Precision machining: giving toolmakers a competitive edge

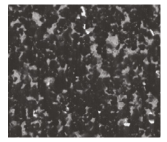
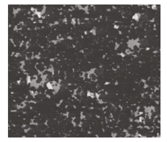
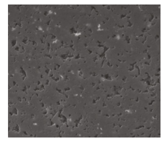
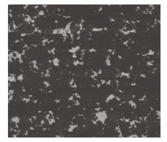
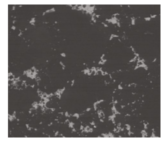
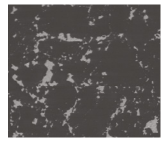
PCD, PCBN, CVD diamond and single crystal diamond solutions

Competitive advantage through innovation

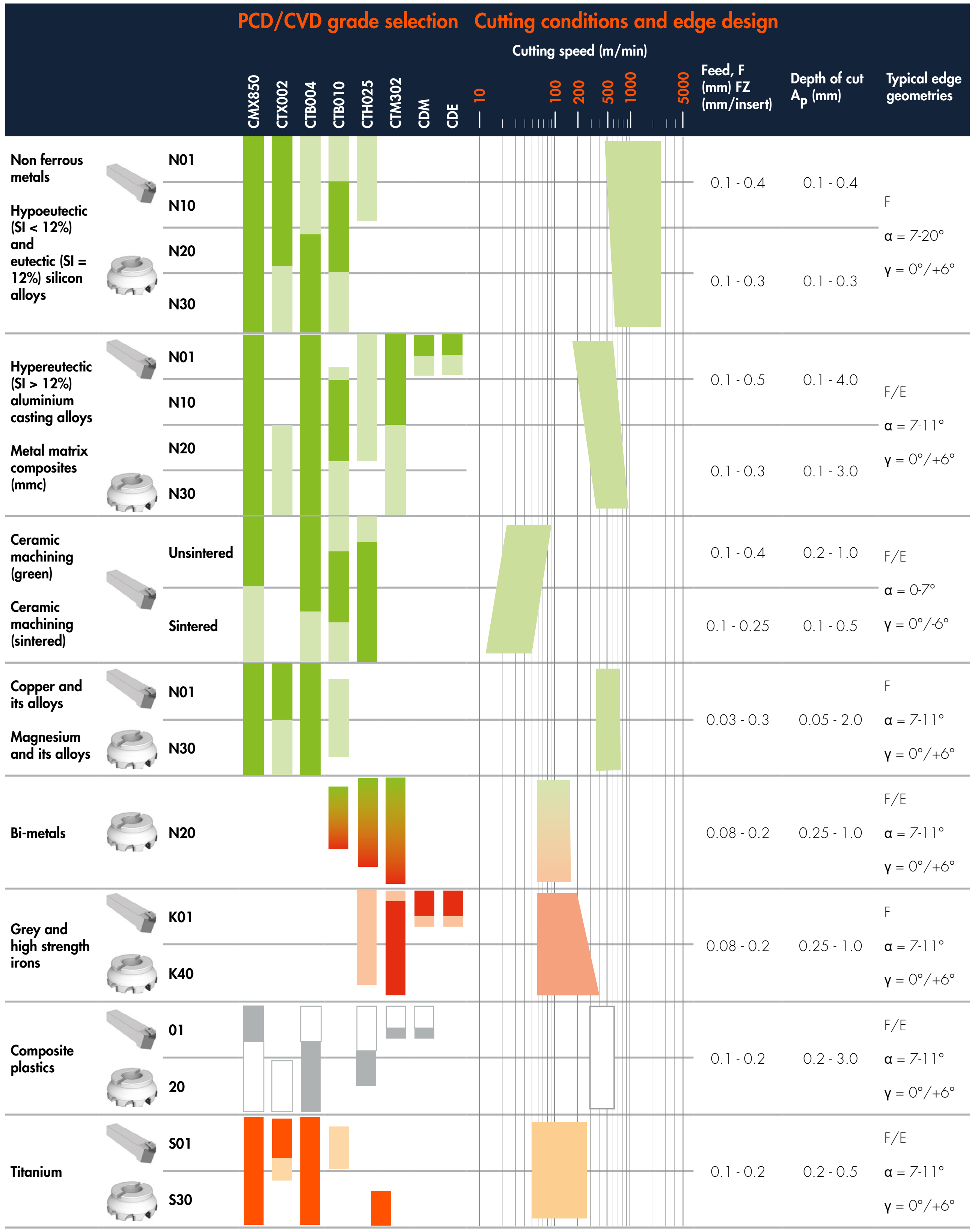
At Element Six, we work in collaboration with our customers to develop cutting-edge solutions and materials. We have a proven commitment and capacity to deliver innovative polycrystalline diamond (PCD), polycrystalline cubic boron nitride (PCBN), tungsten carbide (WC), chemical vapour deposition (CVD) and single crystal diamond solutions that enable next generation performance in metalworking applications.

Our state-of-the-art Global Innovation Centre (GIC) located near Oxford, UK, gives us unique access to first-class research and development facilities that enable us to develop and enhance our innovative supermaterials solutions. We strive to continually find new ways to transform the extreme properties of our synthetic diamond and tungsten carbide solutions, to deliver next generation performance.

