DR. KAISER
precision through diamond

GRINDING WHEELS

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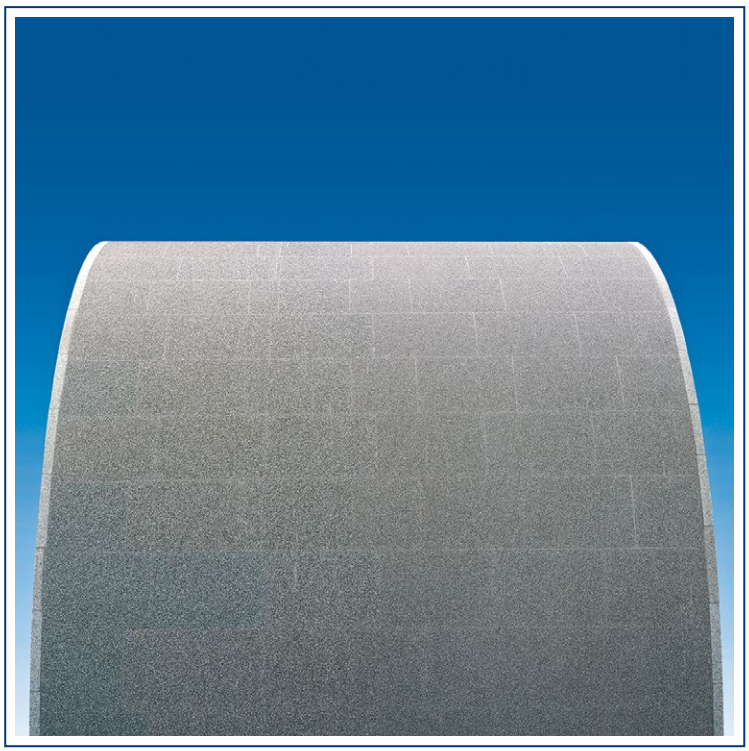


DRESSING TOOLS AND GRINDING WHEELS

DR. KAISER DIAMANTWERKZEUGE started production of electroplated dressing tools for gear wheel production in 1989, soon followed by the manufacture of electroplated grinding wheels for in-house production. The first deliveries to external customers quickly developed into an independent product line with product code designation SG. The rapid expansion of electroplated dressing tools and grinding wheels led to the establishment of a new department geared to the specific needs of grinding wheel manufacture in 2004: the Hard Fine Machining department. The electroplating systems and precision steel machining manufacturing capability were designed specifically for the production of small diameter grinding pins through to high-performance wheels with a diameter of max. 600 mm.

The necessity to use optimized grinding tools for the in-house production of dressing tools led to the manufacturing of dressable, ceramic-bonded diamond grinding wheels (SK) from 2007. After a development period of two years, it was possible to transfer the knowledge gained to CBN and diamond grinding wheels for customer applications. The product category ceramic grinding wheels was born and DR. KAISER DIAMANTWERKZEUGE thus became a global systems provider for all things relating to the grinding process.

CONTINUOUS EXPANSION - A CHALLENGE FOR EVERY EMPLOYEE

The growth of the Hard Fine Machining and Vitrified Grinding wheel departments was only possible by continuous expansion of the production facilities and an increase in the work force. Whether it was a matter of electroplating machines, presses, CNC machinery, or grinding machines, there is a continuous addition of new equipment. The development of production from very small grinding pins in large-lot production or crankshaft grinding wheels in one-off batches, whether it was bonds with very high porosity or electroplated layers, grinding wheels for rough-cutting cast materials or wheels for gear wheel production: every single employee is involved in mastering the daily challenge to ultimately supply customers with the optimum grinding wheel from DR. KAISER.

CBN AND DIAMOND GRINDING WHEELS

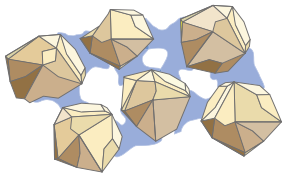
CBN: FOR GRINDING STEEL

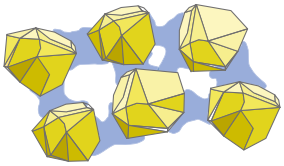
Produced by synthesis: The covalent bonding of boron and nitrogen, CBN is the second hardest material with a hardness of approximately HV 4500. The high thermal and chemical stability of CBN permits the machining of steel materials and results in high cutting performance during the grinding process. In order to utilize the full potential of CBN, it is essential to use with high cutting speeds.
The large number of different CBN types leads to an adaptation of grinding tools to suit the wide variety of applications. Steels, Ni base alloys or HS*: CBN is always the right grinding material.

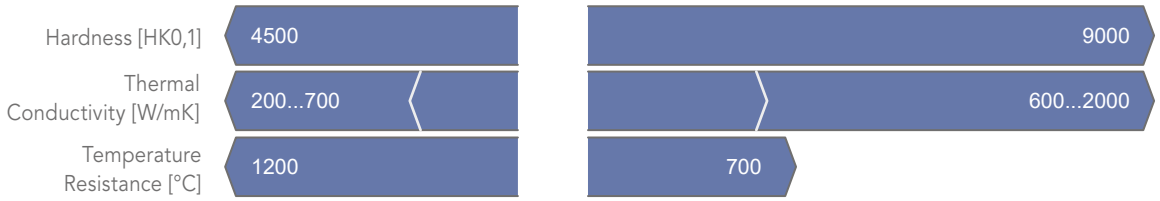
* High-speed steels are abbreviated to HS in compliance with new standards (EN ISO 4957).

DIAMOND: FOR GRINDING NON-FERROUS METALS

Carbon in covalent bonding is the hardest material and has a hardness of HV 9000. New production techniques with synthetic diamonds allow the production of grits optimized for the application. In this way block-shaped or splintered variants can be used to adapt grinding tools to the process.
Diamond oxidizes in air to form carbon dioxide at temperatures of approx. 800°C. These temperatures occur in many machining applications for ferrous materials and lead to a rapid decomposition of diamonds due to the affinity between Fe and C. Diamond is the right choice for carbide, cermets, ceramics, PCD / PCBN, thermal sprayed alloys, sapphire, glass, silicon, ferrite, graphite or composites.







GRIT SIZES - BUT EVEN MORE THAN THAT

Every tool must be designed precisely to the application in order to achieve the required stock removal rates, tool life, and surface requirements of the workpiece. The stock removal rate of the grinding wheel is determined by the various qualities and sizes of the abrasive grit. Whether the requirement demands the ultrafine machining of the highest surface quality or rough-cutting with high cutting rates: the grit size of the abrasive is important. Bonding, porosity, grit concentration, and homogeneous grit and pore distribution of the CBN grinding wheel are the main factors that determine the process behavior of the wheel. Ultimately the interaction of all characteristics determines the behavior of a grinding wheel for an application.
Dressable grinding wheels require a little more: conditioning by creating the profile shape, cleaning the grinding surface and sharpening by removing bonding. In fact, Eckhart Saljé was once quoted as saying „when it is impossible to dress, it is not even worthwhile to try grinding".
As a dressing and grinding system provider, the many years of experience DR. KAISER has in grinding and dressing processes will certainly benefit your process and components.

