WOOD WORKING MAIN CATALOGUE

WOOD WORKING

INTRODUCTION
CONTENTS

Welcome to the world of CERATIZIT ...

... a world of unique and consistently innovative solutions for wear parts, cutting tools and wood and stone machining. CERATIZIT is your partner for exceptional and highly personalised hard material products which guarantee cost efficiency, resistance and performance. Increasing both the productivity and service life of your products in a very diverse range of industrial sectors is the very essence of our business.

... because 'hard material matters'

Hard materials in general and hard metals in particular are characterised by a range of interesting properties for all applications where maximum wear resistance is required. High pressure, high temperature and highly abrasive or aggressive conditions are factors to which hard materials or metals must be resistant. Our powder metallurgical production of parts for wear protection enables tailor-made adaptation of the material properties to your wear criteria.

This fact makes CERATIZIT hard materials and carbides indispensable materials in order to significantly increase the service life of components which are subject to high stress. Ever more powerful machines, facilities and machining methods constantly create new challenges for the CERATIZIT development engineers. Intensive research and development activities which precisely match your requirements and work processes already today are able to provide the solutions for tomorrow.

Guided by corporate values

We employ more than 5,500 people worldwide who are guided by our corporate values in their daily work:

1 The views and focus of our business partners matter

Instead of talking product with customers, we work on real solutions for business partners.

2 Innovative and flexible thinking matters

We challenge state-of-the-art technologies and develop intelligent alternatives. Our speed of thought and decisive actions give us a leading edge.

3 Communication matters

Trust and respect enable open communication. We show who we are and what we feel. We keep our promises. We are open to and accept constructive criticism.

4 Employee development matters

We continuously invest in personnel and offer outstanding internal development opportunities. We attract talents around the world and create a favourable environment for long-term personal growth.

5 Professionalism matters

We strive to be professional in everything we do. Our performance leads to results and growth which are always above average.

6 Our environment matters

Environmental protection is a matter of each employee – at home and at work. As a company we guarantee the community to be a 'considerate neighbour'.

Production site

Mamer (Luxembourg)

The CERATIZIT Group has its headquarters in Mamer in Luxembourg. Today the plant in Mamer has more than 1,150 employees and concentrates on industrial wear protection, wood and stone machining as well as inserts and tools.

Carbide – a composite material with valuable properties

Carbides are composite materials consisting of a hard material and a comparatively soft binder metal, like cobalt (Co). The performance characteristics of carbide are determined by hardness, transverse rupture strength and fracture toughness. With regard to their application, important parameters for the optimisation of these characteristics are the cobalt content and the grain size of the metal binder phase. The tungsten carbide grains have an average size of less than 0.2 µm up to several micrometres (µm). The cobalt fills the gaps between the carbide grains. When extremely high toughness is required, the cobalt content can amount up to 30%, whereas, for maximum wear resistance, the cobalt content is reduced and the grain size decreased to the nano-crystalline range of < 0.2 µm.

CERATIZIT produces far more than 100 different carbide grades particularly for wear parts and cutting tools, thus offering a customised solution for every application.

Carbide production

Carbide production at CERATIZIT started in 1929.
Last but not least, thanks to long-standing experience CERATIZIT handles the entire process chain, from the raw material to the dispatching of the finished products to customers. The production process of powder-metallurgical products basically includes the four steps of powder preparation, forming, sintering and finishing.

Tungsten carbide production

The APT (ammonium para-tungstate) is calcined into tungsten oxide under high temperature. Subsequently the oxide is reduced to tungsten metal in a hydrogen atmosphere. The metal powder is then mixed with carbon and carburised under inert atmosphere at high temperatures. The production parameters are decisive for the WC grain size in the sintered carbide.

Powder preparation

The tungsten carbide is intensely mixed with the binder metal cobalt, nickel or iron, various grain growth inhibitors and materials, which promote compaction, by wet grinding so that a homogeneous suspension is created.
Afterwards, the suspension is dried in a spray tower to produce a granulate with good flow characteristics.
This granulate represents the basis for all forming processes.