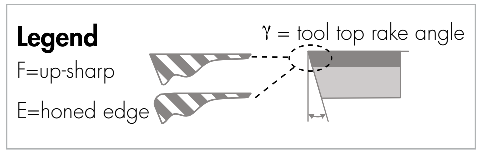
PCD grades and characteristics

Grade	Applications	Characteristics	Microstructure
CMX850	Ideal for milling and rough cutting of aluminium alloys where extreme chip resistance is required, also for machining titanium and composites	Sub-micron grain size. CMX850's ultra-fine grain structure is suitable for applications where mirror finishes are required due to its extreme edge sharpness/retention	
CTX002	Ideal for profile routers and thread cutting tools, can also be used in wear part applications	2 μm average grain size with increased cobalt for ease of processing. CTX002 is ideal for complex tools where excessive processing is required	
CTB004	Ideal for cutting of aluminium alloys where high surface finish is required alongside higher wear resistance	4 μm average grain size. CTB004's 4-micron fine grain structure offers the optimum balance between tool performance and resistance to abrasions and chips	
CTB010	The ideal grade where roughing and finishing are performed with a single tool. Highly recommended for low to medium content aluminium alloys	10 μm average grain size. CTB010 is the workhorse PCD grade, ideal for many applications where a good balance of toughness and wear resistance is required	
CTH025	Successful in machining of high silicon aluminium alloys, metal matrix composites (MMC), tungsten carbides and ceramics	Average grain size of 25 μm. CTH025 offers optimum wear resistance for abrasive machining conditions	
CTM302	Application areas include MMC, high silicon aluminium alloys, high strength cast irons and bi-metal applications. Excellent abrasion resistance and good thermal stability	A multi-modal PCD with a combination of 2 μm to 30 μm grain sizes, giving CTM302 excellent wear resistance, edge strength and edge quality	

PCD and CVD application guide



Work material characteristics and to a lesser extent, cutting parameters, determine the demands placed on the cutting tool and hence, the optimum balance of tool material properties. Knowledge of the application, including workpiece composition, facilitates selection of the optimum grade and selection of the correct tool geometry. Often, work material composition and machining parameters (vc, f, ap) go hand in hand. It is possible, therefore, only to provide a typical range of values for each parameter.

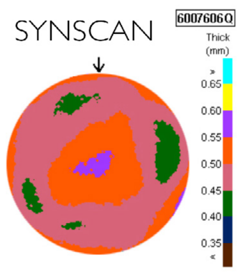


PCD product range

70 mm metalworking disc product range

Grade	Standard PCD layer	Overall height (+/- 0.05 mm) 0.8	1.0	1.2	1.4	1.6	2.0	3.18	8.0	PCD layer thickness (mm)
CMX850	0.3 mm		✓	✓		✓				0.20 to 0.45
	0.5 mm		✓			✓	✓			0.35 to 0.65
	1.0 mm							✓		0.83 to 1.17
CTX002	0.5 mm		✓			✓		✓		0.40 to 0.60
CTB004	0.3 mm					✓				0.20 to 0.45
	0.5 mm					✓				0.35 to 0.65
CTB010	0.3 mm	✓	✓	✓	✓	✓		✓		0.20 to 0.45
	0.5 mm		✓	✓		✓	✓	✓		0.40 to 0.60
	0.7 mm					✓		✓	✓	0.53 to 0.88
	1.0 mm							✓		0.83 to 1.17
CTH025	0.5 mm					✓	✓	✓		0.40 to 0.60
CTM302	0.5 mm					✓	✓			0.40 to 0.60
	0.7 mm							✓		0.53 to 0.88
	1.5 mm							✓	✓	1.35 to 1.80
PSX850 (wafer)	0.8 mm	✓								0.6 to 1.0

Tighter overall height tolerance +/- 0.025 mm available for selected CMX & CTB discs



PCD layer profile

Element Six supplies a unique ultrasonic scan depicting the PCD layer profile. The PCD scan indicates a 'North Point', which matches a 'North Point' laser marked on the disc, allowing users to optimise the cutting areas.

Choosing the right PCD grades

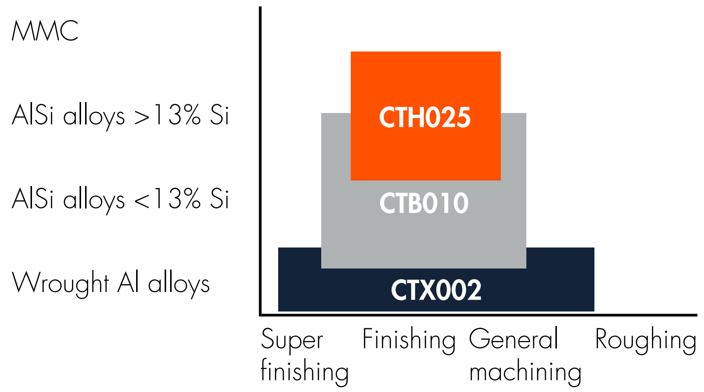
PCD grades for wider usage
Improvements in synthesis techniques coupled with new product development capability have generated two PCD grades, CMX850 and CTM302, that possess the properties to meet all known tool performance challenges. CTM302 provides the ultimate abrasion resistance while CMX850 provides the optimum balance of processability and performance.