FEPA Grit Designation approx. mean size in µm CBN/Diamond	US-Standard ASTME 11	ISO 6106 (in µm)
46	325/400	45/38
54	270/325	53/45
64	230/270	63/53
76	200/230	75/63
91	170/200	90/75
107	140/170	106/90
126	120/140	125/106
151	100/120	150/125
181	80/100	180/150
213	70/80	212/180
251	60/70	250/212
301	50/60	300/250
356	45/50	355/300
426	40/45	425/355

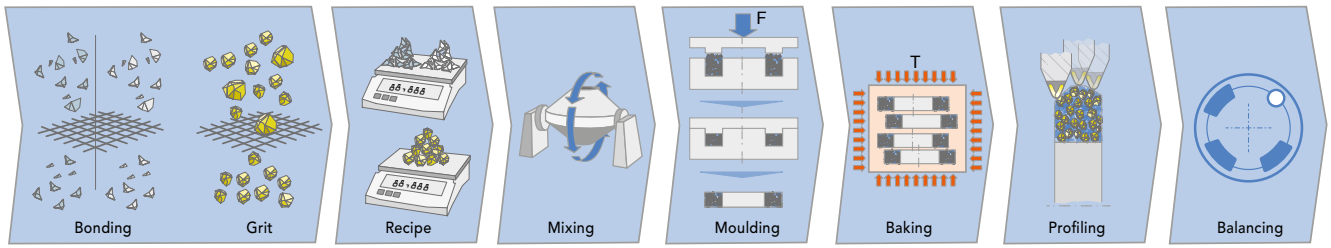
VITRIFIED BOND

TOP QUALITY PERFORMANCE - DRESSABLE

In the past few years vitrified bonded CBN has added a higher level of performance to grinding operations. The wear-free bond fully utilizes the high thermal and chemical stability of CBN in the grinding process. Advanced dressing techniques, tools, and machine concepts have now produced a grinding system that provides economic and efficient solutions when it comes to the high production of steel components.
Vitrified bonded diamond grinding wheels supply the best results for machining high-precision components made of non-ferrous materials.
Whether it is a matter of high-performance wheels or precision machining, vitrified bonds can be specifically designed for application-specific processes to permit the full utilization of CBN and Diamond superabrasives.

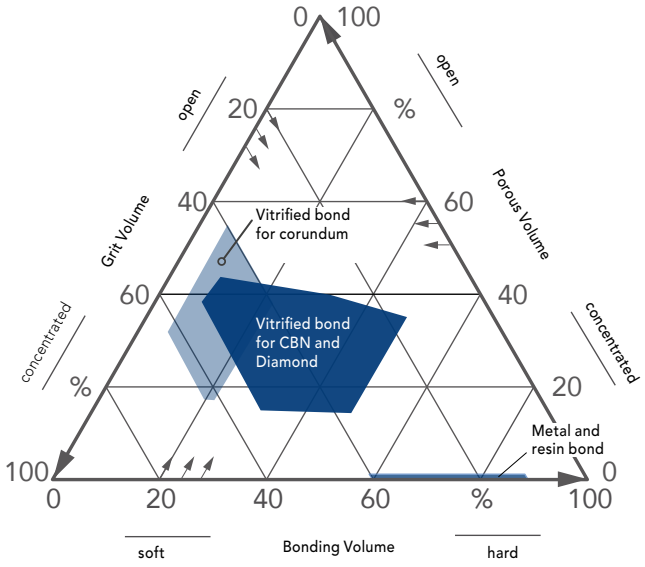
PRODUCTION PROCESSES

Extreme precision is required to achieve a constant quality of the various bond components and manufacturing variables. The bonding materials and grit are combined and mixed based on individual recipes. The finer the grit size of the recipe, the greater the resources needed. Depending on the layer size, the mixtures are pressed into special moulds and then cured in a furnace based on specific firing curves. In addition, inert gases prevent the undesired formation of oxidation. Grinding wheels receive their final geometry by profiling - this is a complex process utilizing diamond dressing tools. Before the grinding wheels are shipped, they are subjected to a balancing test to permit high-speed operation on the machine.



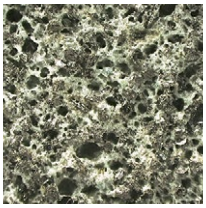
CLEAN GRINDING TOOLS GRIND BETTER

Abrasive grit, bond, and pores: that's all a grinding wheel needs. The abrasive grit grinds, the bond holds, and the pores remove the chips. Supporting grit (e.g. Aluminum Oxide or SiC) is only used in special cases. This makes DR. KAISER grinding wheels unique in their applications.

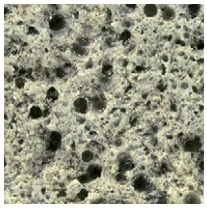


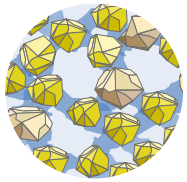
B151/181 – open structure

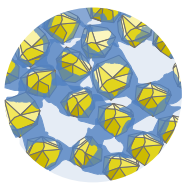
B151 – concentrated structure

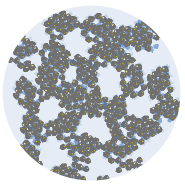


B3/6 – open Struktur









POROSITY - THE KEY TO CUTTING EFFICIENCY

Grinding tools from DR. KAISER feature a high volume of pores. This is possible by applying innovative production technology. Pore volumes up to 60% in conjunction with high-strength bonds give grinding wheels an effective cutting performance and make them very easy to dress. They permit the more efficient transportation of lubricoolant to and from the contact zone. This results in cooler grinding at higher speeds.

