

Lightweight construction  
Focus COMPOSITE MATERIALS

In an era of increasing awareness of the issues surrounding energy, energy conservation and energy efficiency, the lightweight construction segment is becoming more and more important. At a rapid pace, composite materials are carving out ever larger market shares.

Outstanding material properties, however, also present challenges for the manufacturers of precision tools. The extremely high strength and complex make-up of these materials are placing new demands on the tools that work them: the high degree of abrasiveness means that conventional tools in drilling and milling setups last only a few metres.

## Classification of composite materials and typical applications

### FIBROUS COMPOSITE MATERIALS

Fibrous composites are inhomogeneous materials that are essentially an assembly of three components – fibres, matrices and binders.

Typical fibres include carbon fibre (CFRP), glass fibre (GFRP) or aramid fibre (AFRP). With respect to their tensile strength, they are categorised into HT (high tenacity), UT (ultra high tenacity) and IM (intermediate modulus). Depending on the properties desired, the fibres differ in length, thickness and relative orientation (unidirectional, bidirectional, multidirectional).

As matrices, there are currently more than 100 different resins/polymers available on the market, which is just a hint at how varied these materials are. “Cold” cutting is generally recommended for duroplastics (90%) and thermoplastics (PEEK, PEI, PPS, etc.), while elastomers (PUR) should be cut at “high speed”.

#### Applications:

Aerospace, automotive, medical industry, sports industry, wind farms, transport, building/architecture

In light of this requirement, the KOMET GROUP has developed a brand new class of tools distinguished by their innovative geometry, suitability for new machining strategies involving very high cutting parameters and also by the use of intelligent cutting materials. These new solutions range from single-edge to multi-tooth milling cutters and from drills with a new chamfer geometry to indexable tools having a special insert arrangement.

Cutting materials have also followed the trend: hard coatings – particularly KOMET RHOBEST® diamond coatings – and PCD solutions are demonstrating that they are fully equipped for the task.





### HYBRIDS

Hybrids are material combinations of at least three layers of metals, polymers and fibrous composites.

**Application:**

Aircraft construction



### HONEYCOMBS

These materials are usually three-layer composite constructions with a honeycomb-shaped core made, for example, of aluminium, polycarbonate or polypropylene and are therefore characterised by their extremely lightweight and highly stiff properties.

**Applications:**

Satellite engineering, packaging industry, exhibition stand, model and aircraft construction



### METAL MATRIX COMPOSITE MATERIAL

Metal matrix composites (MMC) have at least two constituent materials, usually a ceramic or organic component bonded in a metal matrix.

**Applications:**

Engine building, cylinder liners, connecting rods

The non-homogeneous nature of these new lightweight materials imposes exacting and individual requirements on the machining process. Not only does the KOMET GROUP offer a standard product range, it is an expert partner for its customers – with absolute focus on problem-solving.

Thanks to full process control in-house – from carbide/cutting material selection, consolidated expertise and many years of experience in grinding through to final coating – the KOMET GROUP is your single source of smart and viable machining solutions.

The standard product range presented here enables you to order the right tool for your applications and feasibility tests with zero fuss.

All other specifications including inch measurements can be created for you on request and tailored to your individual requirements.

**We would be delighted to collaborate with you to develop new machining strategies. We offer a modern machining environment to conduct tests in-house or we can visit you to coordinate further. Interested? Simply contact our experts in lightweight construction at [www.kometgroup.com](http://www.kometgroup.com)**

