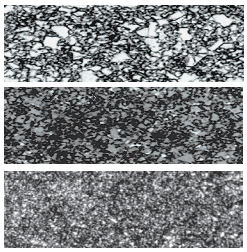
DIAMETAL

Success with precision

Cutting materials (절삭 소재)

Cutting material	ISO	Application
UG 8	K 01/05	높은 내성과 높은 표면 품질을 위한 등급
MG 6	K 05/10	비철 재료 및 경금속 재질에 알맞고 높은 절삭 속도에 사용 가능하며 내마모성이 뛰어난 등급
MG 7.5	K 10/20	일반적인 경도 및 강도에 적합한 등급
MG 10	K 20/30	일반적인 절삭 속도와 이동 속도에 내마모성이 뛰어난 등급
M 10/30	K 20/30	일반적인 절삭 속도와 이동 속도를 가진 니켈합금뿐만 아니라 티타늄에도 사용할 수 있게 강도와 내마모성의 조합이 뛰어난 등급
Cermet		절삭속도가 높은 강철의 마감 작업에 적합한 등급
PCD + MCD		알루미늄, Al–Si 합금, 구리, 황동, 청동 및 흑연, MMC, 섬유 유리 플라스틱, 경화 카바이드 및 귀금속과 같은 비철 금속을 가공하기 위한 폴리크리스탈린 및 모노크리스탈린 다이아몬드 재료

Description of carbides (초경의 종류)



MG Micrograin / 입자크기 0.6 – 1.0 µm

UG Ultragrain / 입자크기 0.3 – 0.6 µm

NG Nanograin / 입자크기 〈 0.3 µm

Technical information on cutting materials (절삭 소재에 대한 정보)

		Carbide grades					
		UG 8	MG 6	MG 7.5	MG 10	M 10/30	Cermet
WC 함유량	per%	92	94	92.5	90	90	16
Co 함유량	per%	8	6	7.5	10	10	11
TiC/TiN 함유량	per%						50
입자크기	µm	0.4	0.8	0.8	0.7	0.8	
횡파열 강도	N/mm^2	3150	2700	3600	3200	3000	
밀 도	g/cm^3	14.50	14.90	14.70	14.50	14.45	7.00
경 도	HV	1900	1800	1700	1600	1580	1580

Effect of the constituents (구성 성분의 영향)

	WC	Co	TiC / TaC	Grain size
Hardness 경 도	↑	↓	↑	↓
Compressive strength 내압(압축) 강도	↑	↓	○	↓
Resistance to abrasion 마모저항	↑	↓↓	↑	↓
Transverse rupture strength 횡파열 강도	↓	↑	↓	↑
Wear resistance 내 마모성	↑	↓	↑	↓

↑ = increased (증가) ↓ = reduced (감소) ○ = insignificant (차이없음)

Coatings (코팅 종류)

Coating 코팅	Application 적용
D 10	보편적 적용 (범용), 강철에 적용
D 20	정삭 작업 및 티타늄, 비철금속, 강철에 적용
D 30	강철, 스테인리스강, 니켈합금, 티타늄에 적용
D 60	스테인리스강, 고온 합금강, 가공이 어려운 재료에 적용

Technical data (기술 자료)

Coating 코팅	Hardness (HV 0.05) 경도	Coefficient of friction 마찰계수	Max. temperature of application 적용가능 최대 온도
D 10	2300	0.4	600 ° C
D 20	3000	0.4	400 ° C
D 30	3300	0.4	800 ° C
D 60	3200	0.35	1000 ° C

Practice (실행)

제품 코너R에 따른 절삭속도 및 절삭깊이 비율

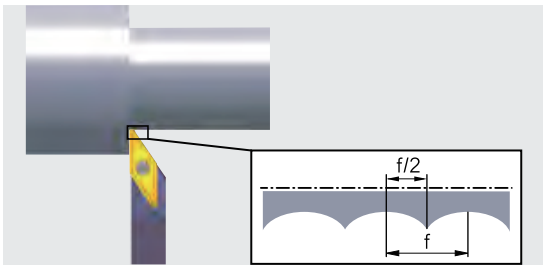
- 최대이동속도는 – $\frac{1}{2}$ 코너 R 이하여야 한다.
- 절삭 깊이 〉 코너 R
- 가능한 큰 코너 R 사용을 추천.