GRIT TYPES

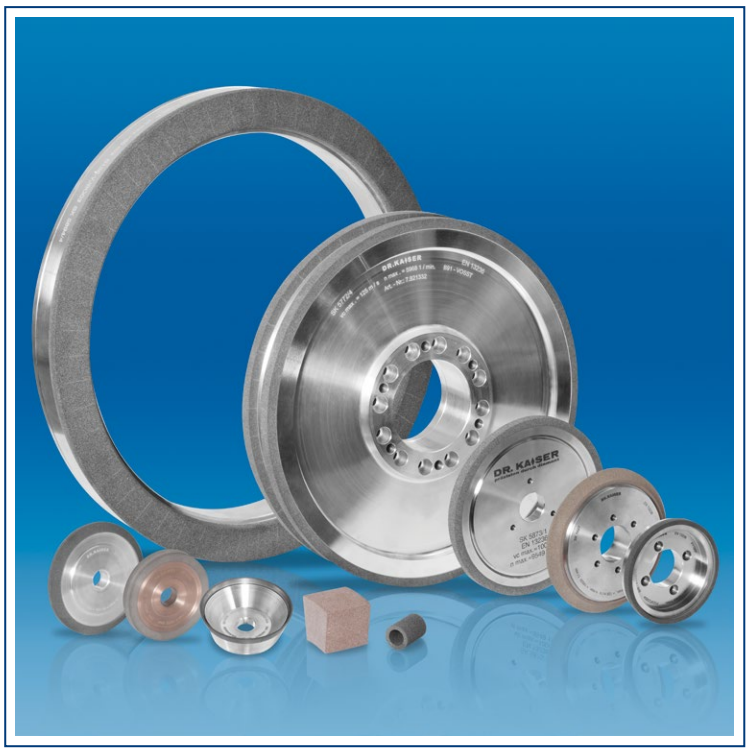
There are different types of CBN. The wide color spectrum ranges from black and brown through to amber. The grit shapes vary from blocky to splinter-shaped and lead to micro- or macrofracturing in use, despite its monocrystalline crystal structure. This results in a wide variety of applications that are modified to the process on a case-by-case basis.

There are different types of diamond. An increased use of synthetic grit has reduced the amount of wheels using natural grit. The reasons for this trend include the better availability and homogeneous quality of synthetic grits.

CBN

Synthetic diamond

VITRIFIED BOND



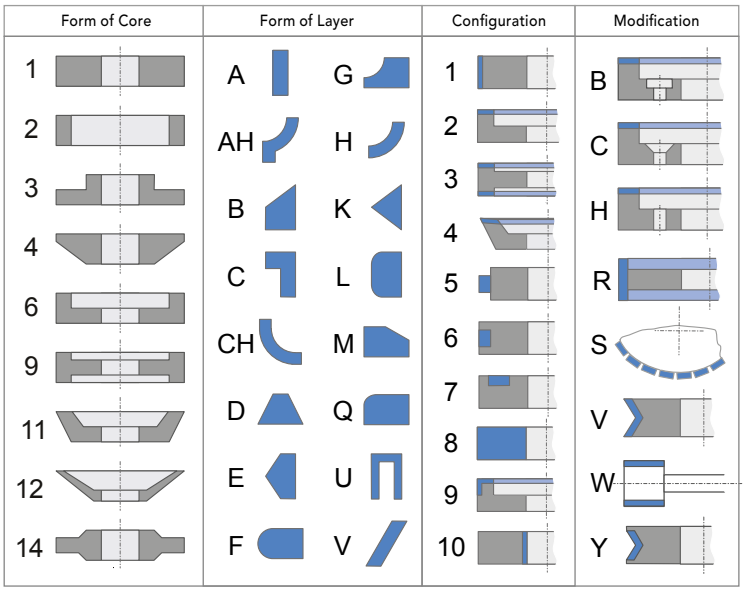
ALL SHAPES AVAILABLE

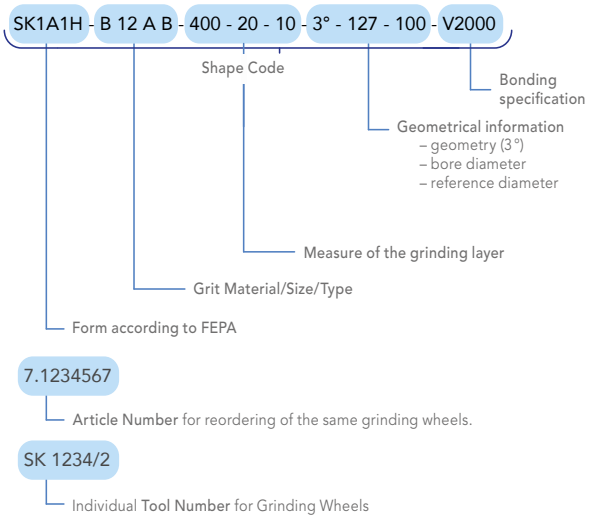
The large number of different grinding applications require an equally large number of wheel shapes. DR. KAISER supplies small grinding pins with diameters from 25 mm through to OD grinding wheels with diameters of 750 mm and centerless wheels with widths up to 500 mm. Grinding wheels are available with any profile. The standard shapes in compliance with FEPA* are available as well as special requirements.

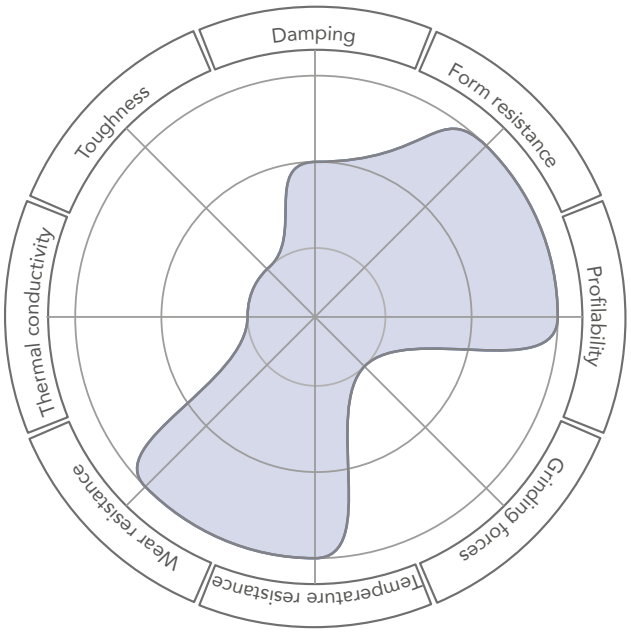
* Fédération Européenne des Fabricants de Produits Abrasifs.

SHAPE CODE

As with all tools from DR. KAISER, grinding wheels are also described by a type of a „talking" shape code. It reproduces the tool's shape, layer, layer dimensions, and detailed geometric data. The shape data is dependent on FEPA specifications. In addition, every tool type receives its own article number and every tool is given a serial number for unambiguous identification and trackability.







BOND CHARACTERISTICS

High form stability requires a heat-resistant bond and superabrasive material. Vitrified bonded CBN and diamond grinding wheels possess these properties. Since vitrified bonds are easily dressed due to their brittle nature, vitrified bonded CBN and diamond grinding wheels are used in all types of industry, provided the grinding machines are capable of high cutting speeds.
Grinding wheels from DR. KAISER are designed to optimize grinding and dressing characteristics. Ask our experts to help with your applications.