Tool selection

Material				Tool	Page
CFRP	GFRP	CFRP/Al stacks	Honey-combs		
●	●			 NCD Composite milling cutter, HSC type FZ, flat head 78980..	6
●	●			 NCD Composite milling cutter, HSC type FZ, burr style 78981..	6
●	●			 NCD Composite milling cutter, HSC type FZ, ball nose 78982..	6
●	●			 NCD Composite milling cutter, HSC type GZ, ball nose 78983..	6
●	●			 NCD Composite milling cutter, HSC type FZ, 2-edge 78984..	7
●	●			 NCD Composite milling cutter, HSC type GZ, 2-edge 78985..	7
●	●			 NCD Composite milling cutter, HSC type FZ, 2-edge, 135° drill centre 78986..	7
●	●			 NCD Composite milling cutter, HSC type GZ, 2-2-edge, 135° drill centre 78987..	7
●	●	●	●	 NCD Composite multi-tooth milling cutter straight teeth 78988..	8
●	●	●	●	 NCD Composite multi-tooth milling cutter helical teeth, pull cut 78989..	8
●	●	◐	◐	 PCD Compression milling cutter left-right cutting 38300..	9
●	●	●	●	 PCD Slot milling cutter straight fluted 38304..	9
●	●	●	◐	 PCD High-performance drill Drillmax 90 78205..	10
●	●	●	◐	 PCD High-performance drill Drillmax 90 30435..	11
●	●	◐	●	 PCD High-performance drill Drillmax 38405..	11

● main area of application, ◐ suitable in some cases. Other materials and combinations on request.

## Nano technology in lightweight construction



Since 1994, RHOBEST has been developing and continually adapting the nanocrystalline diamond coating to the tools used in specific machining processes.

In 2011, this nanotechnology became part of the KOMET GROUP. With KOMET RHOBEST® diamond coating technology, the surfaces and properties of tools for machining composite materials can be individually tailored to meet the requirements of the particular application.

KOMET RHOBEST® diamond coating technology has made it possible to manufacture ultrananocrystalline, highly pure and extremely hard diamond coatings that join with the tool surface to form a compact and stable unit.

Standard technology



micro

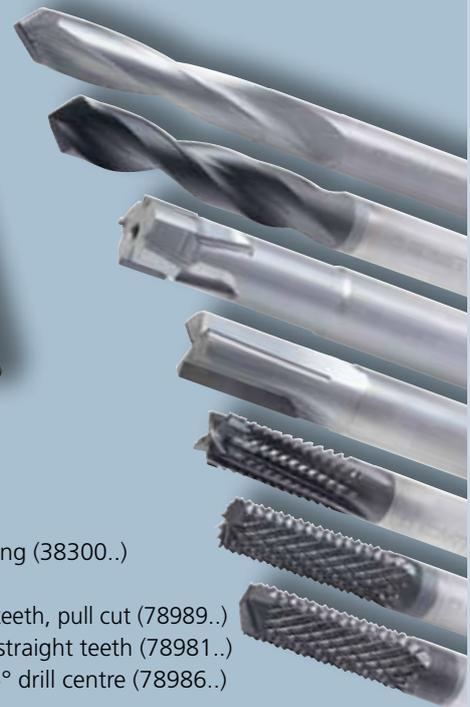
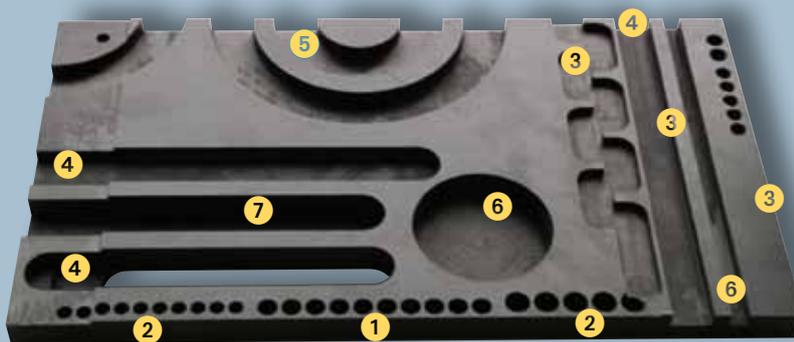
KOMET RHOBEST® technology

ultra nano

Thanks to this nanostructure, the geometry and surface of the optimised tool are retained, thin coatings are compact, wear-resistant and high-performing, and the sharpness of the tool – an important prerequisite for the machining of fibrous composite materials – is preserved.

With KOMET RHOBEST® diamond-coated tools, we meet the requirements for machining new lightweight materials – absence of burr and fibre, a smooth, flat cutting edge, suitability for painting and bonding, short machining times and long tool life.

