Tungaloy
Member IMC Group

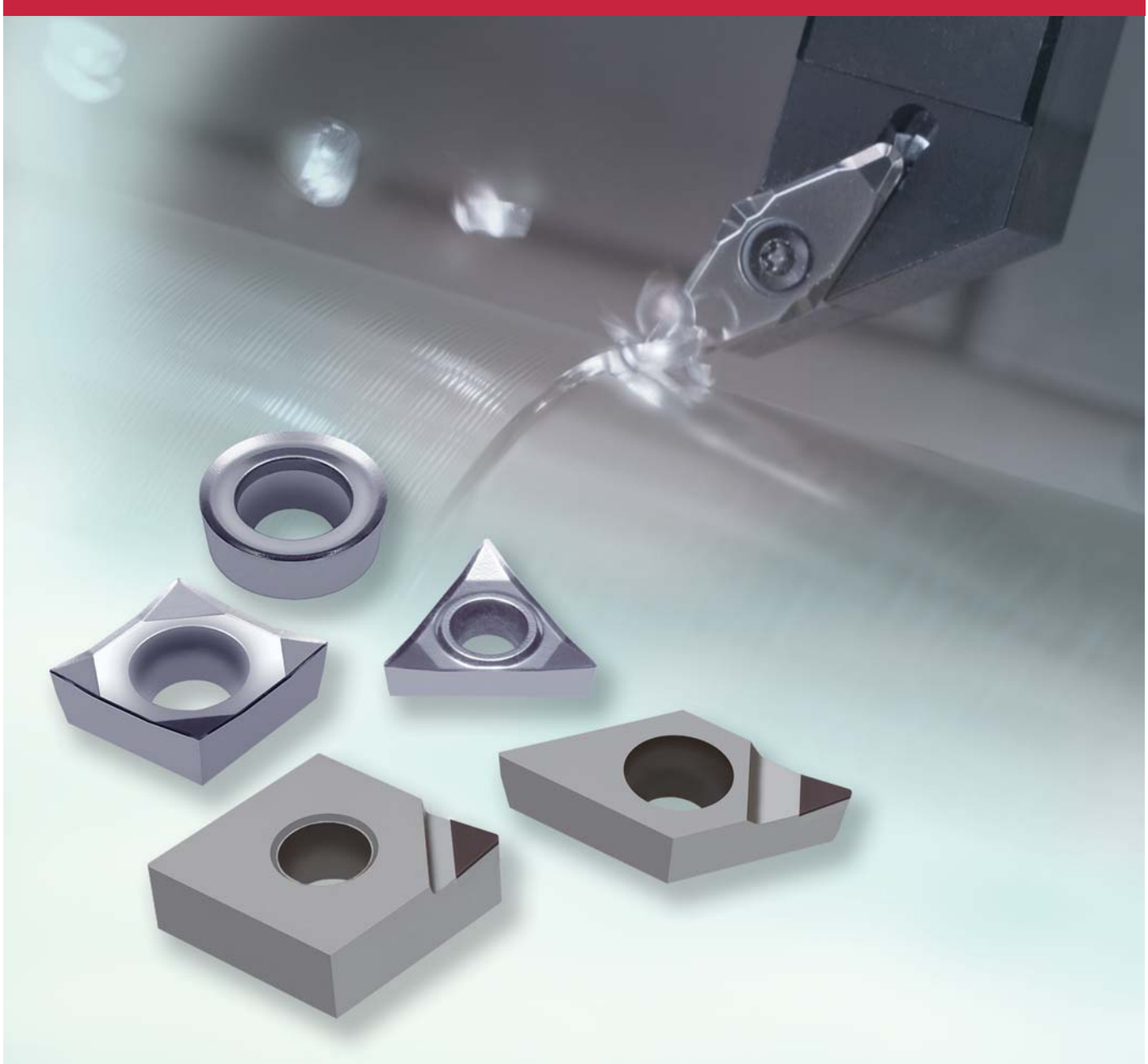
Keeping the Customer First

Tungaloy Report No. 351-E

TURNLINE TAC insert for turning aluminum

AL chipbreaker
T-DIA

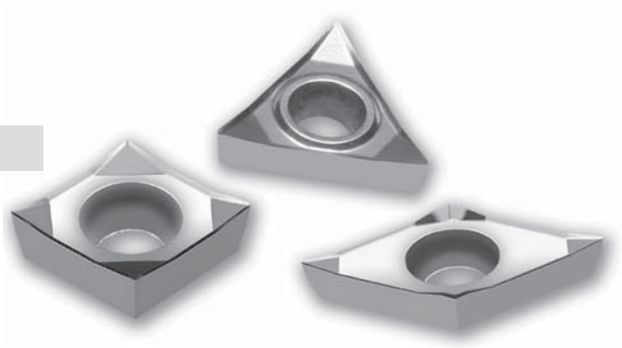
The ultimate solution for turning aluminum!!



AL chipbreaker

N
Non-ferrous

For turning aluminum alloy and non-ferrous metal



Features

Lapped surface

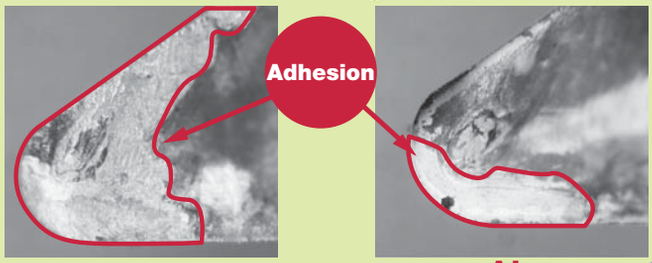
Enhanced adhesion resistance with the lapped rake face!!

Comparison of adhesion resistance

AL chipbreaker greatly prevents adhesion!