SEGMENTING

Grinding layers up to 250mm in diameter are produced in the form of rings and are directly bonded to the wheel body. We also use individually produced segments which are fixed to the wheel body by gluing. This makes production easier and the tools efficient. Whether your requirement is for straight or formed layer segments, DR. KAISER can supply.

closed ring | straigth segments | beveled segments

ACCURACY

All wheels are subject to extremely high accuracy requirements and are preprofiled close to the final contour in processes which are gentle to the layer. To shorten initial dress time on your machine, we can manufacture to tolerances of less than 1/100 mm. Every vitrified CBN or Diamond grinding wheel has measuring surfaces which permit concentricity and face runout checks on the machine.

DELIVERY OPTIONS

Extreme precision is required to assemble grinding wheels. The tools have precision-machined reference surfaces which permit fine adjustment on the spindle flange. We ship your grinding wheels in wooden crates for safe transportation. On request, we will also supply you with a test coupon of the wheel profile.
Every grinding wheel leaves our plant with a test report that meets your inspection requirements after consultation with you.

VITRIFIED BOND

Core	Damping	Strength	Weigth
Aluminium	--	++	o
Al/Resin	+	o	o
Steel	-	++	--
Ceramic	+	-	o
Carbon fiber reinforced body	++	++	++

BODY MATERIAL - NOT ONLY A QUESTION OF WEIGHT

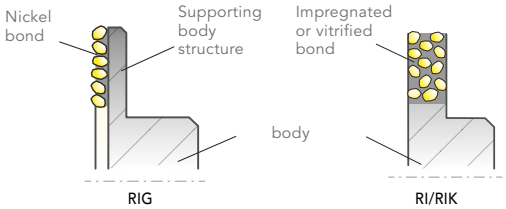
Diamond and CBN grinding wheels normally consist of a relatively thin-walled grinding layer fixed to a wheel body made of aluminum, steel, bronze, ceramic, or reinforced resin. The wheel body material not only determines the weight of the wheel, it also affects damping and strength.
The lighter a grinding wheel, the easier it is to retool the machine. Carbon fiber-reinforced grinding wheel carrier bodies are more frequently used due to their excellent damping properties and high strength. This new material has a density of ρ = 1.5g/cm³ and is an interesting alternative, especially with large grinding wheel sizes, difficult mounting situations, and high cutting speeds. The spindle's low mass moment of inertia is also a benefit for lower starting loads.

DRESSING VITRIFIED CBN GRINDING WHEELS

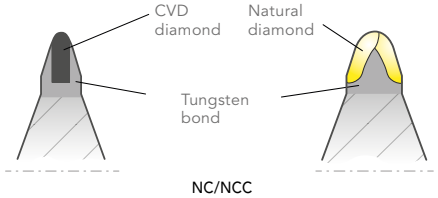
Ceramic bonded grinding wheels are particularly easy to dress due to their brittle bond. The „classic" dressing tool for profiling superabrasive grinding wheels is the sturdy, single-layer, nickel electroplated tool (RIG). Tools with sintered multilayers (RI) offer longer service lives and dressing capability with high cutting performance. Ceramic bonds (RIK) are ideal for intricate applications and the dressing of miniature grinding wheels. Modified or handset sintered tools (NC) are an excellent compromise between cutting performance and wear, and meet various requirements. The NCC point-crush dressing tool features a higher diamond concentration and has particularly low wear during crush dressing (q_d=1).

As a systems provider, DR. KAISER has the right grinding wheel for the job and – if necessary – the right dressing system. You will find further details on dressing vitrified bonded CBN wheels in our dressing brochure. Our experts will be delighted to assist you in selecting, designing and installing application-specific grinding wheel and dressing systems.

Self-Sharpening



Stable Form

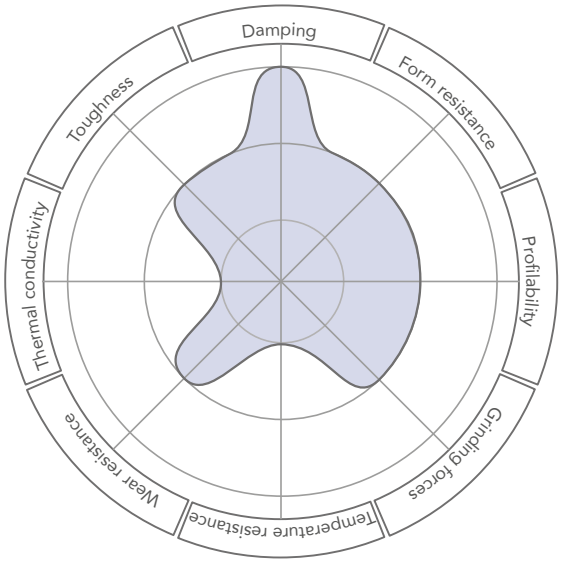


RESIN AND METAL BOND

SOFT RESIN BONDING

Resin bonds have a wide range of applications. From fine polish-grinding through to creep-feed processes with high metal removal rates: The resin bonded wheel is an excellent compromise both in dry and wet grinding. The most frequent application is grinding of high-speed steels (HS) and carbides (HW, HF, HT).

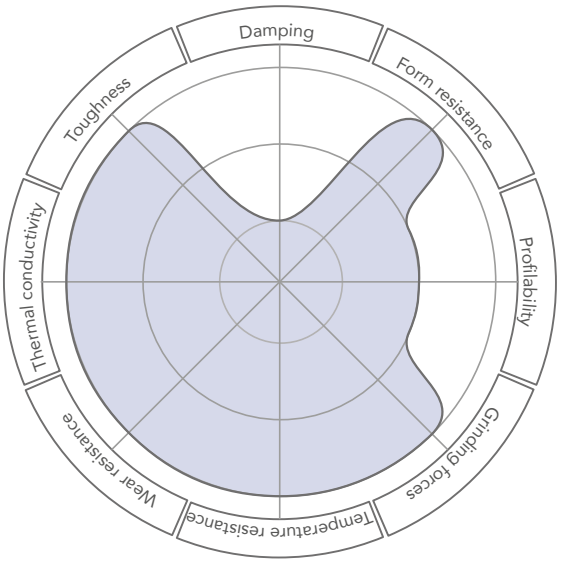
The manufacturing process using resin bonds requires no pores, so their application field has been restricted in favor of vitrified bonds. Normally, these bonding systems can only be profiled on offline dressing devices and are therefore unsuitable for all grinding tasks.