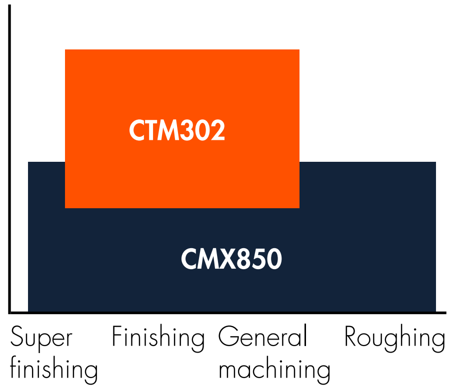
4 main factors to consider when selecting PCD grades

1. Chip resistance
2. Abrasion resistance
3. Electro-discharge characteristics
4. Grindability characteristics

1–2: Behaviour in application
3–4: Processing characteristics

Workpiece abrasivity





Materials and machining
Element Six PCD grades provide the ideal balance between behaviour in application and processing characteristics to meet the requirements of the cutting or grinding operation.

		Behaviour in application		Processing characteristics	
Grade	**Grain size**	**Chip resistance**	**Abrasion resistance**	**Electro-discharge machining**	**Grindability**
CMX850	0.85-1 µm	■■■■■■■■■■	■■■■■■■□□□	■■■■■■■■■■	■■■■■■■■■■
CTX002	2 µm	■■■■■■■■■□	■■■■■□□□□□	■■■■■■■■■■	■■■■■■■■■□
CTB004	4 µm	■■■■■■■■■□	■■■■■■■□□□	■■■■■■■■■□	■■■■■■■■■□
CTB010	10 µm	■■■■■■■■□□	■■■■■■■■□□	■■■■■■■■□□	■■■■■■□□□□
CTH025	25 µm	■■■■■■■□□□	■■■■■■■■■□	■■■■■■■■□□	■■■■■□□□□□
CTM302	2-30 µm	■■■■■■■□□□	■■■■■■■■■■	■■■■■■■□□□	■■■■■□□□□□

Aero-Dianamics™ PCD round tool blanks

Grades and characteristics

Grade	Applications	Grain sizes	Characteristics
A3MH helix	Milling	Fine	• Helical geometry results in lower tool forces and better chip evacuation • High thermal conductivity and low coefficient of friction result in less heat build-up and adhesion • Sharp PCD edges cut fibres cleanly
A2DS chevron	Drilling	Coarse	• Tool life extended by 10 times compared to carbide drills • Half round disc formats available • EDM segments available and cut to order
A3DP planar	Drilling	Fine	• Almost infinite flexibility in drill point geometry • Tool life more than 10 times longer than tungsten carbide drills • Large rake angles possible for lower tool forces

Setting tool design free

Our Aero-Dianamics™ range of round tool blanks provides tool designers with the ability to create entirely new PCD tool geometries that break through existing barriers in PCD tool design, with:

- Freedom of design in flute profiles
- Multiple flutes
- Limitless flute angles and orientations

Aero-Dianamics™ - transforming composite tooling
These next generation composite tooling solutions entirely replace the need for coated tungsten carbide tools for fabricating composite components.

3D tungsten carbide tool

2D PCD two flute tool

3D PCD multi flute tool

PCD backed discs

PCD round tool blanks

Revolutionary A3MH blanks for milling tools
Our Aero-Dianamics™ milling range enables significant improvements in productivity over coated tungsten carbide tools:

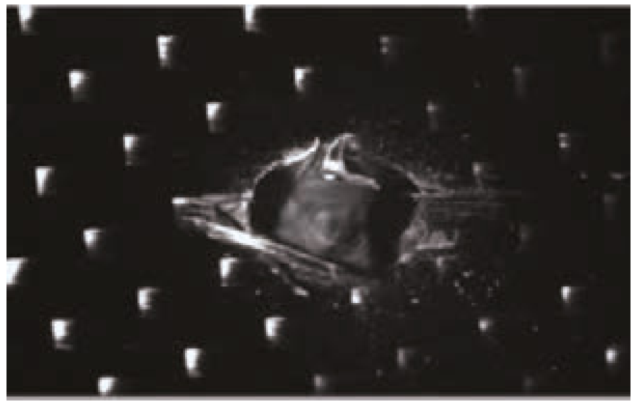
- 3-12 x faster machining speeds
- Lower cutting forces
- Improved tool evacuation

A3DP planar blanks for complex drill geometries
Our Aero-Dianamics™ drilling range enables significant improvements in productivity over coated tungsten carbide tools:

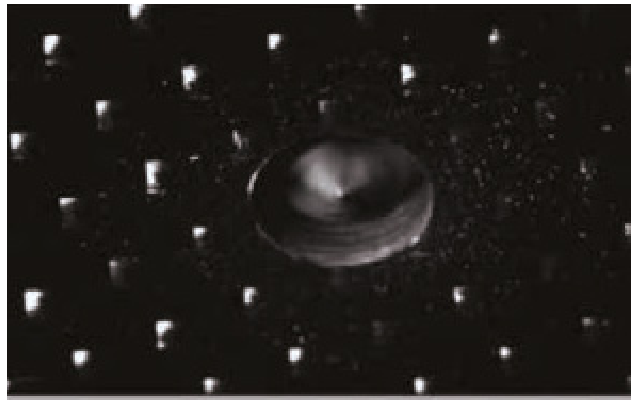
- Significantly increased wear resistance over coated carbide drills
- 10 x longer tool life in drilling CFRP
- 2 x speed of drilling CFRP/ Al
- Consistent performance over tool life
- Superior workpiece finish

Achieving a superior edge quality and improved productivity

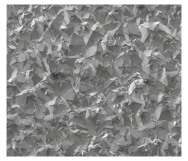
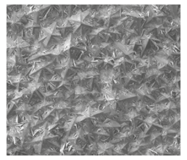
Tungsten carbide
Hole surface quality on CFRP test piece