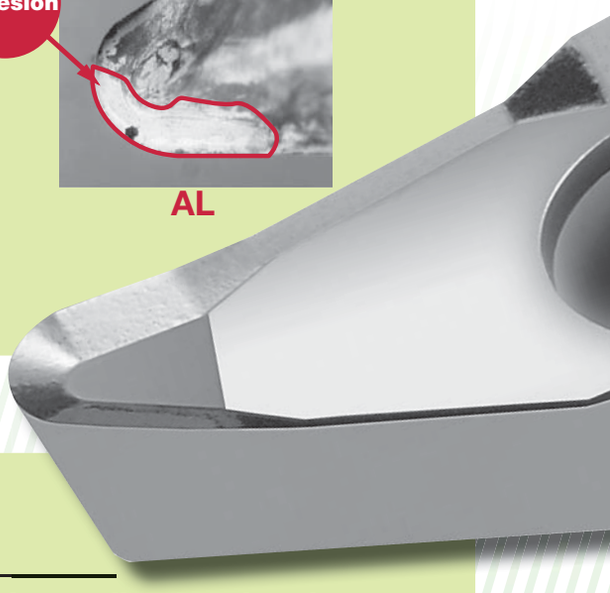
Cutting condition	
Work material:	AC4C (Si: 6.5 ~ 7.5%)
Insert:	VCGT160404-□□
Cutting speed:	*Vc* = 800 m/min
Depth of cut:	*ap* = 1 mm
Feed:	*f* = 0.15 mm/rev
Coolant:	Water soluble type

■ After 5 min. of machining



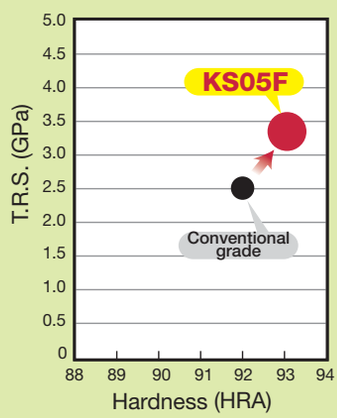
Competitor (without lapping)

AL



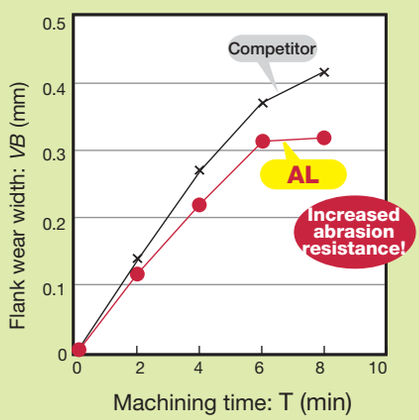
KS05F grade

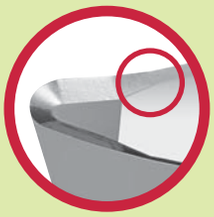
Increased wear resistance by adapting a fine grained cemented carbide!!



Comparison of wear resistance

Cutting condition	
Work material:	AC4C (Si: 6.5 ~ 7.5%)
Insert:	RCGT0803M0-□□
Cutting speed:	*Vc* = 1500 m/min
Depth of cut:	*ap* = 2.0 mm
Feed:	*f* = 0.4 mm/rev
Coolant:	Water soluble type



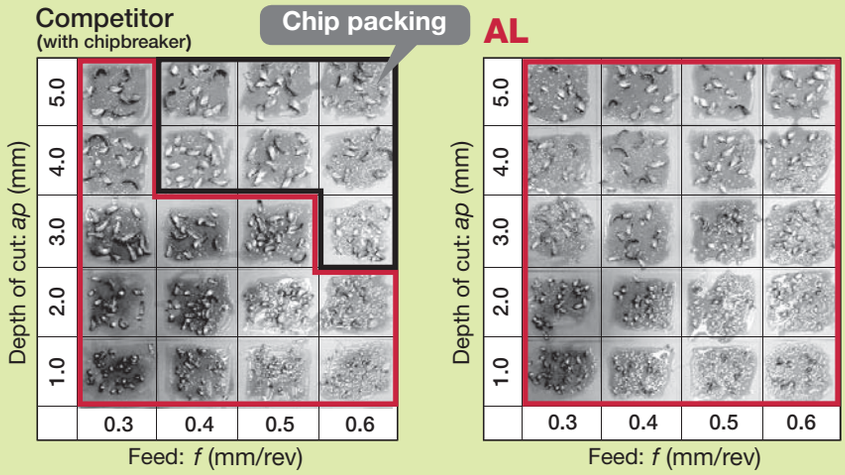


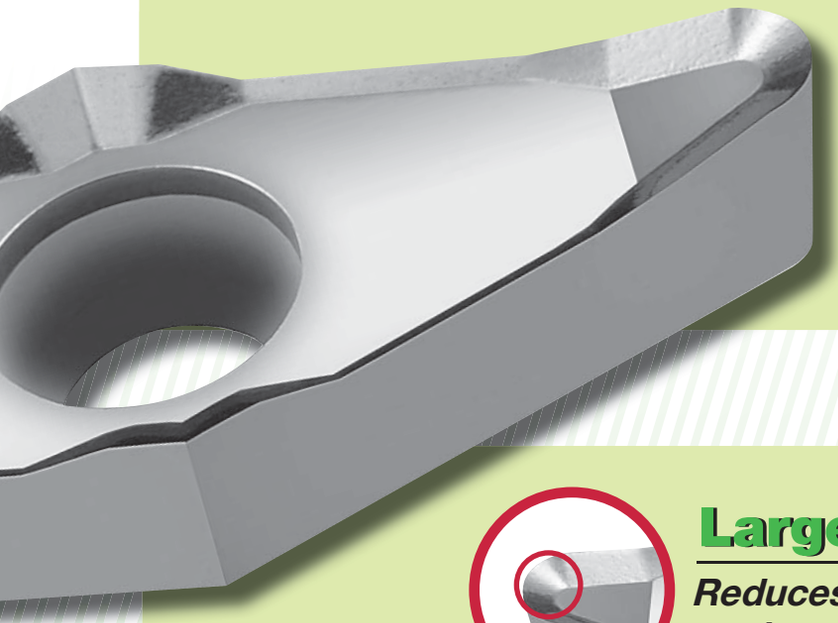
Large inclination

The deep pocket geometry improves chip packing!!

Excellent chip control!