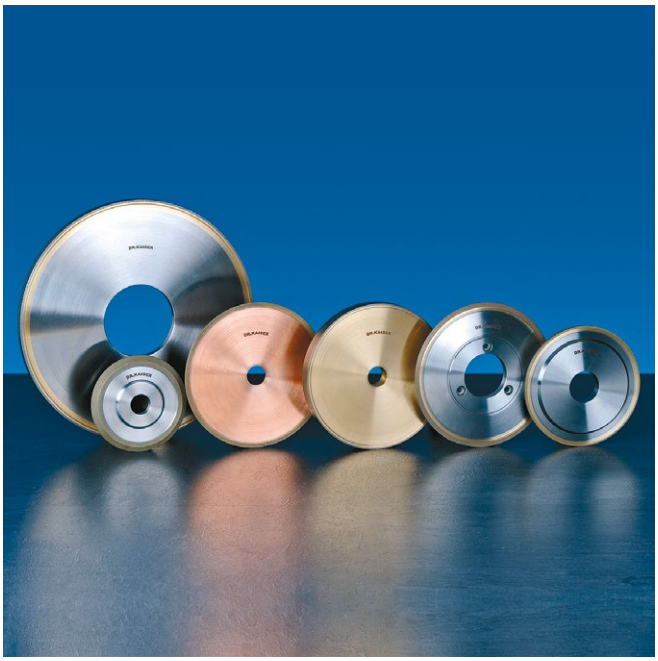


TOUGH METAL BONDING

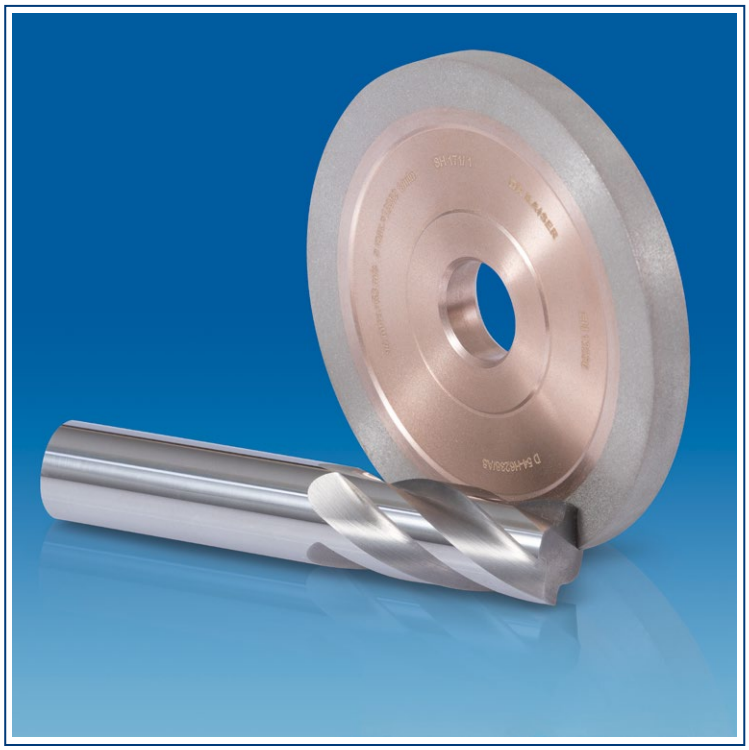
Sintered metal bonding combines high bonding hardness with toughness. Abrasive grits are firmly embedded by the bond and are released slowly. Therefore, they generate a relatively high amount of heat which must be compensated by excellent process cooling. Process-parallel profiling is not normally possible and must therefore be performed on external machines.

Excellent applications for metal bonding are grinding wheels for intricate profiles which must achieve long service lives without profiling.



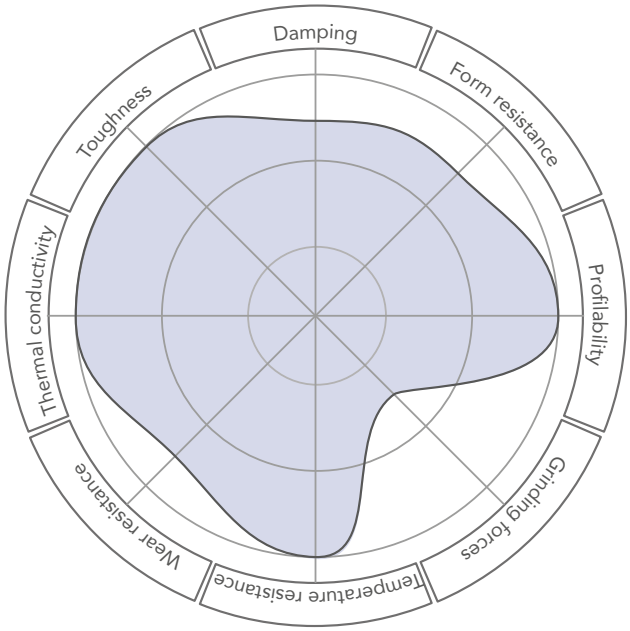


HYBRID BOND



HIGH STRENGTH FOR DIAMOND AND CBN: FINE BRONZE RESIN BOND

The most important criterion for economical grinding is the cutting ability of the abrasive coating. DR. KAISER has recently developed a new dressable bond system for tool grinding of carbide and HSS: the fine bronze synthetic resin hybrid bond.
The diamonds for the carbide or CBN grains for HSS machining are bonded in a fine bronze skeleton with a temperature-stable synthetic resin filling and are thus optimally held.
The new hybrid bond system enables high stock removal rates over a long period of time and high stability of the grinding wheel edge at the same time. Compared to standard metal bonds, the self-sharpening effect of the grinding wheel can be used, which significantly increases the time between truing and dressing.



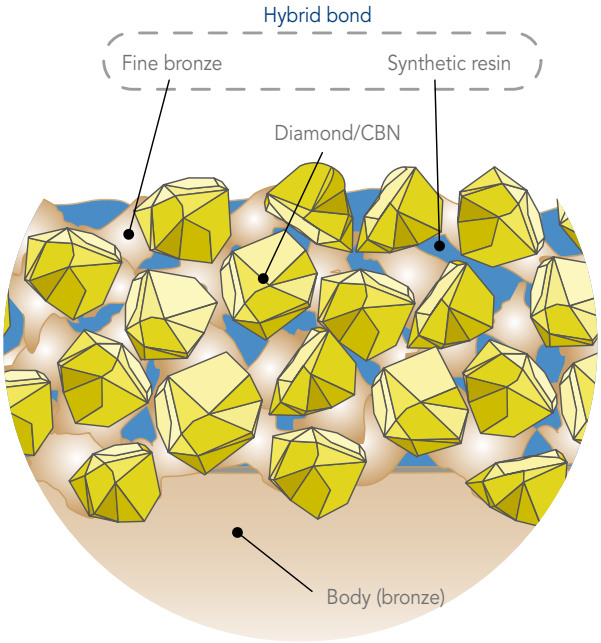
EXCELLENT PROPERTIES FOR TOOL GRINDING

The new generation of grinding wheels uses special diamond and CBN qualities as well as a balanced bronze synthetic resin ratio for the bond. This guarantees a special cut of the self-sharpening bond, the best possible edge stability and at the same time good dressability with SiC wheels (e.g. on external dressing and profiling machines from GEIGER, STRAUSAK, ERO, CLEVELAND, ... or on tool grinding machines such as WALTHER, ANCA, SCHÜTTE, ULMER, ...).