A3DP planar
Drills faster and provides a consistently clean finish



CVD diamond grades and characteristics

Grade	Applications	Characteristics	Microstructure
CDE PL	Wide-ranging laser cut shape and size for precision machining of MMC, CFRP and woodworking materials	An electrically conducting grade of CVD for cutting tool applications, that allows customers to use EDM machining or EDG grinding within their tooling processing	
CDM PL	Wide-ranging laser cut shape and size for precision machining of MMC and CFRP materials	A general purpose mechanical grade for cutting tools	

Benefits of Element Six CVD diamond: CVDite

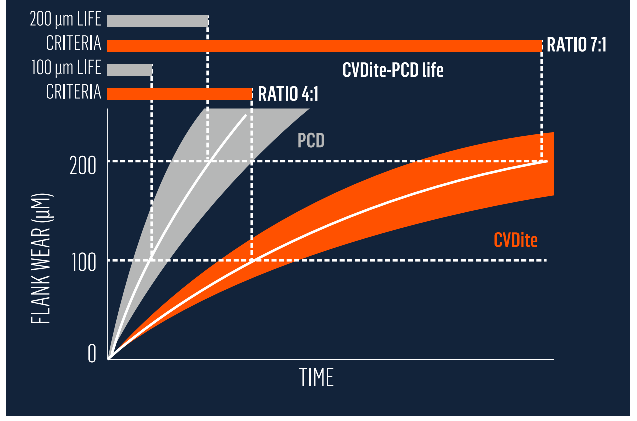
- Higher wear resistance than medium PCD grades
- Excellent thermal stability and thermal conductivity
- Binder-free so is extremely chemically inert
- Extreme abrasion resistance
- Ideal for applications where higher temperature operating conditions are seen
- High purity

		Behaviour in application		Processing characteristics	
Grade	**Grain size**	**Chip resistance**	**Abrasion resistance**	**Electro-discharge machinability**	**Grindability**
CDE	60-80 µm				
CDM	60-80 µm			n/a	
CTB010	10 µm				

Choosing the right CVDite grade
Element Six's CVDite is most commonly suited to the machining of non-ferrous materials where high abrasion resistance is required. CVDite has high thermal stability and more wear resistance than PCD.

Due to its high abrasion resistance and low coefficient of sliding friction, the CVDite range is also ideal for uses in lubricated and dry wear part applications.

CVDite-PCD life
Abrasion resistance depending on application



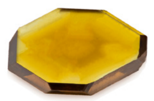
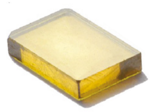
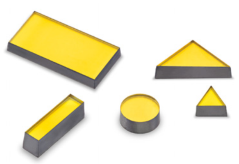
Single crystal diamond grades & characteristics

Single crystal MCC

Applications	Characteristics
MCC is available in 2pt and 4pt orientations. Ultra-precision machining acrylics, copper, germanium. Generates very high surface finishes.	Produced under ultra-high purity conditions, giving it a colourless appearance. It offers a combination of extreme wear resistance, excellent chip resistance and high thermal conductivity combined with low thermal expansion. 

Monodite

Applications	Characteristics
Primary applications for Monodite are engineered cutting tools and wear parts for super finishing, burnishing, wire guides and ultra-precision machining.	Manufactured using a proprietary high pressure, high-temperature synthesis process and pale yellow in colour. The result is a single crystal synthetic diamond that is highly consistent and has predictable properties and behaviours, offering an unparalleled choice of synthetic diamond required for cutting tool applications.

Product range	Key product features	Primary application	
MSP	Individually priced, large edge length plates	Long edge length requirements (e.g. profile tools)	
MLP	Long edge length, polished near-rectangular logs	Long edge length requirements (e.g. controlled waviness tools)	
MT L (rectangular) **MT T (triangular)** **MT R (round)**	Highly engineered polished plates, laser cut to specific dimensions	Engineered cutting tools and wear parts for superfinishing, burnishing and wire guides Convenient cut shapes	
MXP	Near-square plates having guaranteed inscribed square	Superfinishing and precision machining (e.g. precious metals and MMC materials)	
MWS PT4	Near-round plates having guaranteed inscribed circle		
MWS PT2	Engineered polished plates benefiting from 2pt orientation		

Benefits of Element Six single crystal

- Highly consistent, predictable properties and behaviour
- Unrivalled surface finish and component accuracy performance unattainable with conventional polycrystalline tool materials
- Surface roughness values are of the order of nanometres and form accuracies are commonly sub-micron
- Facilitates the manufacture of cutting tools with edge roughness and sharpness values in the order of 10 nm and form accuracies in the micrometre range

PCBN standard product range available

Other sizes and formats available on request

PCBN WC-backed disc product range

Grade	Outside disc diameter (mm)	PCBN usable area (mm)	PCBN layer (mm)	Overall thickness (+/- 0.05 mm)			
				1.6	2.38	3.18	4.76
DCN450 **DCC500** **DCX650** **DBW85** **DBS900**	75	70	0.7	✓	✓	✓	✓

PCBN solid low-content product range

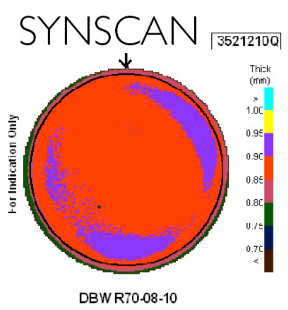
Grade	Conductive/ non-conductive	Overall thickness (+/- 0.05 mm)							Outside disc diameter (mm)	PCBN usable area (mm)
		1.0	1.6	2.38	3.18	4.76	6.35	7.94		
DSN450	Conductive	✓	✓	✓	✓	✓	✓	✓	95	90
DSC500		✓	✓	✓	✓	✓	✓	✓		
DHA650		✓	✓	✓	✓	✓			Only supplied as cut product	