APT (ammonium para-tungstate)

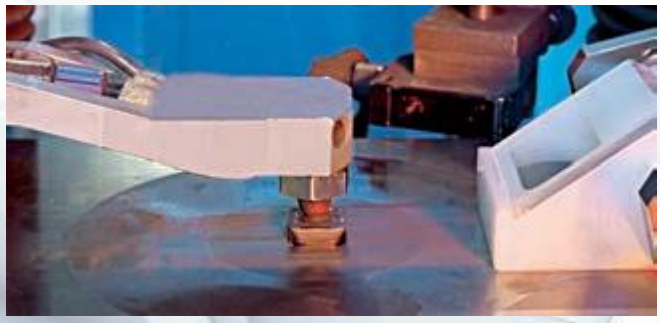
Yellow tungsten oxide

Blue tungsten oxide

Tungsten

Tungsten carbide

Metal forming – pressing – machining



Metal forming

The objective of the forming process is to obtain a near net shape sample. Pressing is normally carried out at room temperature with pressures reaching up to several tons per square centimetre.
There are several ways of pressing blanks:

During isostatic cold pressing the powder is filled into an elastic flexible hose and pressed into a compacted form through high liquid pressure. The powder blocks which are produced in this way can then be processed mechanically. All common machining methods like milling, cutting, drilling or turning may be applied.

In uniaxial pressing the pressing tool consists of a die and an upper and a lower punch. The carbide powder is filled into the die and then compacted to create the so called green carbide, which is ejected from the pressing die.

Extrusion pressing is mainly used to produce rectangular bar or cylindrical rod, with or without axial hole(s). A plasticiser is added to the powder. The resulting paste is pressed through an extrusion nozzle. Before sintering, the plasticiser must be evaporated in special drying furnaces.

Metal Injection Moulding (MIM) is a process used to produce more complex forms which cannot be produced by direct pressing. The paste preparation is similar to the extrusion process.

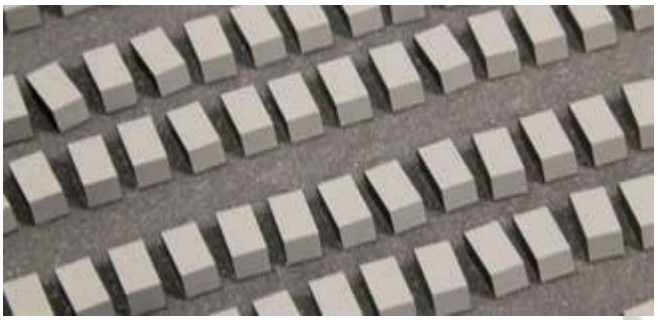
Pressing

Machining

Sintering

Sintering process

The sintering process converts the blank into a homogeneous and dense carbide with a high level of hardness. The material is sintered at temperatures between 1,300 and 1,500 °C (liquid phase sintering) and sometimes also at high pressure (up to 100 bar). The volume is reduced by up to 50 % during this process.



Sintering

Finishing – grinding – coating

Finishing

In order to achieve the final requirements of surface finish, tolerances, etc. carbide parts can be subjected to a series of finishing processes such as grinding, spark erosion and coating. As a pioneer in coating technology we set new standards through revolutionary coating developments even today. Our coating competency covers classic hard material coatings, functional tailor-made coatings for specific customer applications as well as multi-layer coating. These coatings, which consist for example of titanium carbide, titanium nitride or aluminium oxide, maximise the cutting performance and service life of the CERATIZIT carbide products. The most important coating procedures are CVD (Chemical Vapour Deposition) and PVD (Physical Vapour Deposition).

Cemented carbide machining by spark erosion meets the highest technological standards. Wire erosion and cavity sinking by EDM guarantee high precision. Long-standing experience combined with carbide grades that are specially adapted for erosion guarantee optimum machining results.

