and ductile cast irons Features closely calculated CBN content and medium sized CBN particles bound with special binder. Excels in impact resistance.
	BX950		3900 ~ 4100	1.80 ~ 1.90	High CBN content grade for high speed machining PCBN grade featuring a high CBN content with cobalt alloy binder.

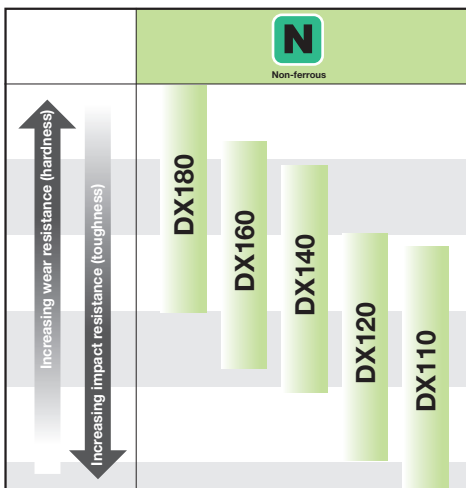
Application	Grades	Microstructure	Hardness (Hv)	Transverse rupture strength (GPa)	Features
 Superalloys	BX950		3900 ~ 4100	1.80 ~ 1.90	High CBN content grade for high speed machining PCBN grade featuring high CBN content and use of cobalt alloy binder.
	BX480		4100 ~ 4300	1.90 ~ 2.10	PCBN grade for machining ferrous sintered metals and hard rolls World's highest content of CBN in a practical tool material. Features the highest hardness level of all the T-CBN grades*.
	BX470		4100 ~ 4300	1.90 ~ 2.10	Super fine grain PCBN grade for machining ferrous sintered metals The highest content of CBN in the world as a practical tool material*.
 Hard Materials	NEW BXM10 Coated T-CBN		2700 ~ 2900	0.80 ~ 0.90	Coated grade for high-speed continuous and light interrupted machining High crater resistance CBN substrate. The surface is coated with a dedicated coating material.
	NEW BXM20 Coated T-CBN		3500 ~ 3700	1.35 ~ 1.50	First choice: Coated grade for continuous and interrupted machining and the removal of the carburized layer High chipping resistance CBN substrate. The surface is coated with a dedicated coating material.
	BXC50 Coated T-CBN		3500 ~ 3700	1.15 ~ 1.30	Coated grade for continuous to interrupted machining Medium grained CBN particles are bound with special binder. The surface is coated with dedicated coating material.
	BX310		2700 ~ 2900	0.80 ~ 0.90	High speed, continuous machining grade The binding force between particles is improved by using relatively coarse CBN grains. Excellent wear resistance.
	BX330		2800 ~ 3000	0.85 ~ 0.95	Super fine grained grade for superior surface finish Super fine grain CBN particles are bound with a special binder. Maintains its very sharp cutting edges.
	BX360		3200 ~ 3400	1.00 ~ 1.10	General purpose grade for continuous to ordinarily interrupted machining Composed with fine grained and coarse grained CBN particles. General purpose grade featuring excellent impact resistance.
	BX380		3500 ~ 3700	1.15 ~ 1.30	Tough grade for heavily interrupted machining Composed of relatively high content of coarse CBN particles. It contributes to the excellent impact resistance.
	BX530		2800 ~ 3000	0.85 ~ 0.95	Ultra fine grain PCBN grade for superior surface finish Features homogeneous and ultra fine grain structure that is produced with Tungaloy's own manufacturing method. The world's finest grain PCBN*.

*As of July 2010

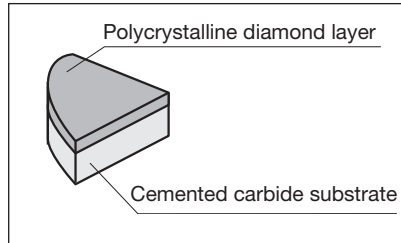
PCD (T-DIA)

1
Grades


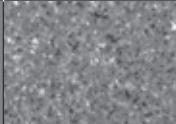


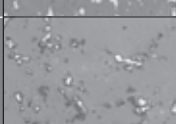
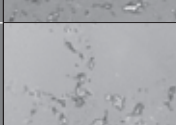
Polycrystalline Diamond Compacts (PCD), T-DIA



Diamond is the hardest known material on the earth. This is an advanced diamond based tool material where tiny diamond crystals are tightly sintered on the cemented carbide alloy base by means of a super high pressure and temperature process. When compared to the single crystal diamond, the hardness is slightly reduced but PCD is uniform in its structure. Additionally the heat resistant performance of a single crystal diamond can differ according to the crystal quality and orientation. PCD is therefore the optimum choice for cutting non-ferrous and non-metal materials.