PCBN solid high-content product range

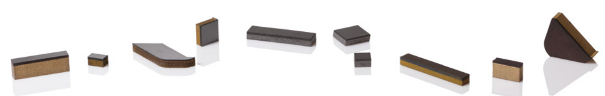
Grade	Conductive/ non-conductive	Overall thickness (+/- 0.13 mm)			Outside disc diameter (mm)	PCBN usable area (mm)
		3.18	4.76	6.35		
AMB90	Non-conductive	✓	✓	✓	99	97
AMK90		✓	✓			
ZAA		✓	✓			

PCBN synscan
Element Six supplies a unique ultrasonic scan depicting the PCBN layer profile.

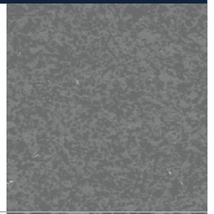
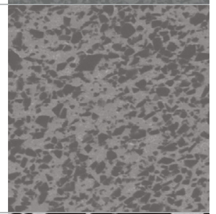
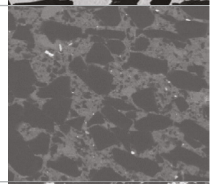
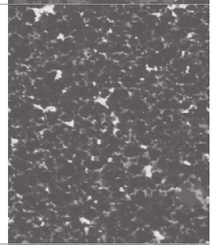
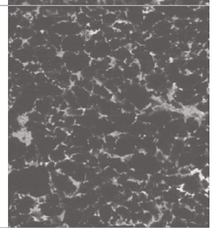
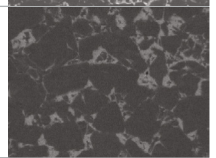
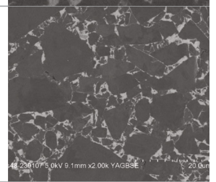
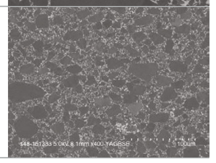
The PCBN scan indicates a 'North Point', which matches a 'North Point' laser marked on the disc, allowing users to optimise the cutting areas.



Our unique scalable segmentation service
Our fast, high quality and cost-effective segmentation service is supported by the largest laser cutting and electrical discharge machinery (EDM) capacity of all abrasive manufacturers. We provide both standard and complex bespoke geometries.



PCBN grades and characteristics

Grade	Applications	Characteristics	Microstructure
DCN450 (WC-backed) **DSN450 (solid)**	For moderately interrupted hard turning and finish hard milling as well as high speed continuous turning. Its resistance to crater wear is among the highest in the market. With one of the finest structures of all commercial grades, DCN450 provides for sub-µm surface roughness	• Approximately 45% CBN • Sub-µm CBN grain size • TiCN binder	
DCC500 (WC-backed) **DSC500 (solid)**	For continuously and lightly interrupted cutting of the majority of automotive steels. Excellent abrasion resistance makes it the ideal choice for cold work tool steels and certain valve seat alloys. Also recommended for finishing abrasive high strength cast irons	• Approximately 50% CBN • 1.5 µm average grain size • Principally TiC binder	
DHA650	For moderately to heavily interrupted hard turning and finish hard milling in both dry and wet conditions. Suitable for both conventional and elevated machining speeds	• Approximately 65% CBN • Binder phase includes TiC/TiN	
DCX650	For moderately to heavily interrupted turning of all common hardened steels. Provides an excellent balance of toughness, and crater and flank wear resistance. Also used for plunge machining of valve seat rings	• Approximately 65% CBN • Average 3 µm proprietary multi-modal grain size • TiN binder	
DBW85	For applications such as grey iron fine boring and valve seat machining, due to excellent strength and abrasion resistance. Ideal for heavily interrupted cutting of all hard and abrasive work piece materials, including powder metallurgy components. Proven performance also in hard fine milling applications	• Approximately 85% CBN • 2 µm average grain size • AlWCoB binder for extreme chip resistance	
DBS900	Ideal for applications where longer tool life is required. Excels in interrupted machining of grey and hard cast irons, hardened steel milling and in the machining of the majority of valve seat ring alloys. Excellent first choice grade for the majority of ferrous powder metals	• Approximately 90% CBN • 4 µm average grain size • Novel binder system to provide the ultimate abrasion and chip resistance	
AMB90	For turning and milling of grey and hard cast irons and heavy turning of hardened steels; including components such as brake discs, pump bodies and impellers and large rolls	• Approximately 90% CBN • Binder phase includes aluminium nitrides and borides	
AMK90	For similar application areas as AMB90, but providing higher wear resistance. Exhibits particularly high performance in abrasive work materials such as high chrome cast irons. Usable edges on both faces of insert	• Approximately 90% CBN • Binder phase includes aluminium nitrides and borides	
ZAA	A value-orientated grade for turning of grey cast iron, including components such as brake discs and pump bodies	• Approximately 90% CBN • Binder phase includes aluminium nitrides and borides	

Supporting the switch to higher performing solid PCBN

Element Six's low-content solid PCBN grades, DSN450 and DSC500, offer significant advantages over their WC-backed PCBN equivalents. Their uniform and self-supporting structures significantly increase tool life and provide unique opportunities for innovation in tool design giving toolmakers a technical and commercial edge.