Finishing

Grinding

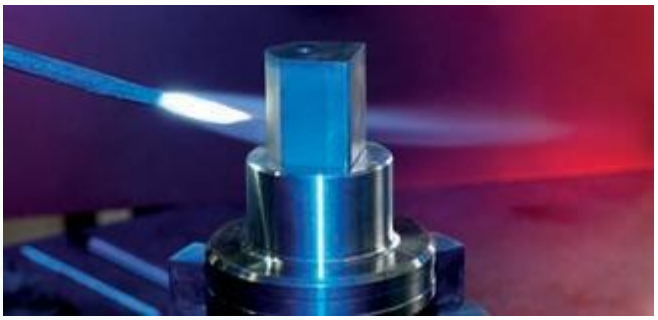
Coating

Joining – erosion – quality check

Composite parts

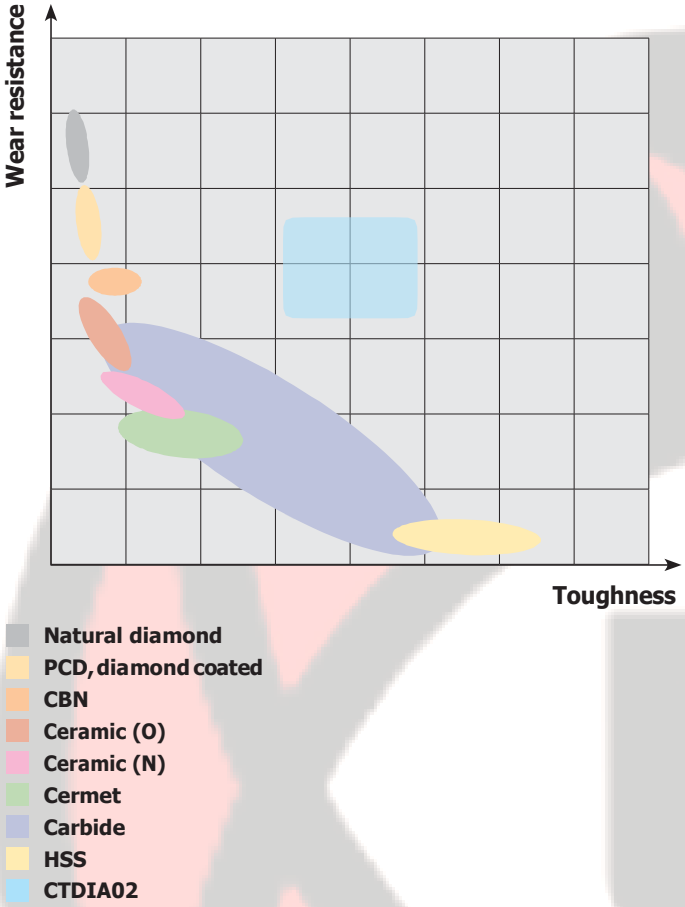
In many cases it is not optimal to manufacture the entire component in carbide. The use of carbide is then limited to the area in which wear occurs. Materials with appropriate wear resistance are used for the tool; they are easier to machine than carbide. Numerous tried and tested technologies, such as brazing, gluing, clamping, connections with screws and shrinking are applied to combine carbide with other materials.

Joining



Erosion,
grinding, honing, ...

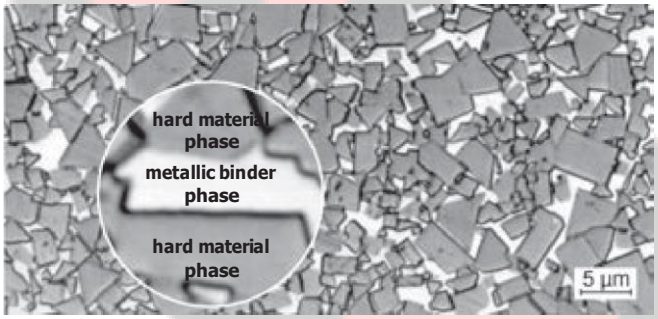
Quality check



Carbide is a hard material with mechanical properties that can be adjusted within a very wide range, given its composition and microstructure. The hardness and toughness range of the CERATIZIT grades includes everything from wear-resistant tool steel to super-hard ceramic materials.