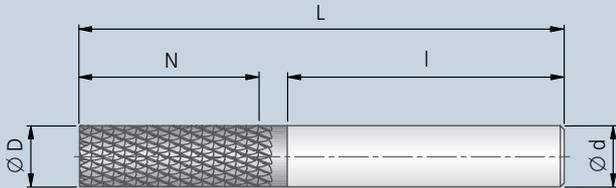
## Machining CFRP material



- ① Solid drilling with PCD High-performance drill Drillmax 90 (30435..)
- ② Solid drilling with NCD High-performance drill Drillmax 90 (78205..)
- ③ Milling and trimming with PCD Compression milling cutter, left-right cutting (38300..)
- ④ Slot milling with PCD Slot milling cutter straight fluted (38304..)
- ⑤ Interpolation milling with NCD Composite multi-tooth milling cutter, helical teeth, pull cut (78989..)
- ⑥ Circular and slot milling with NCD Composite milling cutter, HSC type FZ, straight teeth (78981..)
- ⑦ Slot milling with NCD Composite milling cutter, HSC type FZ, 2-edge, 135° drill centre (78986..)

### NCD Composite milling cutter, HSC

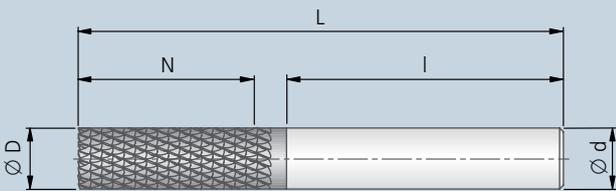
- milling and trimming
- type FZ (fine-tooth)
- flat head
- shank to DIN 6535 HA
- cutting material: diamond



78980.. type FZ				
$\varnothing D_{h10}$	$\varnothing d_{h6} \times l$	L	N	Order No.
4	4 × 20	40	15	78980040000400
4	4 × 55	75	15	78980075000400
6	6 × 25	50	18	78980050000600
6	6 × 48	75	18	78980075000600
8	8 × 30	63	25	78980063000800
8	8 × 42	75	25	78980075000800
10	10 × 37	72	30	78980072001000

### NCD Composite milling cutter, HSC

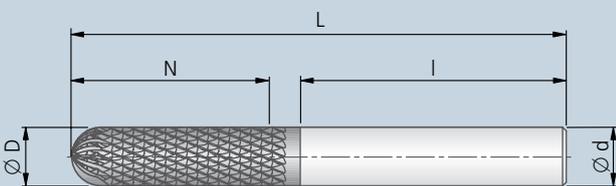
- milling and trimming
- type FZ (fine-tooth)
- burr style
- shank to DIN 6535 HA
- cutting material: diamond



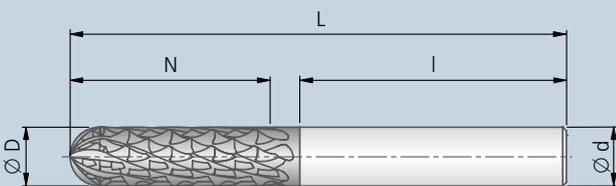
78981.. type FZ				
$\varnothing D_{h10}$	$\varnothing d_{h6} \times l$	L	N	Order No.
4	4 × 20	40	15	78981040000400
4	4 × 55	75	15	78981075000400
6	6 × 25	50	18	78981050000600
6	6 × 48	75	18	78981075000600
8	8 × 30	63	25	78981063000800
8	8 × 42	75	25	78981075000800
10	10 × 37	72	30	78981072001000
12	12 × 32	83	32	78981083001200

### NCD Composite milling cutter, HSC

- slot milling and plunge milling
- type FZ (fine-tooth), type GZ (coarse-tooth)
- ball nose
- shank to DIN 6535 HA
- cutting material: diamond



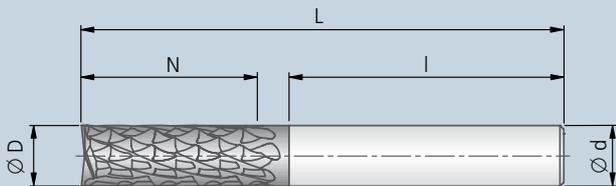
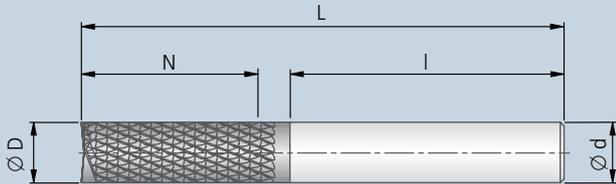
78982.. type FZ				
$\varnothing D_{h10}$	$\varnothing d_{h6} \times l$	L	N	Order No.
4	4 × 28	50	16	78982050000400
6	6 × 34	60	19	78982060000600
8	8 × 28	63	25	78982063000800
10	10 × 40	72	25	78982072001000