PureCut™ grade DHA650 is only offered in solid PCBN format and shares the same benefits as DSN450 and DSC500.

Solid DSN450 WC ← Backed DCN450
Solid DSC500 WC ← Backed DCC500

Discovering competitive advantage with solid PCBN
With an identical structure, it has never been easier to make the switch from WC-backed PCBN. The benefits of our low-content solid PCBN grades, DSN450 and DSC500, include:

- Highly adaptable and fully conductive
- Discs can be cut using EDM wire machines and configured into many shapes and geometries, offering greater flexibility in design to differentiate product lines
- Can be brazed directly onto tool substrates through advances in active brazing capabilities, reducing production costs
- Free of bi-metal stress, reducing instances of chipping and cracking during brazing
- Can be supplied at any thickness between 1.0 mm - 10.0 mm

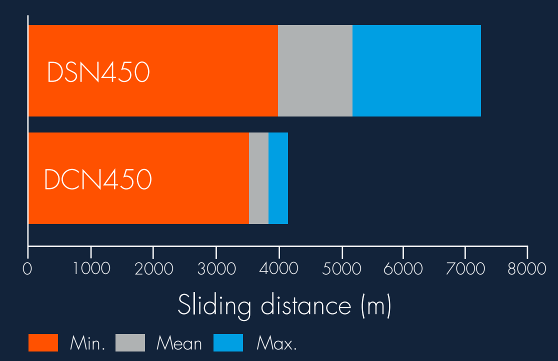
Proven performance
In our application tests under laboratory conditions in continuous turning of hardened steel 60 HR, our solid PCBN significantly extended mean tool life by:

- up to 40% with DSN450
- up to 35% with DSC500

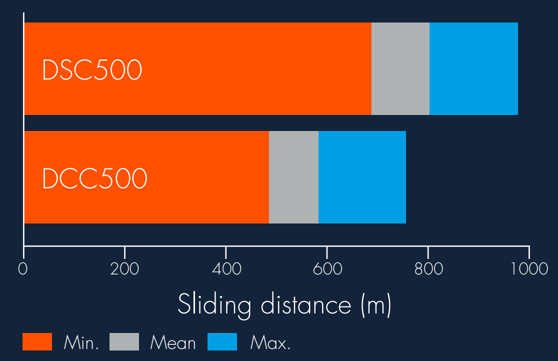
Extended tool life means better performance and reduced costs for end users.

Sliding distance results in continuous machining of hardened steel 60 HRC (SAE620)

Solid PCBN (DSN450) vs. WC-backed PCBN (DCN450)

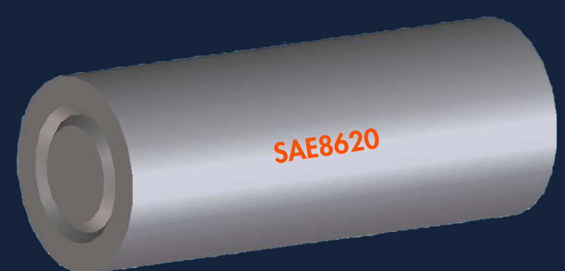


Solid PCBN (DSC500) vs. WC-backed PCBN (DCC500)



Test conditions

Cutting speed:	200 m/min
Feed rate:	0.1 mm/rev
Depth of cut:	0.15 mm
Failure mode:	Edge chipping



PCBN application guide

Selecting products and grades for your applications

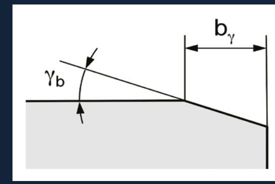
- Due to the very large number of unique applications, it is possible only to make general recommendations
- Significant improvements in tool performance should be possible through further optimisation
- ISO513's colour-coded classification of cutting tool applications has been used here to indicate the intended application area for cutting tool materials
- Deeper colour bars indicate preferred grades
- Lighter colour bars indicate other grades which may be preferable in specific circumstances