Structure of T-DIA

Application	Grades	Microstructure	Grain size (µm)	Hardness (Hv)	Strength (GPa)	Features
 Non-ferrous	DX110		< 1	8500	1.8	Super fine grain T-DIA grade for superior surface finish. Excels in cutting edge sharpness and produces consistently high quality surface finish, resulting from gradual wear resistance.
	DX120		4.5	9000	1.8	For precision machining of non-ferrous metals and nonmetals where high quality surface finish is required. Features the finest grain structure in T-DIA series and excels in grindability and cutting edge sharpness.
	DX140		12.5	10000	1.7	Used for machining of non-ferrous metals and nonmetals. Composed of medium and fine grain diamond, provides moderate wear resistance and grindability.
	DX160		28	11000	1.6	Can be used for machining half sintered ceramics and cemented carbides, stones and non-ferrous metals. Mixed sintered compact composed of large and fine grain diamond. Grindability is superior to that of DX180.
	DX180		45	12000	1.5	Suitable for turning half sintered ceramics and cemented carbides. Features the highest purity levels with large grain PCD for excellent wear resistance.

Regrinding method

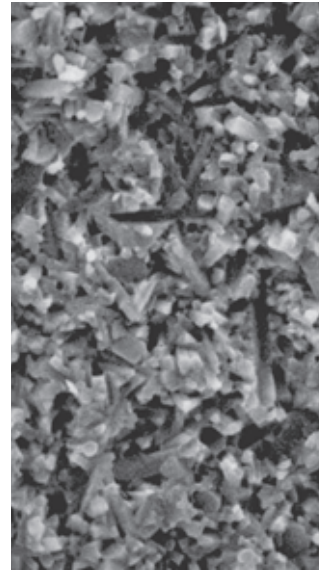
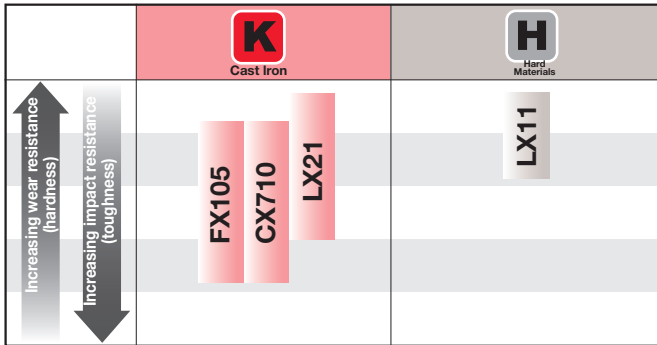
Wheel	Diamond wheel
Bond	Vitrified bond
Grain size	Roughing: #400 ~ 600 Finishing: Finer than #1000
Concentration	100 ~ 125
Grinding speed	900 ~ 1200 m/min

Ceramics

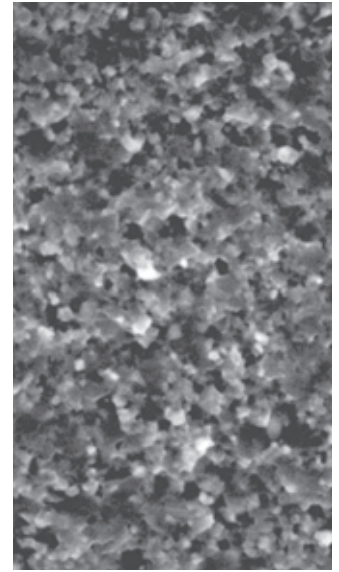
Ceramics

1

Grades





Microstructure of FX105



Microstructure of LX11

Tungaloy ceramics consist of high purity fine powder Oxides, Nitrides and Carbides. The fine and dense compacting ensures superior wear resistance, adhesion resistance, oxidation resistance and heat resistance.

These grades enable high speed finish to light machining, offering high accuracy and high quality surface finishes. Ceramic grades are classified into alumina base and silicon nitride based groups. These can be selected according to the application.