Cutting condition	
Work material:	AC4C
Insert:	VCGT220520-□□
Cutting speed:	*Vc* = 1500 m/min
Coolant:	Water soluble type





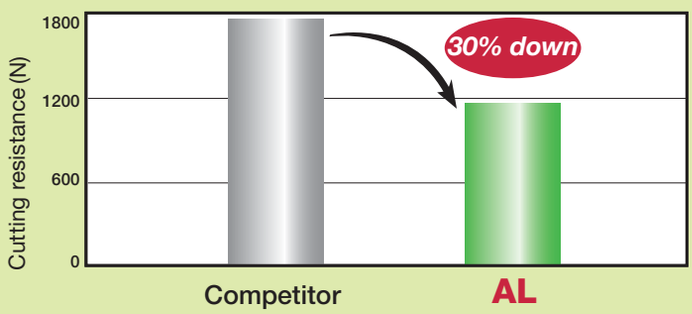
Large rake angle

Reduces cutting force with a large rake angle and sharp edge!!

Comparison of cutting force

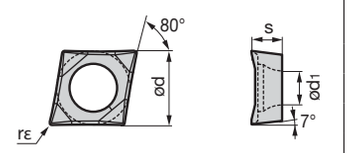
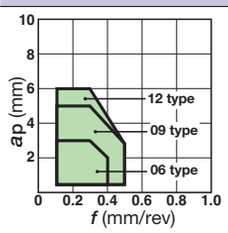
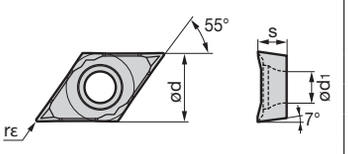
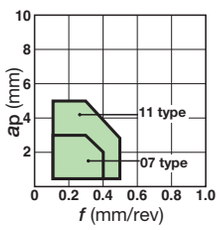
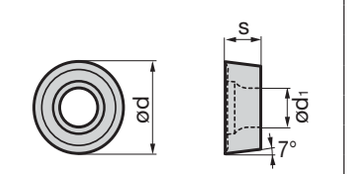
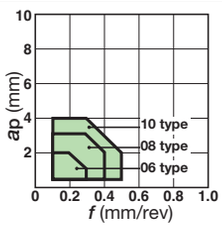
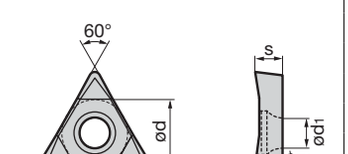
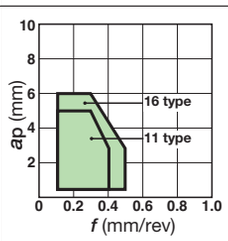
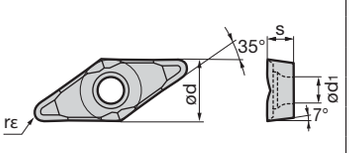
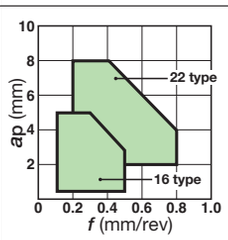
Cutting force reduced by 30%!

Cutting condition	
Work material:	AC4C (Si: 6.5 ~ 7.5%)
Insert:	VCGT220520-□□
Cutting speed:	*Vc* = 800 m/min
Depth of cut:	*ap* = 4.0 mm
Feed:	*f* = 0.4 mm/rev
Coolant:	Water soluble type



Inserts

Positive type

Shape	*f*-*ap*	Cat. No.	Grade	Dimensions (mm)			
			KS05F	ød	s	ød1	rε
		CCGT060202-AL	●	6.35	2.38	2.8	0.2
		CCGT060204-AL	●				0.4
		CCGT09T302-AL	●	9.525	3.97	4.4	0.2
		CCGT09T304-AL	●				0.4
		CCGT09T308-AL	●				0.8
		CCGT120402-AL	●	12.70	4.76	5.5	0.2
		CCGT120404-AL	●				0.4
		CCGT120408-AL	●				0.8
		DCGT070202-AL	●	6.35	2.38	2.8	0.2
		DCGT070204-AL	●				0.4
		DCGT11T302-AL	●	9.525	3.97	4.4	0.2
		DCGT11T304-AL	●				0.4
		DCGT11T308-AL	●				0.8
		RCGT0602M0-AL	●	6.00	2.38	2.8	–
		RCGT0803M0-AL	●	8.00	3.18	3.4	–
		RCGT1003M0-AL	●	10.00	3.18	4.0	–
		TCGT110202-AL	●	6.35	2.38	2.8	0.2
		TCGT110204-AL	●				0.4
		TCGT16T302-AL	●	9.525	3.97	4.4	0.2
		TCGT16T304-AL	●				0.4
		TCGT16T308-AL	●				0.8
		VCGT160404-AL	●	9.525	4.76	4.4	0.2
		VCGT160408-AL	●				0.8
		VCGT160412-AL	●				1.2
		VCGT220520-AL	●	12.70	5.56	5.5	2.0
		VCGT220530-AL	●				3.0

● : Stocked items

Standard cutting conditions

Work material	Cutting speed *Vc* (m/min)	Depth of cut *ap* (mm)	Feed *f* (mm/rev)
Aluminum alloys (Si < 12%)	600 (100 ~ 1,200)	2.0 (1.0 ~ 3.0)	0.3 (0.1 ~ 0.6)
Aluminum alloys (Si ≥ 12%)	200 (100 ~ 300)	1.0 (0.5 ~ 1.5)	0.2 (0.1 ~ 0.4)
Copper, Brass	500 (300 ~ 800)	1.0 (0.2 ~ 1.5)	0.3 (0.1 ~ 0.6)
Bronze	200 (150 ~ 400)		

*Attention:
It is recommended that this product range is used with a water-soluble coolant. Please be aware that the recommended cutting conditions may change according to the work material, surface finish conditions, machining conditions, cutting speeds or the size of the corner radius.