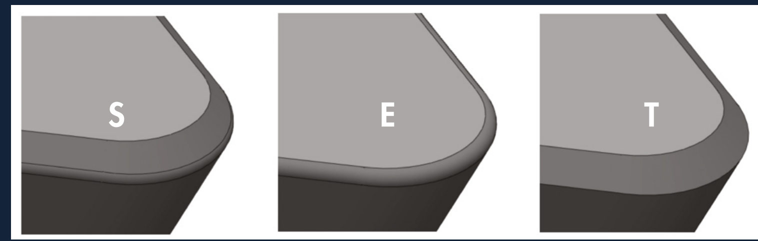
		Grade recommendations									Cutting conditions						Edge geometry guide			
		DCN450/DSN450	DCC500/DSC500	DHA650	DCX650	DBS900	DBW85	AMB90	AMK90	ZAA	Cutting speed, V_c (m/min) [8, 16]		Feed, f (mm) [3, 4, 7]		Depth of cut, ap (mm) [4, 5, 7]		Champfer angle, γ_b	Champfer width, $b\gamma$ (mm)	Edge radius, r_β (µm)	Nose radius, r_ε (mm) [6]
											Min	Max	Min	Max	Min	Max	Recommended ranges			
Hardened steels	H01										130	210	-	0.5	-	0.5	15 - 25	0.1-0.2	5-10	0.4-1.6
	H10										100	170	-	0.5	-	0.3	20 - 35	0.1-0.2	5-10	0.4-1.6
	H20										100	160	-	0.5	-	0.3	25 - 35	0.1-0.2	10-30	0.4-3.2
	H30 Hard milling										100	190	-	0.5	-	0.3	25 - 35	0.1-0.2	10-30	0.4-3.2
Cast irons[1, 2]	Grey iron - K01										600	2500	0.1	1	0.1	2	15 - 25	0.2 - 1.0	- 20	- 3.2
	Grey iron - K10[12]																			
	Grey iron - K20[12]												0.2	2	0.5	5				
	Grey iron - K30																			
	AD[9] - K01										150	500	0.15	0.5	0.15	0.5	15 -	0.1 -	10 -	0.8 -
	ADI - K10																			
	ADI - K20 - K30										200	400	0.2	0.4	0.2	0.4	25	0.3	20	1.6
	Nodular iron and CGI[10, 11]										150	350	0.1	1	0.2	2	As for ADI			
	White and chrome irons - K10										50	80	0.1	0.5	0.2	2	20 -	0.2 -	20 -	1.6 -
	White and chrome irons - K20-K30										50	100	0.2	2	1	3	30	1.0	30	> 9.0
	Ferrous powder metals < 300 HV										-	350	0.1	0.5	-	1.0	0. - 20	-0.2	-15	-1.6
	(Excl. VSR[13]) < 750 HV										-	250	0.1	0.3	-	1.0	15 - 35	-0.2	-30	-1.6
Valve seat rings	< 350 HV: Plunging										50	150	0.02	0.05	NA	NA	10 -	0.1 -	0 -	NA
	< 350 HV: Turning										50	180	0.05	0.2	0.1	0.5	30	0.2	20	- 1.6
	< 350 HV: Plunging										50	150	0.02	0.05	NA	NA	15 -	0.1 -	10 -	NA
	< 350 HV: Turning										50	180	0.05	0.2	0.1	0.5	25	0.2	30	- 1.6
Super-alloys	NI-base: S10[14, 15]										150	400	-	0.3	-	0.5	0 - 20	0 - 0.3	20 - 40	1.6 - 3.2
	NI-base: S20 - S30										100	150				1.0				
	CO-base: S10										50	200				0.5	0 - 20	0 - 0.3		
	CO-base: S20 - S30										50	100				1.0				

ISO1832 prescribes several edge conditions, three of which are most commonly applied to PCBN indexable inserts.

Indexable inserts made in accordance with ISO16462 are obliged to indicate the edge condition, expressed as a letter symbol (e.g. S, T, E). Five digits indicate the T-land dimensions. Hone dimensions are not indicated in ISO designations.

Example: CNGA120408 S 015 30
- Edge shape (S, E, T, etc.)
- Chamfer width, bγ, in 1/100th mm
- Chamfer angle, γb in degrees





Chamfer and hone
- Stronger than T-land - First choice for HPT
- Feed must be greater than hone size

Honed edge
- Hone size is more difficult to control than chamfers, but popular for HRSAs

Chamfer / T-land
- The larger the T-land width and angle, the higher the forces

1. For cast iron and roll machining, solid grades AMB90 and AMK90 are more economical, while DBW85 and DBS900 provide for a superior finish and greater edge strength; e.g. for positive inserts or a heavily interrupted cut
2. Performance for grey irons can vary depending on casting quality and degree of ageing
3. The feed is selected with nose radius according to surface roughness requirements
4. The depth of cut is typically determined by stock removal allowance (oversize) prior to hardening of the component
5. While there is no strict minimum feed or depth of cut, excessively low values (e.g., < 0.02 mm) may result in adverse machining vibrations
6. While a larger nose radius provides a stronger edge, excessively large values may result in adverse machining vibrations
7. For braze-tipped tools, the segment area (in mm²) should be > 100*f*ap so as to securely bear the cutting load
8. Indicated cutting speeds for hard steels are primarily for case hardened steels. For higher alloy steels, it may be necessary to reduce the cutting speed to achieve the required tool life
9. ADI: Austempered Ductile Iron
10. CGI: Compacted Graphite Iron (also known as vermicular iron)
11. Compacted graphite cast irons are also successfully machined with PCD - we recommend CTM302. The cutting speed for PCD should be 200 +/- 50 m/min
12. Milling of grey cast irons is typically done within the upper portion of the speed range indicated
13. VSR: Valve Seat Rings
14. Super-alloys - also known as heat resistant superalloys (HRSA) - consist of a very large range of compositions and properties, resulting in very different machining characteristics
15. For HRSAs it is preferable to use round inserts. It is also advisable to assess the use of un-chamfered, but honed, cutting edge geometries
16. PureCut™ grades are designed to operate at higher speeds than E6's other grades. Please contact E6 technical support for further details