78983.. type GZ				
$\varnothing D_{h10}$	$\varnothing d_{h6} \times l$	L	N	Order No.
4	4 × 28	50	16	78983050000400
6	6 × 34	60	19	78983060000600
8	8 × 28	63	25	78983063000800
10	10 × 40	72	25	78983072001000

### NCD Composite milling cutter, HSC

- plunge milling and trimming
- type FZ (fine-tooth), type GZ (coarse-tooth)
- 2-edge
- shank to DIN 6535 HA
- cutting material: diamond



78984.. type FZ

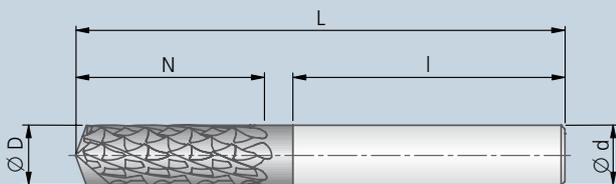
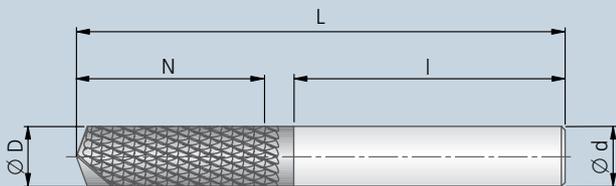
Ø D <sub>h10</sub>	Ø d <sub>h6</sub> × l	L	N	Order No.
4	4 × 28	50	16	78984050000400
4	4 × 52	75	15	78984075000400
6	6 × 34	60	19	78984060000600
6	6 × 38	75	30	78984075000600
8	8 × 28	63	25	78984063000800
8	8 × 30	75	35	78984075000800
10	10 × 40	72	25	78984072001000

78985.. type GZ

Ø D <sub>h10</sub>	Ø d <sub>h6</sub> × l	L	N	Order No.
4	4 × 28	50	16	78985050000400
4	4 × 52	75	15	78985075000400
6	6 × 34	60	19	78985060000600
6	6 × 38	75	30	78985075000600
8	8 × 28	63	25	78985063000800
8	8 × 30	75	35	78985075000800
10	10 × 40	72	25	78985072001000

### NCD Composite milling cutter, HSC

- trimming, slot milling, plunge milling and shoulder milling
- type FZ (fine-tooth), type GZ (coarse-tooth)
- 2-edge, 135° drill centre
- shank to DIN 6535 HA
- cutting material: diamond



78986.. type FZ

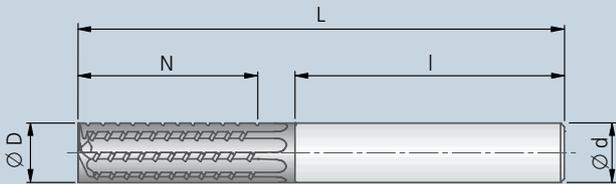
Ø D <sub>h10</sub>	Ø d <sub>h6</sub> × l	L	N	Order No.
4	4 × 28	50	16	78986050000400
4	4 × 52	75	15	78986075000400
6	6 × 34	60	19	78986060000600
6	6 × 48	75	18	78986075000600
8	8 × 28	60	25	78986060000800
8	8 × 30	75	25	78986075000800
10	10 × 40	72	25	78986072001000

78987.. type GZ

Ø D <sub>h10</sub>	Ø d <sub>h6</sub> × l	L	N	Order No.
4	4 × 28	50	16	78987050000400
4	4 × 52	75	15	78987075000400
6	6 × 34	60	19	78987060000600
6	6 × 48	75	18	78987075000600
8	8 × 28	60	25	78987060000800
8	8 × 30	75	25	78987075000800
10	10 × 40	72	25	78987072001000