Practical examples

Aluminum wheel tooling

(Example 1)

● **Process 1**

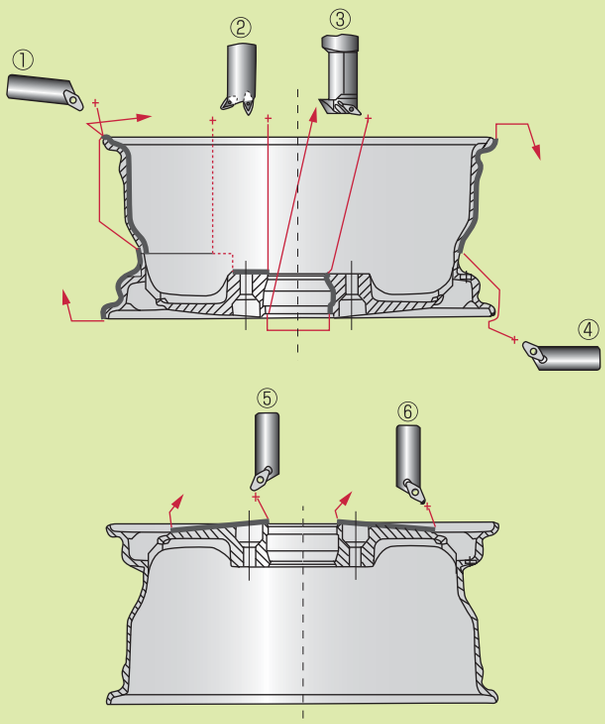
Number of revolution: n = 1250 min^{-1} (Constant)
Depth of cut: ap = 2 mm
Cutting speed: Vc = 250 ~ 1500 m/min

Tool number	Processing Operation	Cat. No.	Inserts	Feed f (mm/rev)
①	Edge, External profiling	SVHCR2525M22	VCGT220530-AL (KS05F)	0.6
②	Edge, Bore profiling	Special holder	VCGT220530-AL (KS05F)	0.6
③	Bore profiling	Special holder	VCGT220530-AL (KS05F)	0.3
			DCGT11T308-AL (KS05F)	
④	Edge, External profiling	SVHCL2525M22	VCGT220530-AL (KS05F)	0.6

● **Process 2**

Number of revolution: n = 1250 min^{-1} (Constant)
Depth of cut: ap = 1 mm
Cutting speed: Vc = 300 ~ 1200 m/min

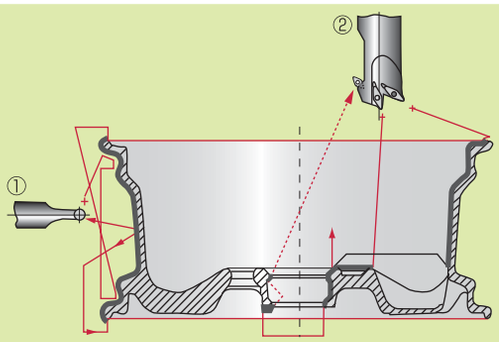
Tool number	Processing Operation	Cat. No.	Inserts	Feed f (mm/rev)
⑤	Facing & roughing	SVHCR2525M22	VCGT220530-AL (KS05F)	0.6
⑥	Facing & finishing	SVHCR2525M22	VCGW220530-DIA (DX140)	0.15



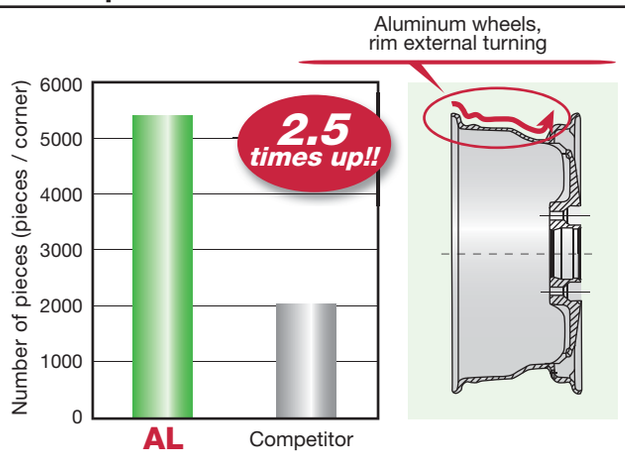
(Example 2)

Number of revolution: n = 1800 min^{-1} (Constant)
Depth of cut: ap = 2 mm
Cutting speed: Vc = 320 ~ 1500 m/min

Tool number	Processing Operation	Cat. No.	Inserts	Feed f (mm/rev)
①	Facing, External profiling	SRDCN2525M06	RCGT060M0-AL (KS05F)	0.45
②	Facing, Internal profiling	Special holder	VCGT160412-AL (KS05F)	0.2 ~ 0.3
			DCGT070204-AL (KS05F)	

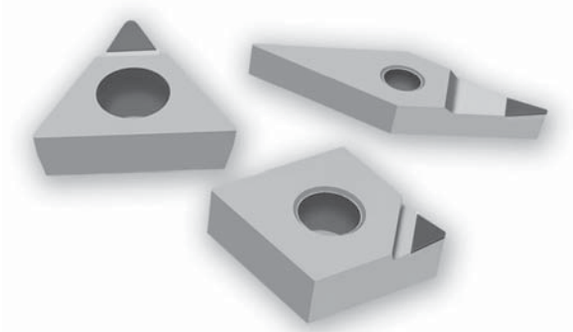


Comparison of tool life



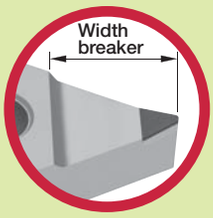
Inserts		VCGT220520-□□
Cutting condition	Work material	A356 (T6 Castings)
	Cutting speed	Vc = 220 ~ 1630 m/min
	Feed	f = 0.45 ~ 0.50 mm/rev
	Depth of cut	ap = 2 ~ 6 mm
	Coolant	Water soluble type
Results	Enables stable machining because of the combination of AL chipbreaker and KS05F grade.	

T-DIA



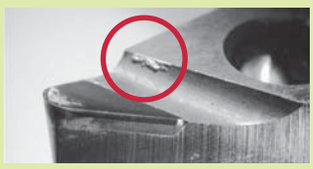
T-DIA TAC insert with rake angle!