Criteria relevant for application

- Wear resistance, hardness
- Compressive strength
- Impact strength
- Transverse rupture strength
- Tribological properties
- Specific weight
- Magnetic properties
- Modulus of elasticity, rigidity
- Thermal properties
- Corrosion resistance, resistance to oxidation
- Toughness



Micrograph of WC-Co carbide

The hard material provides the necessary

- hardness
- wear resistance

The metallic binder provides

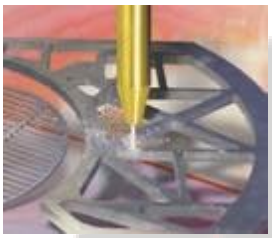
- toughness

Classification of the WC grain size		CERATIZIT code
Average grain size [µm]	Classification	
< 0.2	nano	N
0.2 – < 0.5	ultrafine	U
0.5 – < 0.8	submicron	S
0.8 – < 1.3	fine	F
1.3 – < 2.5	medium	M
2.5 – < 6.0	coarse	C
> 6.0	extra-coarse	E

The classification of carbides according to grain size corresponds to the recommendations of the Powder Metallurgy Association.

Carbide properties depending on the Co contents and C grain size

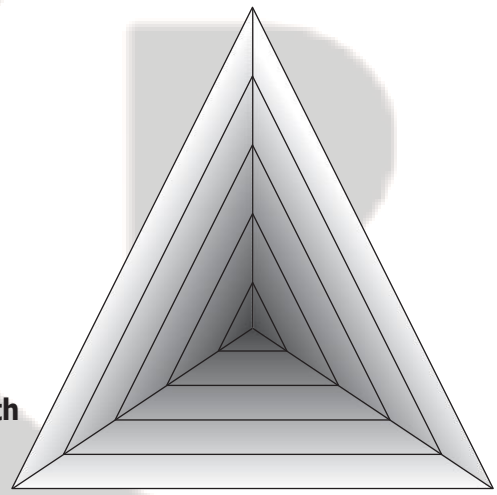
Hardness (wear resistance)



Nozzles for water jet cutting

Type of stress
- Wear
- Corrosion

Carbide grade
- Very high hardness: 2650HV30
- Small grain size: < 0.5 um
- Low Co content: 0.4%
- Corrosion resistance when adding Cr_3C_2



Transverse rupture strength

Micro-drilling

Type of stress
- Wear
- Deflection

Carbide grade
- T.R.S.: >4000 MPa
- Small grain size: < 0.5 µm + VC
- Low Co content ~ 8.5%
- High wear resistance: 1930 HV30