### NCD Composite multi-tooth milling cutter

- straight teeth
- burr style, every second tooth exposed
- fine chip breake
- shank to DIN 6535 HA
- cutting material: diamond

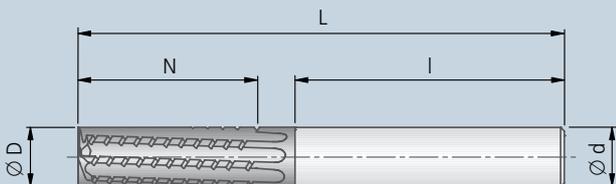


#### 78988..

Ø D <sub>h10</sub>	Ø d <sub>h6</sub> × l	L	N	No. of teeth Z	Order No.
4	6 × 30	60	16	6	78988060000400
6	6 × 28	60	20	8	78988060000600
6	6 × 30	75	28	8	78988075000600
8	8 × 28	63	22	8	78988063000800
8	8 × 32	75	32	8	78988075000800
10	10 × 30	72	32	8	78988072001000

### NCD Composite multi-tooth milling cutter

- helical teeth, pull cut
- burr style, every second tooth exposed
- feine Spanbrecher
- shank to DIN 6535 HA
- cutting material: diamond

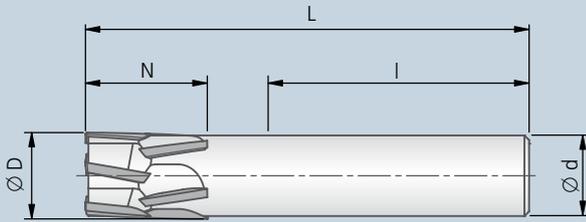


#### 78989..

Ø D <sub>h10</sub>	Ø d <sub>h6</sub> × l	L	N	No. of teeth Z	Order No.
4	6 × 30	60	16	6	78989060000400
6	6 × 28	60	20	8	78989060000600
6	6 × 30	75	28	8	78989075000600
8	8 × 28	63	22	8	78989063000800
8	8 × 32	75	32	8	78989075000800
10	10 × 30	72	32	8	78989072001000

PCD Compression milling cutter

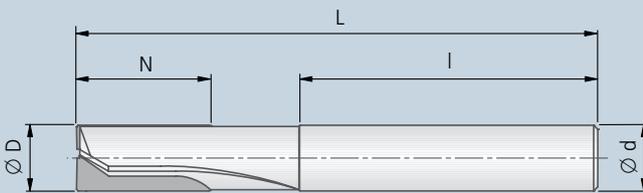
- left-right cutting ■
- shank to DIN 6535 HA ■
- cutting material: PCD ■



38300..					
$\varnothing D_{h10}$	$\varnothing d_{h6} \times l$	L	N	No. of teeth Z	Order No.
6	6 x 36	57	10	3	38300057000600
8	8 x 36	72	16	3	38300072001000
10	10 x 40	90	20	4	38380090001600

PCD Slot milling cutter

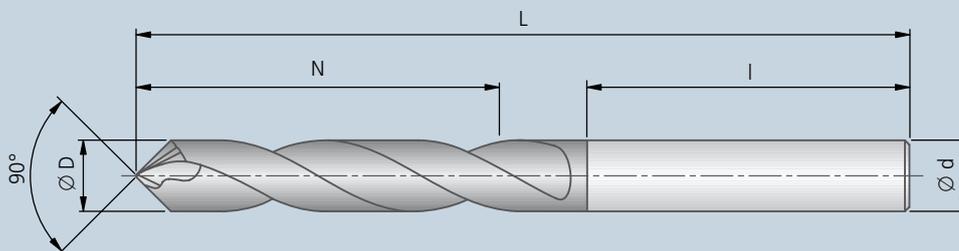
- straight fluted ■
- shank to DIN 6535 HA ■
- cutting material: PCD ■



38304..					
$\varnothing D_{h10}$	$\varnothing d_{h6} \times l$	L	N	No. of teeth Z	Order No.
6	6 x 36	57	12	2	38304057000600
8	8 x 36	63	16	3	38304063000800
10	10 x 40	72	20	4	38304072001000