The grinding wheels in all required shapes (e.g. 1A1, 1V1, 6A2, 11V9, 12V9, 14A1, 14E1 etc.) are usually supplied with a temperature-stable bronze base body with adjustable damping properties.

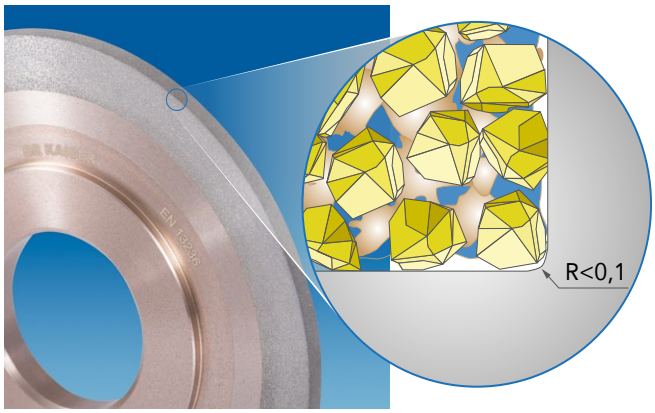
A STRONG STRUCTURE

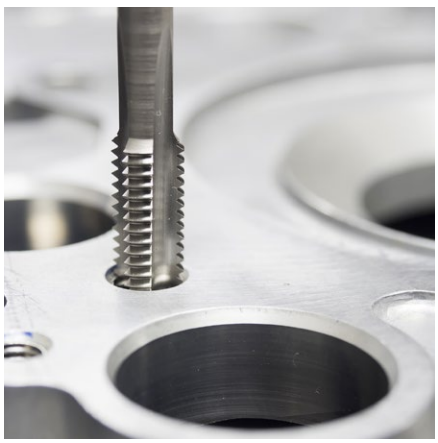
Diamond is used for grinding carbide tools and CBN grit for HSS machining.
These abrasives are bonded in a fine bronze skeleton with a temperature-stable synthetic resin filling and are thus optimally held in the abrasive coating.



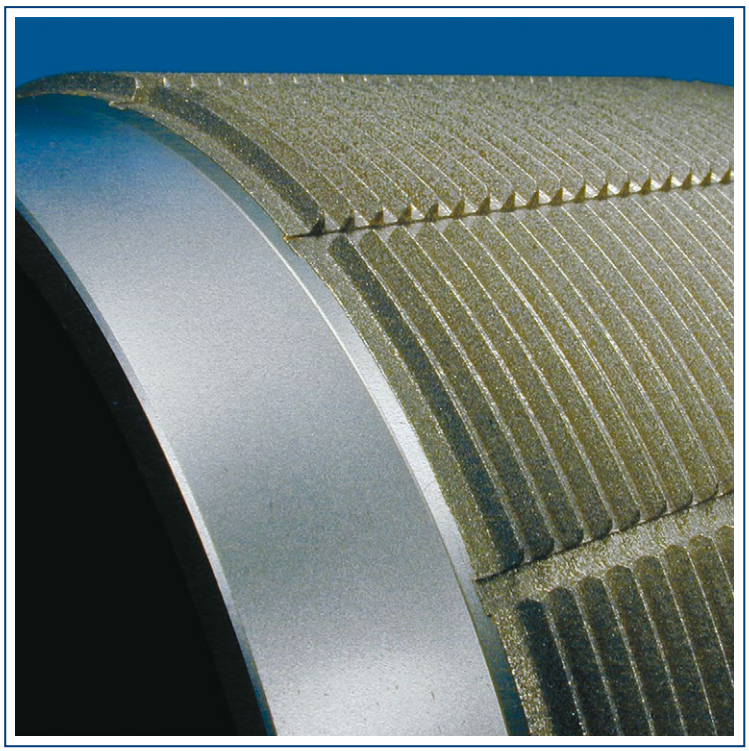
HIGH EDGE STABILITY

Tool grinding places the highest demands on the stability of the grinding wheel edge. In many applications the permissible radii are R < 0.1 mm.
Only the highest CBN and diamond qualities in grit sizes between 46 and 91 µm with a finely tuned bonding system can meet these requirements. The easily dressable fine bronze synthetic resin hybrid bond is an ideal partner for these tasks, holding the grain long enough but leaving it free again in due time: Give the new hybrid bond a try!





ELECTROPLATED BOND



TOP PERFORMANCE - WITHOUT DRESSING

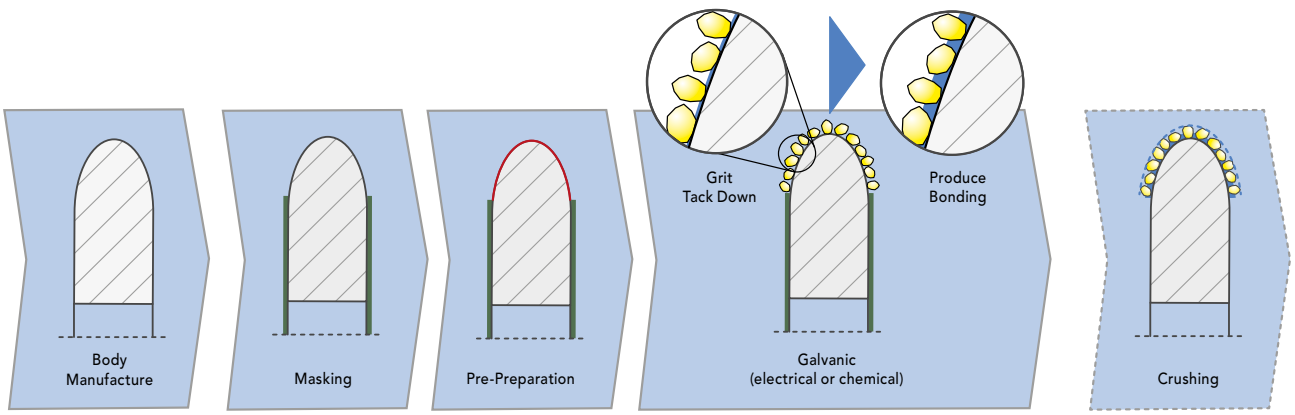
Electroplated grinding wheels with nickel bonding can achieve high stock removal rates and high-precision profiles on parts being ground.