부하가 큰 제품 및 높은 조도가 필요할 때 큰 코너 R 사용 추천.
부하가 작고 제품의 떨림 발생 시 작은 코너 R 사용 추천.

Calculation (계산)

$R_a = \frac{f^2 \times 50}{r_e}$ Average value (평균가치)

R_a = Surface quality – 표면적 (µm)
f = Feed rate – 이동속도 (mm/U)
r_e = Corner radius – 코너 반지름 (mm)



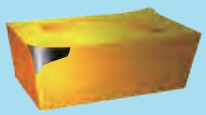
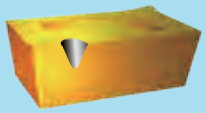
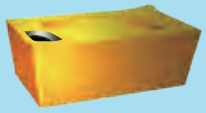
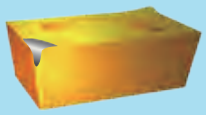
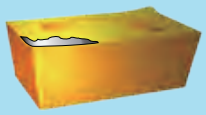
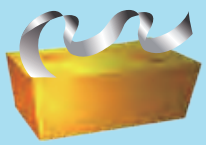
	N1	N2	N3	N4	N5	N6	N7	N8
Ra (µm)	0.025	0.05	0.10	0.2	0.4	0.8	1.60	3.20
Rt (µm)	0.500	0.80	1.25	2.5	5.0	8.0	16.00	32.00
Rz (µm)	0.400	0.63	1.00	2.0	4.0	6.3	10.00	16.00

Friction (마찰저항)

Rule of thumb: Tungsten carbide with steel dry

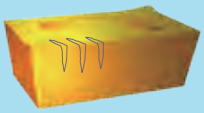
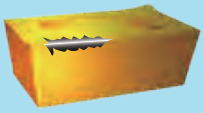
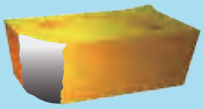
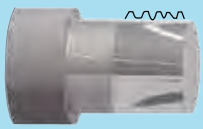
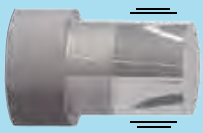
Tungsten carbide	Coefficient of friction
uncoated	~0,8
coated	~0,4

Turning process optimization (터닝 프로세스 최적화)

Flank and nose wear 	↑ Wear resistance of carbide (초경 모재의 내 마모성) ↓ Cutting speed (절삭속도) ○ Feed rate (이송속도)
Notch wear 	↑ Wear resistance of carbide (초경 모재의 내 마모성) ↓ Cutting speed (절삭속도) ○ Feed rate (이송속도)
Cratering wear 	↓ Cutting speed (절삭속도) ↓ Feed rate (이송속도) ↑ Cutting angle (절삭각도) ↑ Coolant (절삭유)
Plastic deformation 	↑ Wear resistance of carbide (초경 모재의 내 마모성) ↓ Cutting speed (절삭속도) ↓ Feed rate (이송속도) ↑ Coolant (절삭유)
Cutting edge build-up 	↑ Cutting speed (절삭속도) ↓ Feed rate (이송속도) ↑ Cutting angle (절삭각도) ↑ Coolant (절삭유)
Long chips 	↑ Feed rate (이송속도) ○ Depth of cut (절입량) ○ Chipbreaker geometry (칩브레이커 형상)

↑ = increase (증가) ↓ = reduce (감소) ○ = control, adapt (상황에 따른 제어 및 맞춤)

Turning process optimization (터닝 프로세스 최적화)

Comb cracks 	↑ Toughness of carbide (초경 모재의 강도) ↑ Coolant (절삭유)
Edge chipping 	↑ Toughness of carbide (초경 모재의 강도) ↓ Cutting angle (절삭각도) O Chipbreaker geometrie (칩브레이커 형상) O State of cutting edge (모서리 상태) ↓ Angle of incidence (홀더의 꺾임 강도) ↑ Stability (안정성)
Insert fracture 	↑ Toughness of carbide (초경 모재의 강도) ↓ Cutting angle (절삭각도) O Chipbreaker geometry (칩브레이커 형상) ↑ Nose radius (코너 R)
Interrupted cut 	↑ Toughness of carbide (초경 모재의 강도) ↑ Cutting speed (절삭속도) ↓ Feed rate (이송속도) ↓ Depth of cut (절입량) O Cutting angle (절삭각도) O State of cutting edge (모서리 상태) ↑ Nose radius (코너 R)
Poor surface finish 	↑ Cutting speed (절삭속도) ↓ Feed rate (이송속도) ↑ Nose radius (코너 R) ↑ Coolant (절삭유)
Vibrations 	↑ Feed rate (이송속도) ↓ Depth of cut (절입량) O Chipbreaker geometry (칩브레이커 형상) ↓ Nose radius (코너 R) ↓ Cutting speed (절삭속도) ↑ Stability (안정성)