Features

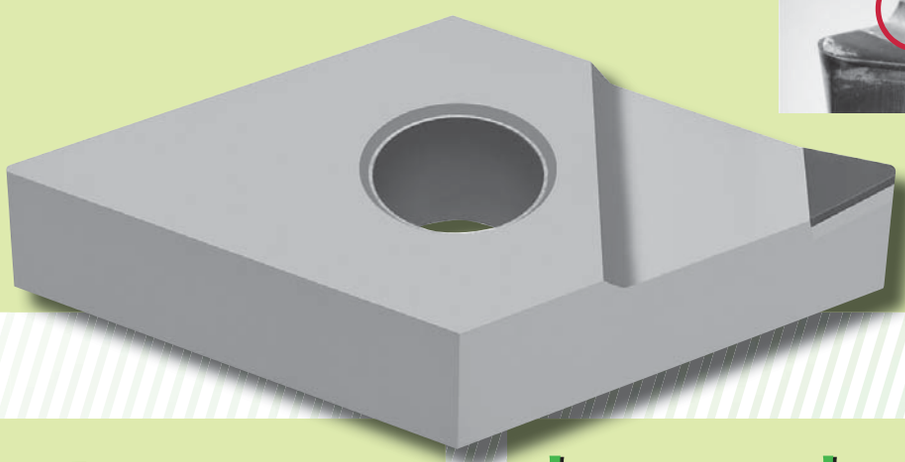


Ground rake face for excellent sharpness

Wide chipbreaker contributes to excellent chip control.



Competitor

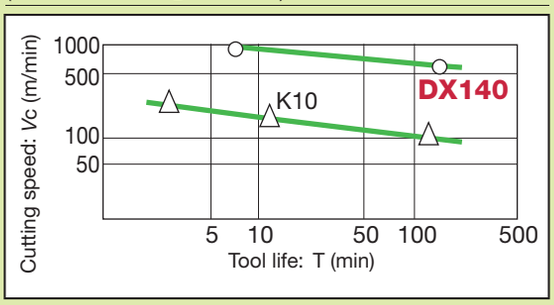


Excellent wear resistance

Provides outstanding tool life

Wear resistance

Cutting condition	
Work material:	Aluminum alloy (Si: 18.0%)
Holder:	CSBPR2525M4
Insert:	SPGN120308-DIA
Cutting speed:	*Vc* = 100 ~ 1000 m/min
Feed:	*f* = 0.1 mm/rev
Depth of cut:	*ap* = 0.5 mm
	Dry cutting
(Tool life criteria: V_B = 0.3 mm)	



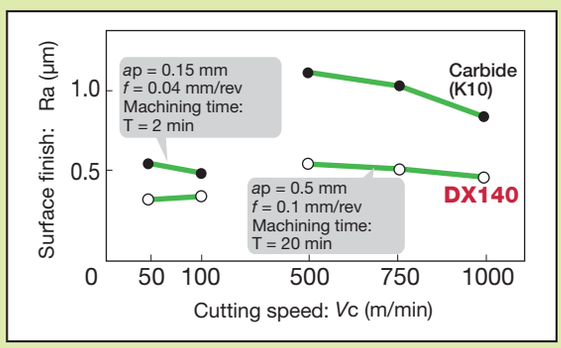
Increased adhesion resistance

Improved quality of machined surface

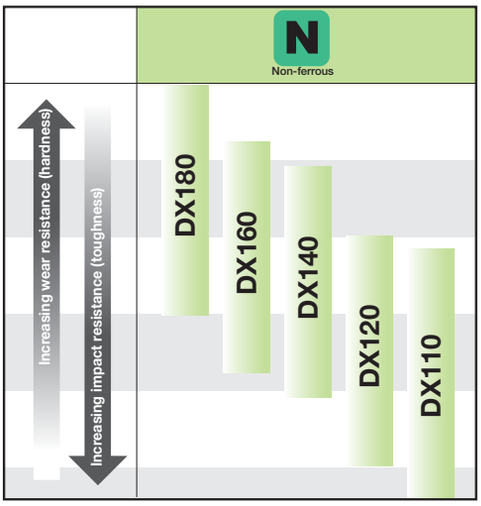
Surface finish

Cutting condition	
Work material:	Aluminum alloy (Si: 10.0%)
Holder:	CSBPR2525M4
Insert:	SPGN120308-DIA

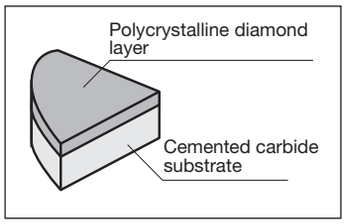
DX140 provides excellent surface finish.



Grades

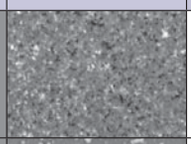
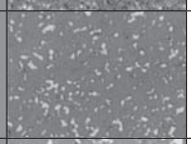
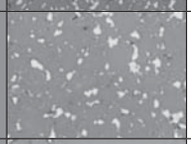
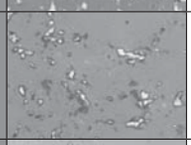
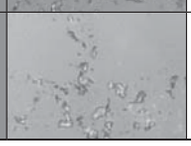


Diamond is the hardest known material on the earth. This is an advanced diamond based tool material where tiny diamond crystals are tightly sintered on the cemented carbide alloy base by means of a super high pressure and temperature process.
PCD is therefore the optimum choice for cutting non-ferrous and non-metal materials.