Toughness

Hot rolling

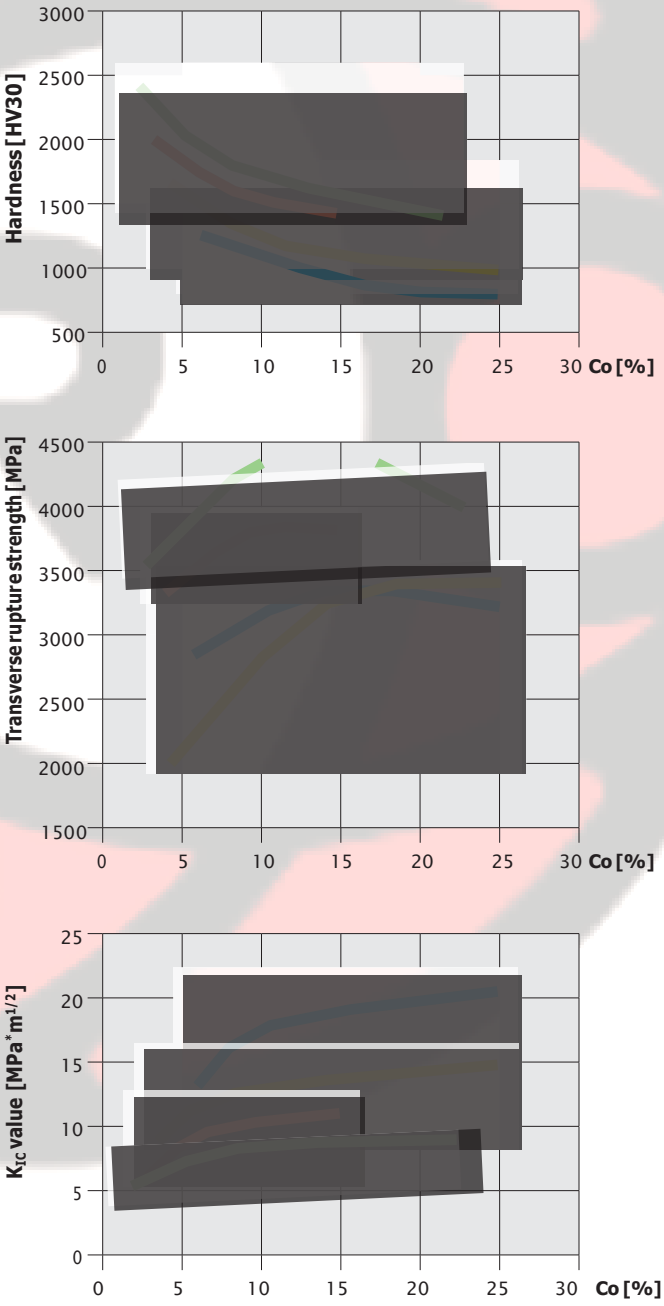
Type of stress
- Wear due to abrasion
- Built-up edge
- Impact stress

Carbide grade
- Sufficient fracture toughness: Co content 20%
- Good wear resistance: 1030 HV30
- Medium grain size coarse or extra-coarse

The graphic illustrations below show that the mechanical properties of the carbide mainly depend on the binder content (Co) and the TC grain size. Hardness, i.e. wear resistance, increases inversely proportional to the fracture toughness. This means that the harder the material the more it reacts to notch tensions and impact stress (the 'impact resistance' parameter, which cannot be precisely defined, correlates with the fracture toughness of the material).
On the other hand, the transverse rupture strength does not directly depend on the hardness but rather on the TC grain size and the cobalt content. The adhesive wear (tendency to stick), however, decreases with the grain size and the cobalt content of the carbide used. The list of the mentioned interdependencies, which could be extended at will for other wear and failure mechanisms, show that it is only possible to choose the correct carbide grade following a systematic procedure and/or based on experience with similar applications.