Depending on the wheel blank design, plating technique, and post-treatment of the single-layer grit structure, many different grinding wheels can be produced using this bond system. There is no need for dressing during the life of the wheel. This avoids downtime and eliminates the need for a dressing device. Worn wheels are replated with new CBN or Diamond grit in a continuous replating cycle. Wheel bodies can generally be reused several times. As such, the tools are ideally suited to high production.

The precondition for using these wheels is sufficiently high machine rigidity, good wheel holding or alignment and, in CBN applications, high cutting speed.

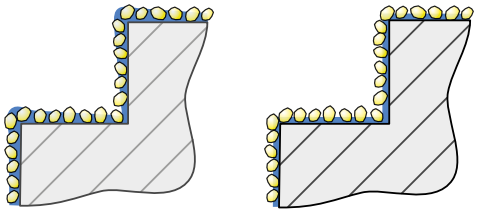
PRODUCTION PROCESSES

Tool quality starts with the production of the wheel blank. This requires absolute precision to reach the running speeds required. Subjecting the wheel blank to surface hardening treatment is one option to achieve several replating cycles without any loss of quality. The grit material is applied to unmasked areas of the wheel blank using nickel electroplating methods which are modified geometrically to the thickness of the grit layer. The function of nickel is to bond the grit to the wheel blank; the depth of nickel bonding permits grit protrusions that no other bond can achieve. The wheels can be used in rough-cutting processes without any post-treatment.



THE BOND IS DECISIVE

With precision electroplated grinding wheels, a single grit layer made of CBN or diamond is responsible for the machining action. The grit must therefore be fixed to the wheel blank in a high-strength bond that is also ductile. Besides electrolytically deposited nickel bonds, chemically generated bonds are also used. Nickel bonding based on chemical deposition processes has the advantage that the deposited layer thickness is homogeneous and there is no nickel coating on non-grinding areas of the tool.
Special treatment processes can also vary the retention force of the bond in order to respond to special requirements arising from the process.

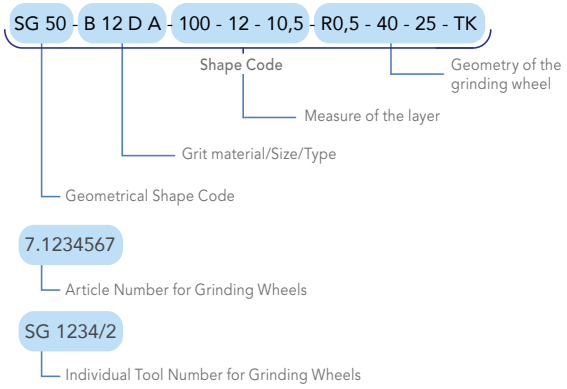


Electroplated nickel bonding

Chemical nickel bonding

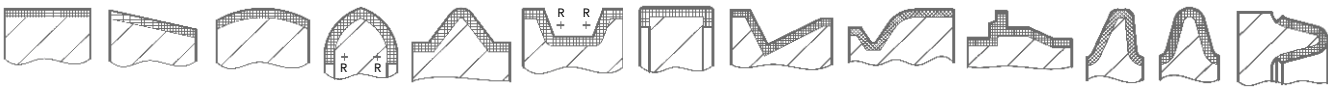
THE SHAPE CODE - WHEEL DESCRIPTION IN WRITTEN FORM

DR. KAISER has already set standards with the introduction of a shape code system for dressing tools. The same naming system is also used for electroplated grinding wheels. The grinding wheel shape specifies the grit layer, layer surface, and the main tool geometry data. This is a simple method to describe all tools and prevents any confusion. In addition, the grinding wheels are assigned an 8-digit part number (article number) to identify the tool system. The serial number permits the unique identification of each wheel. It also helps to track replating operations and repairs.

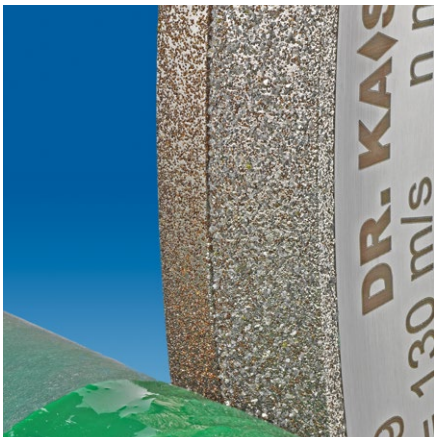


SHAPES (EXAMPLES)

The number of different geometric shapes is much larger — here are only a few standard versions.



SG10 SG20 SG30 SG32 SG50 SG70 SG80 SG120 Schulter SG190 Ventil SG212 Turbine SG300 Rotor SG301 Zahnrad SG320



ELECTROPLATED BOND

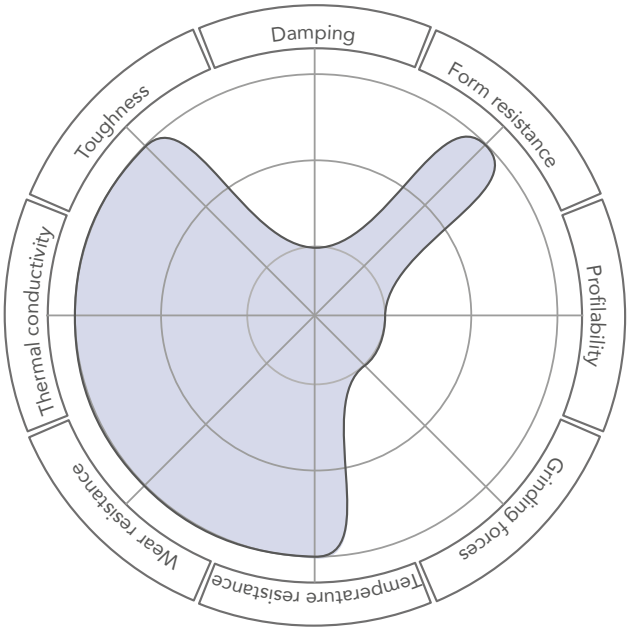
BOND CHARACTERISTICS

The electroplated nickel bond produces large grit protrusions due to high grit retention forces. CBN or diamond abrasives are the optimum solution for high cutting and stock removal rates. They can be used for rough-cutting and finishing processes. Electroplated grinding wheels achieve high efficiency without the need for dressing.