↑ = increase (증가) ↓ = reduce (감소) O = control, adapt (상황에 따른 제어 및 맞춤)

Cutting data, turning

			Vc(m/min)					
Material	**ap[mm]**	**f[mm/U]**	**HM Carbide**	**D10**	**D20**	**D30 (D60)**	**Cermet**	**PCD**
Free cutting steel	<4	0.02-0.15	70-140	120-200		150-280		
95MnPb28(1.0718)	<4	0.02-0.15		120-200		170-250		
Stahl<600N/mm2 Steel	<4	0.02-0.12	50-100	90-170		90-180		
Stahl<850N/mm2 Steel	<3	0.02-0.12	40-80	70-150		80-170		
Stahl>850N/mm2 Steel	<3	0.02-0.12	30-70	60-120		70-170	140-280	
ETG100(1.7225)	<3	0.02-0.12				110-170		
Stainess steel	<3	0.02-0.12		60-120	60-120	60-180	140-300	
316L(1.4435)	<3	0.02-0.12		60-120		100-160	150-280	
Aluminium<10% Si	<5	0.05-0.25	200-2000	300-2000	300-2000			1000-3000
Aluminium>10% Si	<5	0.03-0.25		200-1000	200-1000			500-2500
CFK I GFK Fibreglass plastics	<6	0.02-0.12						200-1200
Brass/Bronze	<5	0.02-0.20	120-250	300-600	300-600			400-1200
Copper	<5	0.02-0.20	120-250	180-500	180-500			400-1200
Gold	<2	0.01-0.10	150-1500	200-2000				300-3000
Platinum/Palladium	<2	0.01-0.10						100-400
Fe - based high-temperature alloys	<3	0.01-0.10				30-80	20-50	
Ni - based high-temperature alloys	<3	0.01-0.10				20-50	10-30	
Co - based high-temperature alloys	<3	0.01-0.10				20-50	10-30	
Titanium pure	<3	0.01-0.10			70-110	70-110		
Titanium alloys alpha-beta	<3	0.01-0.08			60-80	60-80		

▪ Cutting data, grooving and parting

		Vc(m/mim)					
Material	**f[mm/U]**	**HM Carbide**	**D10**	**D20**	**D60**	**Cermet**	**PCD**
Free cutting steel	0.01-0.15	70-140	120-200		150-280		
95MnPb28(1.0718)	0.01-0.15		120-200		170-250		
Stahl<600N/mm2 Steel	0.01-0.12	50-100	90-170		90-180		
Stahl<850N/mm2 Steel	0.01-012	40-80	70-150		80-170		
Stahl>850N/mm2 Steel	0.01-0.12	30-70	60-120		70-170	140-280	
ETG100(1.7225)	0.01-0.12				110-160		
Stainless steel	0.01-0.12		60-120	60-120	60-180	140-300	
316L(1.4435)	0.01-0.12		60-120		100-160	150-280	
Aluminium<10% Si	0.02-0.20	200-2000	300-2000	300-2000			1000-3000
Aluminium>10% Si	0.02-0.20		200-1000				500-2500
CFK I GFK Fibreglass plastics	0.01-0.12						200-1200
Brass/Bronze	0.01-0.12	120-250	300-600	300-600			400-1200
Copper	0.01-0.12	120-250	180-500	180-500			400-1200
Gold	0.01-0.08	150-1500	200-2000				300-3000
Platinum/Palladium	0.01-0.08						100-400
Fe-based high-temperature alloys	0.01-0.10				30-80	20-50	
Ni-based high-temperature alloys	0.01-0.10				20-50	10-30	
Co-based high-temperature alloys	0.01-0.10				20-50	10-30	
Titanium pure	0.01-0.10			70-110	70-110		
Titanium alloys alphbeta	0.01-0.08			50-80	50-80		