Ultrafine grades

Coarse grain



Composition and properties

CERATIZIT grade code	ISO code	U.S. code	Binder [m %]	Density [g/cm³]	Hardness HV10	Hardness HV30	Hardness HRA	Transverse rupture strength [MPa]	Transverse rupture strength [P.S.I.]	Fracture toughness [MPa*m½]
Nano-grades										
UMG04	K01	C4	2,2	15,30	2500	2400	96,0	3200	464000	5,4
Ultrafine grades										
SMG02	K01	C4	2,4	15,25	2300	2200	95,2	3500	508000	5,7
KCR05+			Co+Ni 3,0	15,25	2160	2115	94,5	2600	377000	6,8
KCR05	K01	C4	Co+Ni 2,76	15,20	2150	2110	94,4	2500	363000	6,0
HE40	K40		20,0	13,15	1250	1240	88,8	3500	508000	12,1
Submicron grain										
KCR06+			Co+Ni 3,0	15,30	2060	2020	94,0	2800	406000	7,5
CTMPP03			3,0	15,30	1950	1910	93,6	2300	333000	
KCR06			3,0	15,30	1950	1910	93,6	2300	334000	8,5
KCR08			4,2	15,20	1920	1885	93,4	2300	331000	8,7
CTS12D	K10-K15		6,0	14,95	1800	1770	92,9	3700	537000	8,8
MG18	K20	C2	10,0	14,45	1680	1660	92,3	3700	537000	9,4
CTS18D	K20-K40	C2	9,0	14,55	1610	1590	91,9	3700	537000	11,0
CTOPP10			10,0	14,45	1570	1550	91,6	3000	435000	
CTS24D	K30-K40		12,0	14,25	1480	1460	90,9	4000	580000	12,5
MG30	>K40		15,0	13,95	1330	1320	89,7	3800	551000	11,9
Fine grain grades										
KCR10			Co+Ni 4,0	15,15	1780	1760	92,8	2800	406000	10,1
HC10	K10	C3	5,6	15,00	1760	1730	92,7	2150	312000	9,2
HC05	K10	C3	4,0	15,15	1730	1700	92,5	2200	319000	8,7
HC20	K20	C2-C3	6,0	15,00	1640	1620	92,1	2200	319,000	9,9
S26T	P20	C2	Co 9,5 (Ti,Ta,Nb) C 20,6	12,20	1570	1550	91,6	2200	319000	10,8
S25T	P25	C5-C6	Co 9,5 (Ti,Ta,Nb) C 22,4	12,50	1550	1530	91,5	2500	363000	10,5
SMX	P20M/P25M	C6	Co 11,0 (Ti,Ta,Nb) C 18,5	12,65	1550	1530	91,5	2200	319000	10,0
S4X7	P30/P35	C1-C2	Co 11,0 (Ti,Ta,Nb) C 11,2	13,05	1490	1470	91,0	2300	334000	11,6
S40T	P35	C1-C2	Co 11,0 (Ti,Ta,Nb) C 12,0	13,25	1440	1420	90,6	2400	348000	13,5
HC40	K40	C1	12,0	15,00	1330	1320	89,7	3000	464000	12,0

Composition and properties

CERATIZIT grade code	ISO code	U.S. code	Binder [m %]	Density [g/cm³]	Hardness HV10	Hardness HV30	Hardness HRA	Transverse rupture strength [MPa]	Transverse rupture strength [P.S.I.]	Fracture toughness [MPa*m½]
Medium grain grades										
S3X7	P25	C6	Co 9,0 (Ti,Ta,Nb) C	12,45	1560	1540	91,5	2150	312000	10,7
HC25	K20	C2	7,0	15,00	1550	1530	91,5	2600	377000	10,4
HC30	K30	C1	8,5	15,00	1420	1400	90,4	3500	508000	12,1
HC35	K30	C1	9,0	14,60	1400	1380	90,3	2800	335000	10,9
S6X7	P40	C5	Co 14,0 (Ti,Ta,Nb) C 17,2	11,60	1390	1370	90,2	2350	341000	11,7
Coarse grain										
GC32	K40		10,0	14,60	1130	1120	87,6	2600	377000	18,0
GC40	<K40		15,0	14,05	990	980	85,8	2800	457000	22,0
Silicon nitride										
SNC1	CN-K20		$Al_2O_3Y_2O_3$ 9,0	3,25	1550	1530	91,5	1100	160000	6,5
Steel										
HSS 18%			W 18.0, others 6.0, Fe balance		850		64			
HSS 6%			W 6.4, others 6.0, Fe balance		850		64			
HPS*					790		62			

Comment:

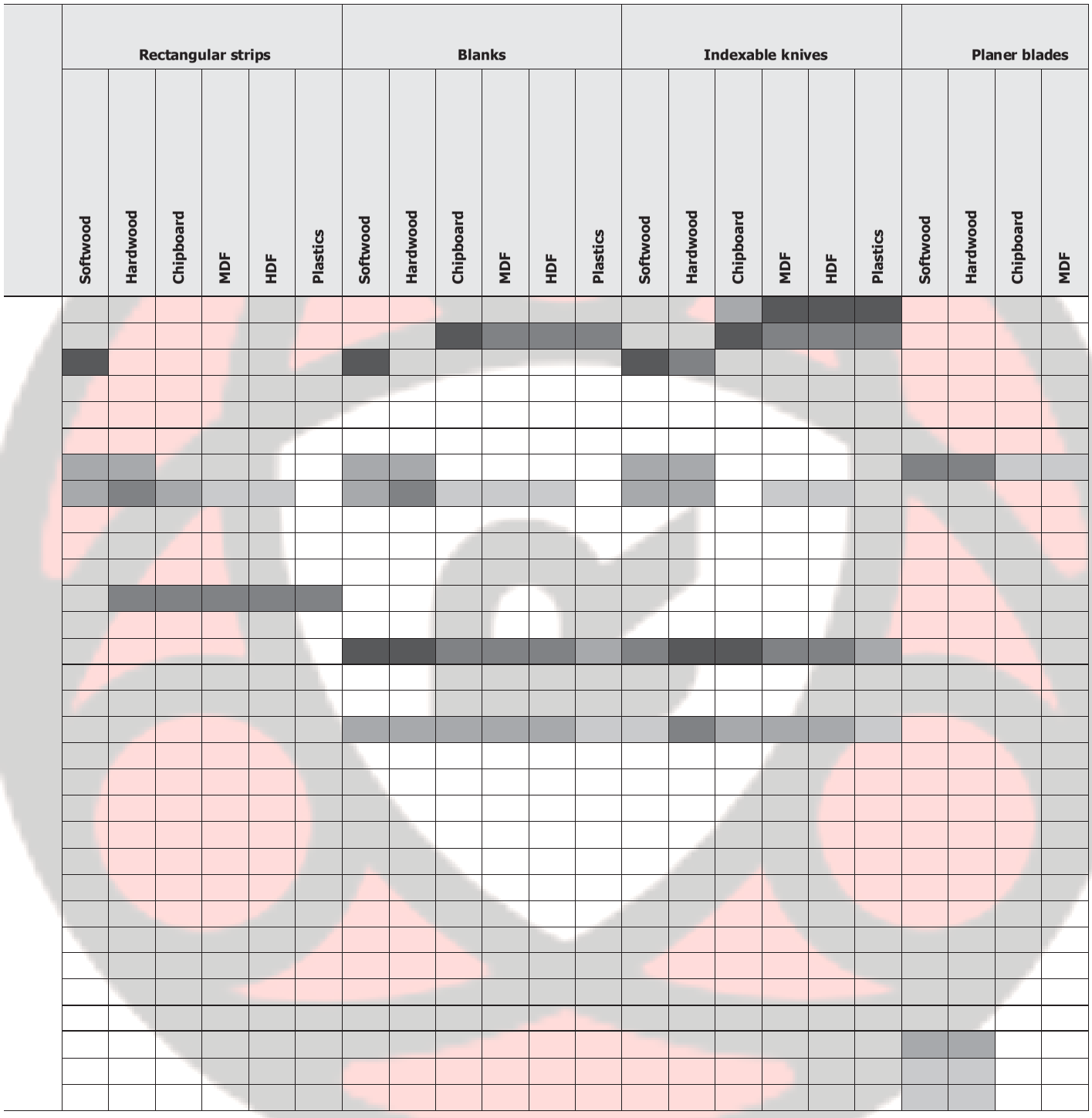
1. The data in this table are typical material parameters. We reserve the right to modify the data due to technical progress or due to further development within our company.
2. K_{IC}*: The measured critical tension intensity factors (K_{IC}) depend to a high degree on the sample geometry and sample preparation. A direct comparison with parameters which have been determined by means of a different method is therefore not admissible.