Reduce downtime and improve productivity by converting to integral inserts

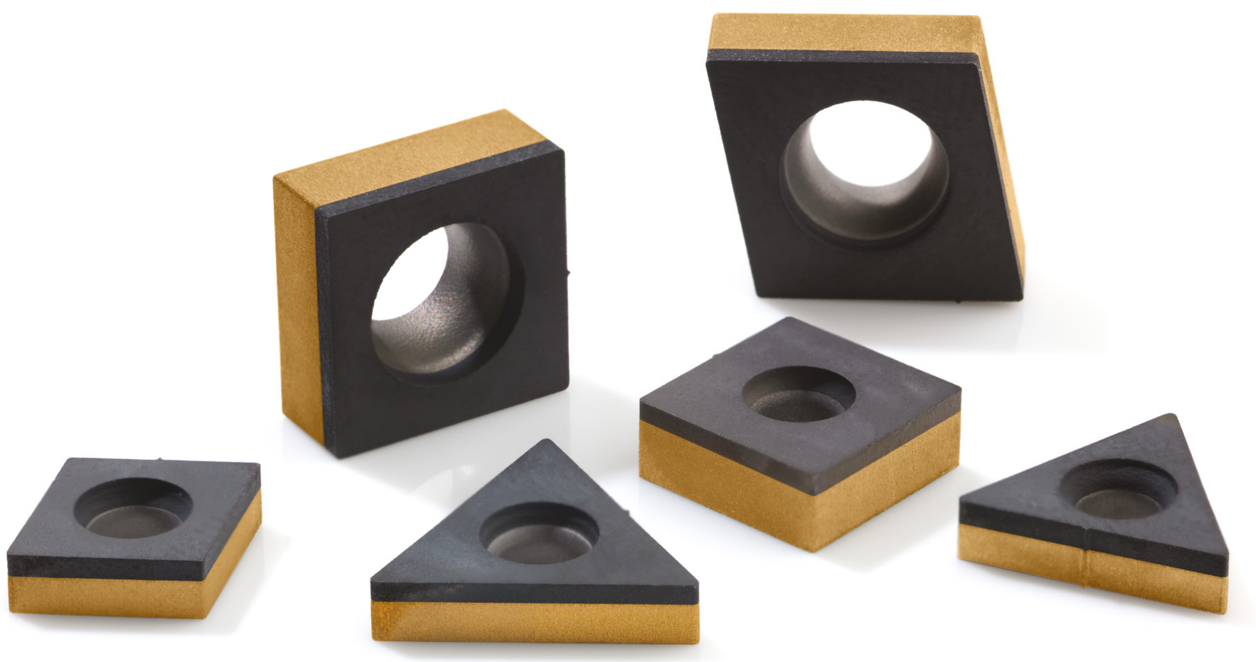
With increasing pressure from competitors and end users, tool manufacturers are always looking for ways to simplify the manufacturing process, raise productivity and reduce costs. By switching from brazed inserts to centre-lock full-face inserts, these aspirations can become a reality.

High performance components
Centre-lock full-face PCBN inserts provide for easily manufactured multi-cornered tools with a number of benefits:

- A more robust cutting component than a conventional brazed tool
- Greater reliability in interrupted cutting applications
- Elimination of the braze joint allowing higher temperature coatings to be applied
- Reduced insert failure risks and improved production continuity
- Longer cutting edges that enable productivity improvements in application; either through the use of larger depths of cut or plunge-type machining operations
- High and low CBN content configurations

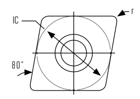
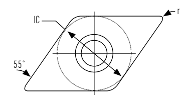
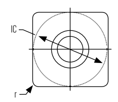
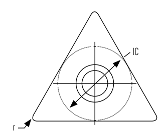
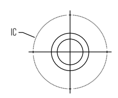
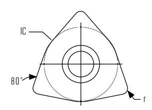
The benefits of using centre-lock full-face inserts

- Eliminate pocketing and brazing procedures
- Improved precision by eliminating brazing inaccuracies
- Reduce the amount of handling
- Cut the overall production cost per usable corner
- Apply higher temperature coatings
- Shorten the production pipeline by eliminating the need for:
    - carbide preparation
    - segment cleaning
    - brazing
    - after-brazing cleaning



Standard PCBN range available

Other sizes and formats available on request.

Insert shape	Insert style	Clearance	Tolerance class[1]	Hole style	Finished IC[2]	Insert thickness	Corner radius
	C	N	M	W	06 - 6.35	02 - 2.38	02
	80				09 - 9.52	T3 - 3.97	02
	D	N	M	W	07 - 6.35	02 - 2.38	02
	55				11 - 9.52	T3 - 3.97	02
	S	N	M	W	06 - 6.35	02 - 2.38	02
	90				09 - 9.52	T3 - 3.97	02
	T	N	M	W	09 - 5.56	02 - 2.38	02
	60				11 - 6.35	02 - 2.38	02
	R	N	M	W	06 - 6.35	03 - 3.18	02
	360				07 - 7.94	03 - 3.18	02
	W	N	M	W	06 - 9.52	03 - 3.18	02
	80						

IC - Inscribed Circle

1. Tolerance on overall thickness +/-0.05 and IC tolerance +/- 0.10 mm
2. Grinding allowances apply, IC diameters shown will be produced with a 0.3 mm grinding
3. All measurements are mm

PCBN grade availability
Centre-lock full-face PCBN inserts are available in all WC-backed PCBN grades.

End user benefits
Machine operators and engineering managers value the benefits of integral inserts over brazed inserts; the ability to switch from corner to corner means that maintaining production continuity is simply a matter of adjusting the insert. The longer cutting edges of an integral insert also enable plunge machining which can achieve valuable gains in productivity and reductions in both downtime and costs.

elementsix™

DE BEERS GROUP

Element Six is a global leader in the design, development and production of synthetic diamond and tungsten carbide supermaterials. Part of the De Beers Group, we employ over 1,900 people. Our primary manufacturing sites are located in the UK, Ireland, Germany, South Africa, and the US.

Since 1959, our focus has been on developing the diamond synthesis process to enable innovative synthetic diamond and tungsten carbide solutions. As well as being the planet's hardest material, diamond's extreme and diverse properties give it high tensile strength, chemical inertness, broad optical transmission and very high thermal conductivity.

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