The development of different nickel bonds allows hardness and toughness characteristics to be modified to optimize wheels for a particular process.

CORE

Steel is the preferred material for the wheel core. In order to achieve a high number of replating cycles, the core is supplied in a hardened condition. Bronze or carbide cores are also possible.



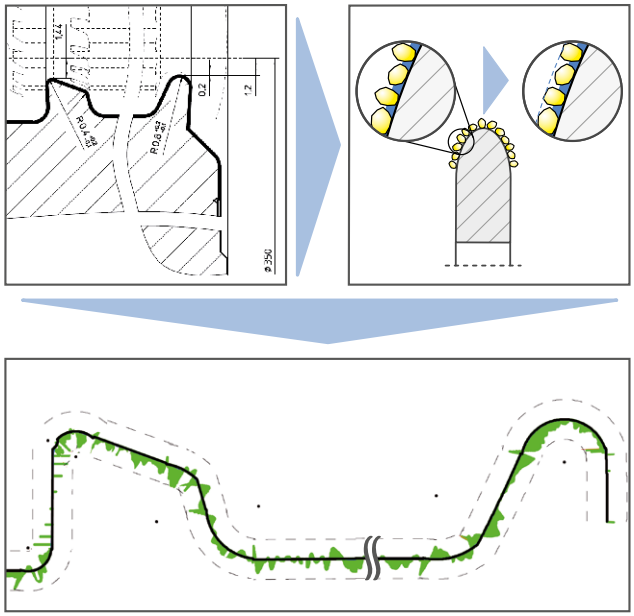
DELIVERY OPTIONS

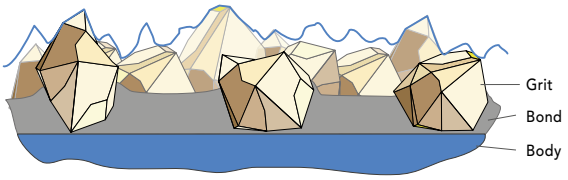
Extreme precision is required to assemble grinding wheels. Electroplated wheels must normally be aligned on the machine to achieve the required radial and axial runout in the machine. Precision-machined reference surfaces are aligned with the aid of micrometers. Grinding wheels are shipped in wooden crates for safe transportation. This transportation packaging protects the new wheels and is used to return worn wheels for the replating cycle.

ACCURACY

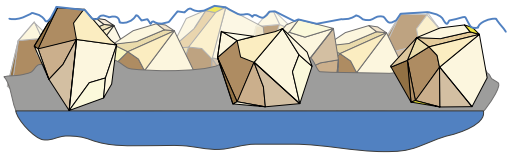
For highest surface qualities and profile accuracies, if required and and technical feasibility, the grain tips can be touched by a special special crushing process without pre-damaging the grain material. Narrow envelope curve tolerances improve accuracy and meet finish requirements of the form envelope.

Every wheel is supplied with a test report to confirm accuracy. The accuracy achieved is measured by tactile or optical measurement processes. They immediately show any deviations from the reference contour. On request, a sample test piece made by the grinding wheel can be supplied to confirm accuracy.





Normal Surface Quality without Crush Finishing



Improved Surface Quality by Crushing of the CBN Grits

REPLATING AND REPAIR

Electroplated grinding wheels can be replated several times. Here, the worn abrasive grit and plating is removed from the core by chemically releasing the bond.

Before replating, the core is tested for its geometric accuracy and repaired by re-machining if it has been damaged. A replated wheel is therefore equivalent to a new wheel but at a much lower cost.

OUR FURTHER PRODUCT FIELDS

DRESSING SPINDLE SYSTEMS
IMPORTANT DRIVE

Application specific dressing systems are necessary to achieve both best surface qualities of the workpiece and high production reliability with excellent spindle run-out. Dressing systems are designed either for CNC dressing or single-axis plunge dressing operations. These systems can be designed for aligned electrical and mechanical power and best dynamic stiffness with different types of acoustic sensor systems. Spindle attributes such as stable drive speed, constant torque, temperature control and acoustic emission sensors are important to the performance of the dressing spindle. Our experts will help find the best solution for your dressing spindle requirements.

DRESSING TOOLS
FOR EVERY TASK

Whether diamond form dressers for CNC-controlled dressing or profile rolls for plunge-cut dressing, DR. KAISER can manufacture and supply dressing tools for almost every grinding application. Through the use of various diamond coatings (natural or synthetic diamonds in a scattered or hand-placed arrangement) combined with a non-wearing sintered bond or a galvanic positive or negative bond system, the dressers can be specifically designed for the processing requirement. Dressing applications cover Aluminum Oxide, SiC as well as bonded CBN and Diamond grinding wheels. Whether it be a job lot, small run or serial production quantities, DR. KAISER DIAMOND DRESSERS are in use around the world.

WEAR RESISTANT PARTS
PCD LASTS LONGER

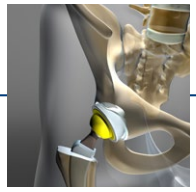
Guideways, shoes-bearings, drivers-bearings, prisms, male and female centers, steady rests or abrasive belt shoes are used to position work-pieces in grinding applications. These components are loaded by process forces resulting in extreme rotational and sliding friction. Special PCD coatings increase tool life and increase the accuracy of the process and improve the surface quality and form accuracy of the workpiece. Do not hesitate to ask a DR. KAISER application specialist to discuss the many possibilities for this modern technique.

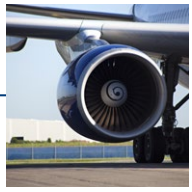
CUTTING TOOLS
SPECIAL SOLUTIONS

Efficient milling and turning of composite materials and non-ferrous alloys can be done with application-designed superabrasive cutting tools. PCD and CVD diamond are used to optimize the process behavior and guarantee highest tool life and best surface finishes. Our knowledgeable specialists can discuss your specific requirements in detail.

OUR FIELDS OF ACTIVITY



EVERYTHING FROM
A SINGLE SOURCE:

DRESSING DISCS

DRESSING ROLLERS

STATIONARY DRESSING TOOLS

CVD DIAMOND DRESSING TECHNOLOGY

DRESSING SYSTEMS FOR VITRIFIED
CBN GRINDING WHEELS

DRESSING TOOLS FOR GEAR GRINDING

DRESSING SPINDLE SYSTEMS

CBN AND DIAMOND GRINDING WHEELS

PCD AND PCBN CUTTING TOOLS

PCD AND CVD DIAMOND WEAR

PROTECTION COMPONENTS

APPLICATION ENGINEERING

SEMINARS AND TRAINING

DR. KAISER
präzision durch diamant

DR. KAISER DIAMANTWERKZEUGE
GmbH & Co. KG

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