INTRODUCTION
GRADE OVERVIEW

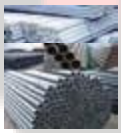
CT grade code	Saw tips for wood working							Saw tips for metal sawing				Rods						
	Winter	Sommer, mainly wood processing companies and saw mills	Softwood	Hardwood	Chipboard	MDF	HDF	Non-ferrous metals	Steel	Stainless steel	Aerospace material	Softwood	Hardwood	Chipboard	MDF	HDF	Plastics	Composite materials
UMG04																		
SMG02																		
HE40																		
KCR05																		
KCR05+																		
CTMPP03																		
CTOPP10																		
MG18																		
CTS18D																		
CTS12D																		
CTS24D																		
KCR06																		
KCR06+																		
KCR08																		
HC10																		
HC20																		
HC05																		
HC40																		
KCR10																		
S25T																		
S26T																		
S40T																		
S4X7																		
SMX																		
HC25																		
HC30																		
HC35																		
GC32																		
HPS®																		
HSS 6%																		
HSS 18%																		

see page(s)
A22–A23

Acceptable
Good
Very good
Optimum


Rectangular strips
Blanks
Indexable knives
Planer blades
Softwood
Hardwood
Chipboard
MDF
HDF
Plastics
Softwood
Hardwood
Chipboard
MDF
HDF
Plastics
Softwood
Hardwood
Chipboard
MDF
HDF
Plastics
Softwood
Hardwood
Chipboard
MDF

Grade recommendations – saw tips for metal

	CT grade code	Material types	Circular saws	Work pieces	Coating
Non-ferrous metals 	HC10	Aluminium < 7% silicon	215–600 mm	tube, plate, bar and extruded section	no
	KCR10	Aluminium < 7% silicon	215–600 mm	tube, plate, bar and extruded section	no
	KCR05+	Aluminium > 7% silicon	215–600 mm	tube, plate, bar and extruded section	no
	HC10	Brass	215–600 mm	tube, plate, bar and extruded section	no
	HC10	Copper	215–600 mm	tube, plate, bar and extruded section	no
Sandwich materials 	SMX	Aluminium steel and other materials	215–600 mm	steel sandwiched with other materials	no
Stainless steels 	CTS24D	Duplex	250–560 mm		yes
	CTS18D	SUS 304, 312, 316	250–560 mm		yes
Aerospace materials 	CTS24D	Inconel 718, Hastelloy	350–550 mm	solid carbide	yes
	CTS18D	Titanium	350–550 mm	solid carbide	yes
Steel 	S40T	General (reground saws)	250–2000 mm	various	no
	S25T	Bearing steel	355–600 mm	various	yes
	S25T	Oil / gas tubes	Flying cut-off 355–600 mm	seamless tubes without internal / external welding seam	yes
	S25T	Various materials	HSC (high speed cutting) 355–600 mm	seamless tubes without internal / external welding seam	yes
	S40T	Various	Orbital saws 355–600 mm	tube with internal / external welding seam	yes
	S25T	Die steel > HRC60	350–550 mm	various	yes
		Medium carbon steel	350–550 mm	solid	yes
Cast iron 	CTS12D	Cast iron, low ferrite content	355–600 mm		yes

new

Grade recommendation – band saws for metal

	CT grade code	Material types
Non-ferrous metals 	HC20	Aluminium < 7% silicon
	CTS12D	Aluminium > 7% silicon
	KCR10	Aluminium > 7% silicon, castings
	HC20	Brass
	HC20	Copper
Steel 	CTS18D	Black steel, constructional steel, annealed steels, cold/hot working steels and tool steel
	HC20	Steel > HRC60
	KCR10	High chrome steel
Stainless steels 	CTS18D	Duplex steels
	CTS18D	Nickel based alloys
	CTS18D	Corrosion resistant steels
Aerospace materials 	CTS24D	Inconel 718, Hastelloy
	CTS18D	Inconel 718, titanium
	CTS24D	
	CTS18D	

Grade recommendations – band saws for wood

	CT grade code	Material types
Wood 	CTS18D	Laminated materials