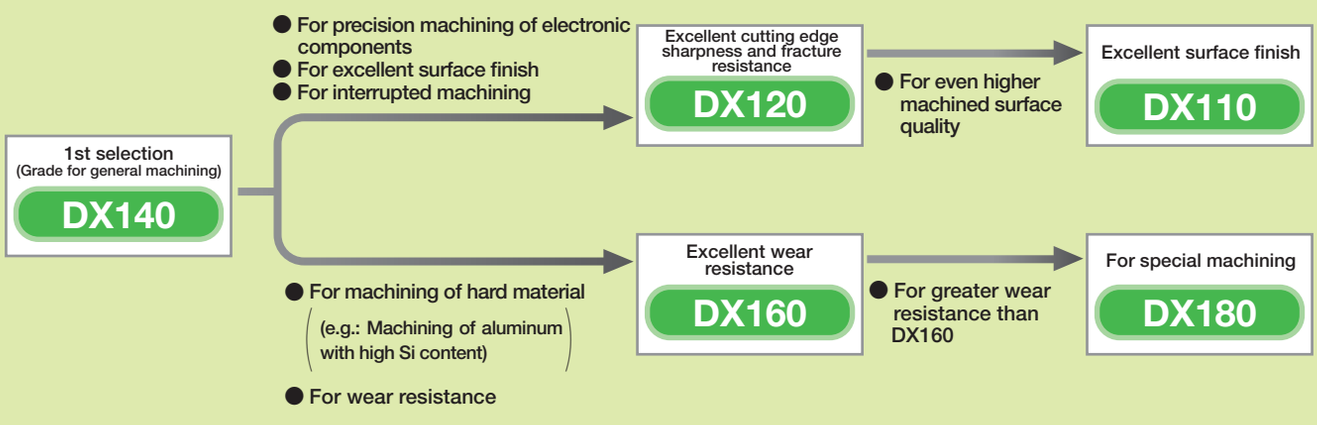


Comparison of Hardness

Tool materials	Hardness (HK)
T-DIA	6000 ~ 9000
Natural diamond	8000 ~ 12000

Application	Grades	Microstructure	Grain size (μm)	Hardness (Hv)	Strength (GPa)	Features
N 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 non-metals where high quality surface finish is required. Features the finest grain structure in T-DIA series and excels in cutting edge sharpness.
	DX140		12.5	10000	1.7	Used for machining of non-ferrous metals and non-metals. Composed of medium and fine grain diamond, provides moderate wear resistance and grind ability.
	DX160		28	11000	1.6	Can be used for machining half sintered ceramics and cemented carbides, stones and non-ferrous metals. The compact mixed sintered composition of large and fine grain diamonds makes the ability to grind 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.

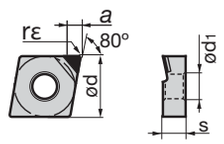
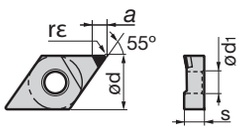
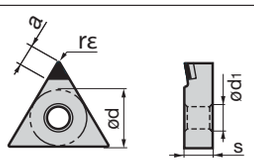
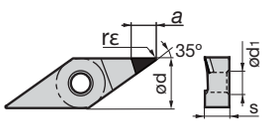
Grade selection guide



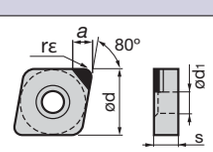
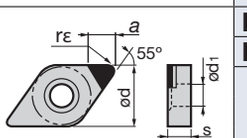
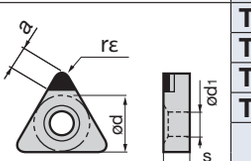
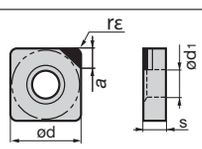
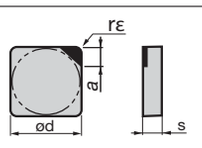
※ If the depth of cut is beyond standard cutting conditions, Please select TH10 (carbide), GH (coated carbide).

Inserts

Negative type (with chipbreaker)

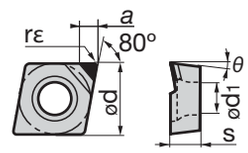
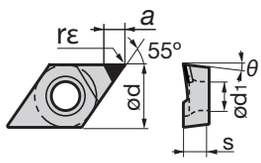
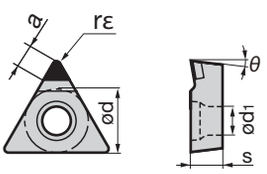
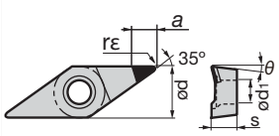
Shape	Cat. No.	Grades (Improved Sharpness ← → Wear resistance Higher)			Dimensions (mm)					Applicable toolholders
		DX120	DX140	DX160	ød	s	ød$_1$	r$_\varepsilon$	*a*	
	**CNMM120402-DIA**	●			12.7	4.76	5.16	0.2	3.5	A, D, P, M type
	CNMM120404-DIA	●						0,4	3.5	
	**DNMM150402-DIA**	●			12.7	4.76	5.16	0.2	3.3	A, D, P, M, E, W-type
	DNMM150404-DIA	●						0.4	3.1	
	**TNMM160402-DIA**	●			9.525	4.76	3.81	0.2	3.3	A, D, P ,M type
	TNMM160404-DIA	●						0.2	3.2	
	**VNMM160402-DIA**	●			9.525	4.76	3.81	0.2	4.8	M-type
	VNMM160404-DIA	●						0.4	4.4	
	VNMM160408-DIA	●						0.8	3.6	

Negative type

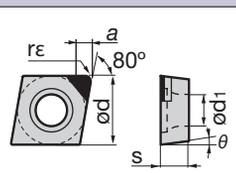
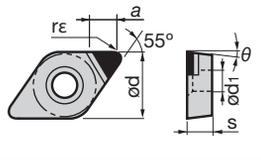
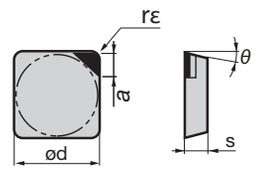
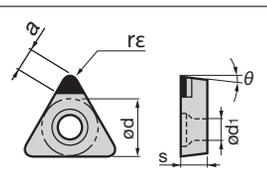
Shape	Cat. No.	Grades (Improved Sharpness ← → Wear resistance Higher)			Dimensions (mm)					Applicable toolholders
		DX120	DX140	DX160	ød	s	ød$_1$	r$_\varepsilon$	*a*	
	**CNGA120404-DIA**		●		12.7	4.76	5.16	0.4	3.5	A, D, P, M, E, W-type
	CNGA120408-DIA							0.8	3.4	
	**DNGA150404-DIA**		●	●	12.7	4.76	5.16	0.4	3.1	A, D, P, M, E-type
	DNGA150408-DIA		●					0.8	2.8	
	**TNGA160304-DIA**				9.525	3.18	3.81	0.4	3.2	C-type
	TNGA160308-DIA							0.8	2.9	
	TNGA160404-DIA		●	●		4.76		0.4	3.2	
	TNGA160408-DIA		●	●				0.8	2.9	
	**SNGA120404-DIA**		●	▲	12.7	4.76	5.16	0.4	3.6	A, D, P, M type
	SNGA120408-DIA		●	▲				0.8	3.6	
	**SNGN090308-DIA**				9.525	3.18	–	0.8	3.6	A, D, P, M type
	SNGN120408-DIA		●		12.7	4.76	–	0.8	3.6	

● : Stocked items

Positive type (with chipbreaker)