NCD High-performance drill Drillmax 90

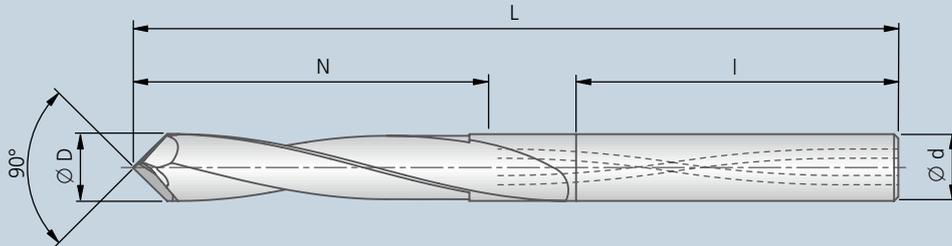
- without internal coolant supply
- 2-flute
- shank to DIN 6535 HA
- cutting material: diamond



78205.. 5xD				DIN 6535 HA
Ø Dh10	Ø dh6 x l	L	N	Order No.
4	6 x 36	74	34	78205074000400
6	6 x 36	82	40	78205082000600
8	8 x 36	91	47	78205091000800
10	10 x 40	103	53	78205003001000

PCD High-performance drill Drillmax 90

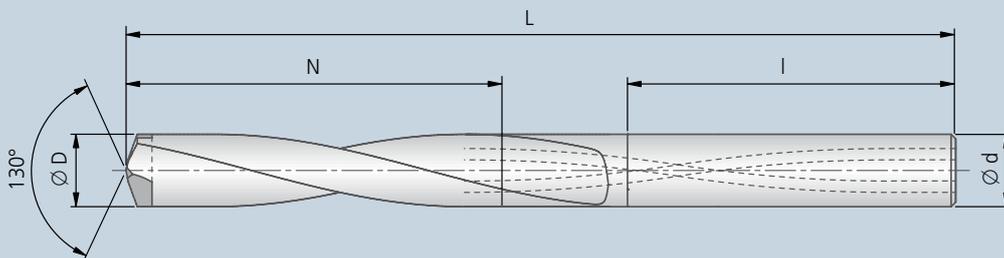
- with internal coolant supply ■
- shank to DIN 6535 HA and DIN 6535 HE ■
- cutting material: PCD ■



30435.. 5xD				DIN 6535 HE	DIN 6535 HA
Ø D <sub>h10</sub>	Ø d <sub>h6</sub> × l	L	N	Order No.	Order No.
6	6 × 36	82	30	30435082000600	38435082000600
8	8 × 36	91	42	30435091000800	38435091000800
10	10 × 40	103	50	30435003001000	38435003001000

PCD High-performance drill Drillmax

- with coolant channels ■
- 2 cutting edges and 4 guides ■
- spiral fluted ■
- shank to DIN 6535 HA ■
- cutting material: PCD ■



38405.. 5xD				DIN 6535 HA
Ø D	Ø d × l	L	N	Order No.
6	6 × 36	82	30	38405002000600
8	8 × 36	91	42	38405002000800
10	10 × 40	103	50	38405002001000

## Recommended application areas

### NCD Composite milling cutter, HSC (78980.. · 78981.. · 78982.. · 78983.. · 78984.. · 78985.. · 78986.. · 78987..)

Machining: trimming, circular cutting, grooving, ramping, plunging, pocket and slot milling

Cutting speed $v_c$ (m/min) Feed $f$ (mm/rev)	Ø 4 mm		Ø 6 mm		Ø 8 mm		Ø 10 mm		Ø 12 mm	
	$v_c$	$f$								
CFRP	100-200	0,06-0,10	100-300	0,08-0,12	100-300	0,10-0,15	100-300	0,10-0,20	100-300	0,10-0,25
GFRP	120-200	0,06-0,12	100-300	0,08-0,15	100-300	0,10-0,20	100-300	0,10-0,25	100-300	0,10-0,30