Application	Grade (Colour)	Specific gravity	Hardness (HRA)	Transverse rupture strength (GPa)	Fracture toughness $K_{1C}(MPa \cdot m^{1/2})$	Modulus of elasticity (GPa)	Features
	FX105	3.24	93.0	1.3	6.1	290	This silicon nitride based Ceramic is used for high speed cutting of cast irons. It has superior strength, toughness and thermal characteristics compared to Al_2O_3 based ceramics.
	Grey						
	CX710	3.20	92.9	1.1	6.3	290	
	Grey						Si ₃ N ₄ based ceramics for high speed cutting of cast irons. Higher toughness level and heat conductivity than the FX105 grade.
	LX21	4.24	94.0	0.8	4.3	370	Al ₂ O ₃ based Ceramics for continuous cutting of cast irons. By adding titanium carbide to alumina, its toughness is improved whilst maintaining excellent wear resistance.
	Black						
	LX11	4.35	94.0	0.9	4.3	400	Al ₂ O ₃ based ceramics used for continuous turning of ferrous hard materials. Improved strength and toughness with a fine microstructure consisting of Alumina and Titanium Carbonitride.
	Gold						

Uncoated Cemented Carbides

Uncoated Cemented Carbides (Tungaloy Cutting Tool Grades)

Tungaloy's cemented carbides are sintered with Tungsten carbide WC, Titanium carbide TiC and Co binder phase. Tungaloy matches the original unique grades with the application to ensure stable performance and complete quality control. Tungaloy offers superior mechanical and thermal wear resistance when compared with high speed tool steel.



Microstructure of **KS05F**

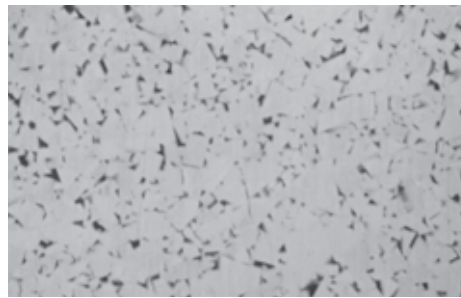
Application	ISO Application code	Grades	Specific gravity	Hardness (HRA)	Transverse rupture strength (GPa)	Compression strength (GPa)	Modulus of elasticity (GPa)	Thermal expansion coefficient (x10 ⁻⁶ /K)	Thermal conductivity (W/(m·K))
P Steel	P30	UX30	12.6	91.1	2.3	4.9	490	5.8	38
M Stainless	M30	UX30	12.6	91.1	2.3	4.9	490	5.8	38
K Cast Iron	K05	TH03	13.8	93.8	1.9	6.2	590	5.3	99
	K10	TH10	14.7	92.0	2.4	6.1	620	5.4	97
	K20	KS20	14.5	90.8	2.8	6.1	620	5.4	96
N Non-ferrous	N05	KS05F	15.0	93.0	2.9	5.9	640	5.4	90
	N10	TH10	14.7	92.0	2.4	6.1	620	5.4	97
	N15	KS15F	14.4	91.5	3.0	4.4	580	5.6	79
S Superalloys	S10	TH10	14.7	92.0	2.4	6.1	620	5.4	97
	S20	KS20	14.5	90.8	2.8	6.1	620	5.4	96
H Hard Materials	H05	TH03	13.8	93.8	1.9	6.2	590	5.3	99
	H10	TH10	14.7	92.0	2.4	6.1	620	5.4	97

Ultra fine Grain Cemented Carbides

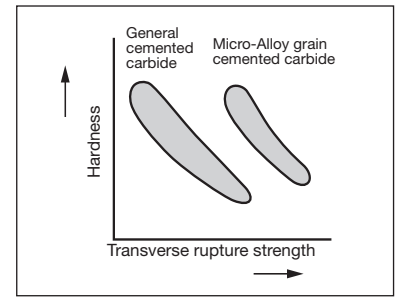
Micro-Alloy



Microstructure of **EM10** 1 μm



Microstructure of **F** 1 μm



Mechanical properties of ultra-fine grain cemented carbide

Micro-Alloy is characterized by the WC hard phase (major component) which is extremely fine (average particle size 1 μm or less) when compared with normal cemented carbide alloys. This ensures higher strength (toughness) than general carbide alloys of the same hardness. This alloy demonstrates high performance

within the application range of high speed tool steel. This is appropriate for cutting tools when the workpiece is too small to achieve the desired cutting speed or for a small diameter endmill or drill.

Grades	Specific gravity	Hardness (HRA)	Transverse rupture strength (GPa)	Compression strength (GPa)	Modulus of elasticity (GPa)	Thermal expansion coefficient (X10 ⁻⁶ /K)	Thermal conductivity (W/(m·K))	Features
F	14.9	93.4	2.5	6.9	640	5.4	85	Tungaloy's hardest Micro-Alloy delivers excellent wear resistance and cutting edge toughness. Suitable for low speed, small depths of cut and lowfeed machining. Mainly used for small tools such as on automatic turning centers.
EM10	14.0	91.5	3.4	6.4	550	5.7	70	Used for solid endmills and other milling cutters. Provides superior chipping resistance with its micro grain.