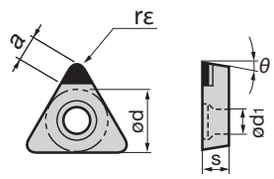
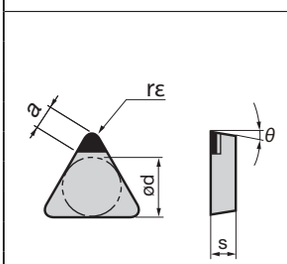
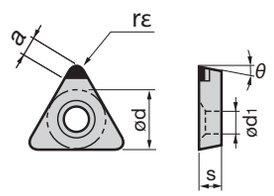
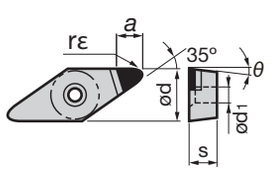
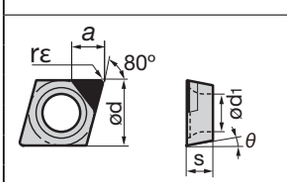
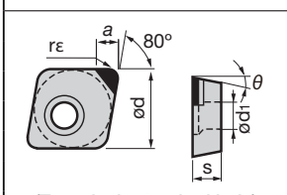
Shape	Cat. No.	Grades (Improved Sharpness ← → Wear resistance Higher)			Dimensions (mm)						Applicable toolholders
		DX120	DX140	DX160	θ	ød	s	ød1	rε	a	
	CCMT060202-DIA	●			7°	6.35	2.38	2.8	0.2	2.4	For boring holes S-type
	CCMT060204-DIA	●							0.4	2.4	
	CCMT09T302-DIA	●				9.525	3.97	4.4	0.2	2.4	
	CCMT09T304-DIA	●							0.4	2.4	
	DCMT070202-DIA	●			7°	6.35	2.38	2.8	0.2	2.3	For boring holes S-type
	DCMT070204-DIA	●							0.4	2.1	
	DCMT11T302-DIA	●				9.525	3.97	4.4	0.2	3.2	
	DCMT11T304-DIA	●							0.4	3.0	
	TCMT080202-DIA	●			7°	4.76	2.38	2.7	0.2	2.2	For boring holes S-type
	TCMT080204-DIA	●							0.4	2.0	
	TCMT110202-DIA	●				6.35		2.8	0.2	2.4	
	TCMT110204-DIA	●							0.4	2.2	
	TCMT110302-DIA	●					3.18		0.2	2.4	
	TCMT110304-DIA	●							0.4	2.2	
	VCMT160402-DIA	●			7°	9.525	4.76	4.4	0.2	4.8	For boring holes S-type
	VCMT160404-DIA	●							0.4	4.4	

Positive type

Shape	Cat. No.	Grades (Improved Sharpness ← → Wear resistance Higher)			Dimensions (mm)						Applicable toolholders
		DX120	DX140	DX160	θ	ød	s	ød1	rε	a	
	CCGW060200-DIA		●		7°	6.35	2.38	2.8	0.03	2.4	For boring holes S-type
	CCGW060202-DIA		●						0.2	2.4	
	CCGW060204-DIA		●						0.4	2.4	
	CCGW09T302-DIA		●			9.525	3.97	4.4	0.2	3.5	
	CCGW09T304-DIA		●	●					0.4	3.5	
	CCGW09T308-DIA		●	▲					0.8	3.4	
	DCGW070200-DIA		●		7°	6.35	2.38	2.8	0.05	2.4	For boring holes S-type
	DCGW070202-DIA	●	●						0.2	2.3	
	DCGW070204-DIA		●						0.4	2.1	
	DCGW11T302-DIA		●			9.525	3.97	4.4	0.2	3.2	
	DCGW11T304-DIA		●						0.4	3.0	
	DCGW11T308-DIA		●						0.8	2.7	
	SPGN090302-DIA				11°	9.525	3.18	–	0.2	3.6	For boring holes C-type
	SPGN090304-DIA			▲					0.4	3.6	
	SPGN090308-DIA		●						0.8	3.6	
	SPGN120302-DIA		●			12.7			0.2	3.6	
	SPGN120304-DIA		●	▲					0.4	3.6	
	SPGN120308-DIA		●	●					0.8	3.6	
	SPGN120312-DIA								1.2	3.6	
	TCGW110202-DIA				7°	6.35	2.38	2.8	0.2	2.4	For boring holes S-type
	TCGW110204-DIA								0.4	2.2	
	TCGW16T302-DIA					9.525	3.97	4.4	0.2	3.3	
	TCGW16T304-DIA								0.4	3.2	
	TCGW16T308-DIA								0.8	2.9	