### NCD Composite multi-tooth milling cutter (78988.. · 78989..)

Machining: trimming, circular cutting, axial grooving, pocket and slot milling

Cutting speed $v_c$ (m/min) Feed $f_z$ (mm/tooth)	Ø 4 mm		Ø 6 mm		Ø 8 mm		Ø 10 mm	
	$v_c$	$f_z$	$v_c$	$f_z$	$v_c$	$f_z$	$v_c$	$f_z$
CFRP	100-200	0,02-0,04	100-300	0,02-0,06	100-300	0,02-0,08	100-300	0,02-0,10
GFRP	100-200	0,02-0,06	100-300	0,02-0,08	100-300	0,02-0,10	100-300	0,02-0,12
CFRP/Al stacks	100-200	0,02-0,04	100-300	0,02-0,06	100-300	0,02-0,08	100-300	0,02-0,10
Honeycombs	100-200	0,02-0,04	100-300	0,02-0,06	100-300	0,02-0,08	100-300	0,02-0,10

### PCD Compression milling cutter (38300..)

Machining: trimming, pocket and slot milling

Cutting speed $v_c$ (m/min) Feed $f_z$ (mm/tooth)	Ø 6 mm		Ø 8 mm		Ø 10 mm	
	$v_c$	$f_z$	$v_c$	$f_z$	$v_c$	$f_z$
CFRP	200-400	0,02-0,06	200-400	0,03-0,08	200-400	0,03-0,10
GFRP	200-400	0,02-0,08	200-400	0,03-0,10	200-400	0,03-0,12
CFRP/Al stacks	200-400	0,02-0,06	200-400	0,03-0,08	200-400	0,03-0,10
Honeycombs	200-400	0,02-0,06	200-400	0,03-0,08	200-400	0,03-0,10

### PCD Slot milling cutter (38304..)

Machining: trimming, face milling, plunge milling

Cutting speed $v_c$ (m/min) Feed $f_z$ (mm/tooth)	Ø 6 mm		Ø 8 mm		Ø 10 mm	
	$v_c$	$f_z$	$v_c$	$f_z$	$v_c$	$f_z$
CFRP	200-400	0,02-0,06	200-400	0,03-0,08	200-400	0,03-0,10
GFRP	200-400	0,02-0,08	200-400	0,03-0,10	200-400	0,03-0,12
CFRP/Al stacks	200-400	0,02-0,06	200-400	0,03-0,08	200-400	0,03-0,10
Honeycombs	200-400	0,02-0,06	200-400	0,03-0,08	200-400	0,03-0,10

### NCD High-performance drill Drillmax 90 (78205..)

Machining: through hole, blind hole

Cutting speed $v_c$ (m/min) Feed $f$ (mm/rev)	Ø 4 mm		Ø 6 mm		Ø 8 mm		Ø 10 mm	
	$v_c$	$f$	$v_c$	$f$	$v_c$	$f$	$v_c$	$f$
CFRP	100-200	0,04-0,08	100-300	0,06-0,12	100-300	0,06-0,12	100-300	0,06-0,12
GFRP	100-200	0,04-0,10	100-300	0,06-0,15	100-300	0,06-0,18	100-300	0,06-0,20
CFRP/Al stacks	100-200	0,04-0,08	100-300	0,06-0,12	100-300	0,06-0,12	100-300	0,06-0,12
Honeycombs	100-200	0,04-0,08	100-300	0,06-0,12	100-300	0,06-0,12	100-300	0,06-0,12

### PCD High-performance drill Drillmax 90 (30435..) and Drillmax (38405..)

Machining: through hole, blind hole

Cutting speed $v_c$ (m/min) Feed $f$ (mm/rev)	Ø 6 mm		Ø 8 mm		Ø 10 mm	
	$v_c$	$f$	$v_c$	$f$	$v_c$	$f$
CFRP	100-300	0,05-0,12	100-300	0,06-0,12	100-300	0,06-0,12
GFRP	100-300	0,05-0,15	100-300	0,06-0,18	100-300	0,06-0,20
CFRP/Al stacks	100-300	0,05-0,12	100-300	0,06-0,12	100-300	0,06-0,12
Honeycombs	100-300	0,05-0,12	100-300	0,06-0,12	100-300	0,06-0,12

Other materials and combinations on request.

We would be delighted to collaborate with you to develop new machining strategies. We offer a modern machining environment to conduct tests in-house or we can visit you to coordinate further.

Interested? Simply contact our experts in lightweight construction at [www.kometgroup.com](http://www.kometgroup.com)