● : Stocked items

Positive type

Shape	Cat. No.	Grades (Improved Sharpness ← → Wear resistance Higher)			Dimensions (mm)						Applicable toolholders
		DX120	DX140	DX160	θ	ød	s	ød1	rε	a	
	TPGW080202-DIA		●		11°	4.76	2.38	2.3	0.2	2.4	For boring holes S-type, Top borer tools
	TPGW080204-DIA		●						0.4	2.3	
	TPGW090202-DIA	●	●			5.56	2.38	2.5	0.2	2.4	
	TPGW090204-DIA		●						0.4	2.2	
	TPGW110202-DIA	●	●			6.35	2.38	2.8	0.2	2.4	
	TPGW110204-DIA		●						0.4	2.2	
	TPGW130302-DIA	●	●			7.94	3.18	3.4	0.2	3.3	
	TPGW130304-DIA		●						0.4	3.2	
	TPGW16T302-DIA		●			9.525	3.97	4.4	0.2	3.3	
	TPGW16T304-DIA		●						0.4	3.2	
	TPGW16T308-DIA		●						0.8	2.9	
	TPGN090204-DIA		●		11°	5.56	2.38	–	0.4	2.2	For boring holes C-type
	TPGN090208-DIA								0.8	2.0	
	TPGN110301-DIA					6.35	3.18		0.1	3.4	
	TPGN110302-DIA								0.2	3.3	
	TPGN110304-DIA	●	●						0.4	3.2	
	TPGN110308-DIA		●						0.8	2.9	
	TPGN160301-DIA					9.525	3.18		0.1	3.4	For boring holes C-type
	TPGN160302-DIA		●						0.2	3.3	
	TPGN160304-DIA	●	●	▲					0.4	3.2	
	TPGN160308-DIA		●						0.8	2.9	
	TPGN160312-DIA								1.2	2.6	
 (Tungaloy's standard hole)	TPGA090202-DIA		●		11°	5.556	2.38	3.2	0.2	2.4	
	TPGA090204-DIA		●						0.4	2.2	
	TPGA110202-DIA		●			6.35	2.38	3.0	0.2	2.4	
	TPGA110204-DIA		●						0.4	2.2	
	TPGA110302-DIA		●				3.18		0.2	2.4	
	TPGA110304-DIA		●						0.4	2.2	
	TPGA110308-DIA		●						0.8	2.0	
	TPGA160302-DIA		●			9.525	3.18	4.0	0.2	3.3	
	TPGA160304-DIA		●						0.4	3.2	
	TPGA160308-DIA		●						0.8	2.9	
	VCGW160402-DIA		●		7°	9.525	4.76	4.4	0.2	4.8	For boring holes S-type
	VCGW160404-DIA		●						0.4	4.4	
	VCGW160408-DIA								0.8	3.6	
	VCGW160412-DIA								1.2	2.7	
	VCGW220530-DIA					12.7	5.56	5.5	3.0	5.0	
	EPGW040102-DIA		●		11°	3.97	1.59	2.3	0.2	2.0	For boring holes S-type, TAC boring bar tools, Round shank, Top borer tools
	EPGW040104-DIA		●						0.4	1.9	
 (Tungaloy's standard hole)	CPGA090202-DIA		●		11°	9.525	2.38	4.0	0.2	2.4	For boring holes S-type
	CPGA090204-DIA		●						0.4	2.4	

● : Stocked items

Standard cutting conditions

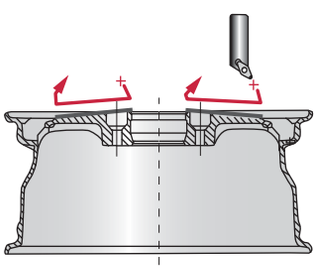
Work material	Cutting speed *Vc* (m/min)	Depth of cut *ap* (mm)	Feed *f* (mm/rev)	Grade selection			
				DX120	DX140	DX160	DX180
Aluminum alloys (Si < 12%)	**1500** (1000-2500)	**0.5** (0.05-2.0)	**0.1** (0.05-0.2)	○	◎		
Aluminum alloys (Si ≥ 12%)	**600** (400-800)	**0.5** (0.05-2.0)	**0.1** (0.05-0.2)		○	◎	○
Copper and Brass	**800** (500-1500)	**0.5** (0.05-2.0)	**0.1** (0.05-0.2)	○	◎		
Bronze	**400** (300-500)	**0.5** (0.05-2.0)	**0.1** (0.05-0.2)	○	◎		
Carbon / Graphite	**400** (300-500)	**0.5** (0.05-2.0)	**0.1** (0.05-0.2)		◎	○	○
FRP	**700** (500-1000)	**0.2** (0.05-0.5)	**0.05** (0.03-0.1)	◎	○		
Plastic	**700** (500-1000)	**0.2** (0.05-0.5)	**0.03** (0.01-0.05)	◎	○		
Cemented carbide (D40 ~ D50)	**15** (10-20)	**0.1** (0.05-0.2)	**0.03** (0.01-0.05)		○	○	◎
Ceramics (sintered tentative)	**130** (100-150)	**0.5** (0.05-2.0)	**0.05** (0.03-0.1)			○	◎

◎ : First choice ○ : Second choice

Practical example

Wheel machining

Workpiece sketch



Tools		SVHCR2525M22
Inserts		VCGW220530-DIA (DX140)
Cutting condition	Work material	Aluminum alloys
	Cutting speed	*Vc* = 300 ~ 1200 m/min
	Feed	*f* = 0.15 mm/rev
	Depth of cut	*ap* = 1 mm
	Coolant	Water soluble type
Results	DX140 provides excellent surface finish. It also enables accurate and high speed machining without chipping.	

Re-grinding method

Grades		DX160, DX140, DX120
Machinery		Universal tool grinding machine with high rigidity
Grinding	type	Diamond wheel
	Bonding material	Bitorifaindobondo
	Granularity	Rough processing # 400 ~ # 600
		Finish machining #1,000 or alternate small dimensions
	Degree of concentrarion	100~125
Grinding condition	Wheel peripheral speed	900 ~ 1,200 m/min
	Wheel swing	30~ 60 min^{-1}

■ Note

Generally there is no need for pre-honing.

■ Operating precaution

・Please apply enough grinding coolant.

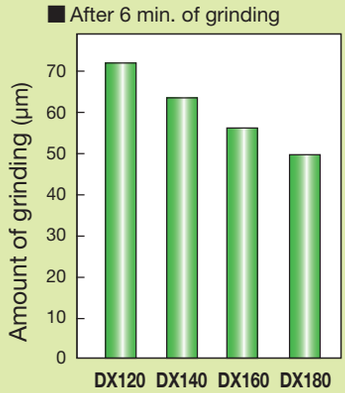
・Please apply the dressing consistently to prevent loading the grinding wheel.

■ Attention

Please pay extra attention to the wheel dressing and also the rigidity of the spindle and its runout. As the sharpness of the cutting edge greatly affects the surface finish and the tool life.

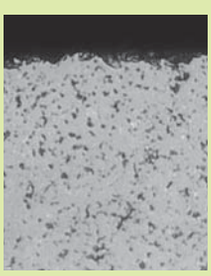
Grinding Comparison

■ After 6 min. of grinding

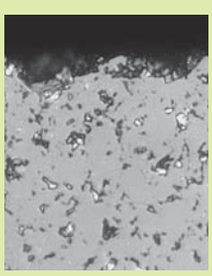


The smaller the particle, the sharper the insert. This improves surface finish reduces the burr on the machined part.

Grinder	Diamond grinding machine
Whetstone	Vitrified
	Cup-type diamond wheel
	# 800 / 1000, ø150
Work material	T-DIA, (4 grades)
	Grinding area 64 mm^2
Wheel rotation speed	1600 min^{-1}
Grinding time	6 min



DX120



DX140

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