Vitrified-bonded CBN and diamond tools from KREBS & RIEDEL

The ultimate in grinding.



## Your production process – our product range.

Each procedure has its own special characteristics. And we have the right individual tools for all of them.

In **cylindrical grinding** – the most widespread process – the interior or exterior of rotationally symmetrical workpieces are machined. We offer the solution for every area – whether you need precision down to the  $\mu$  for machining minute components for injection technology, combustion engines, or rollers for the paper industry that weigh tons.

**Surface grinding** – plane-parallel machining of surfaces with the wheel periphery or grinding face – is primarily used in the construction of tools and molds. The growing diversity of materials here is a challenge we are happy to meet, with proven and lucrative solutions for you.

In **creep feed** or **deep grinding**, a workpiece is usually completed in a one-step procedure. This demands a high infeed motion for small workpiece feeds and thus large contact arcs between the workpiece and the grinding wheel. Our highly porous tools with very good cutting characteristics make this procedure fast and profitable. In **profile grinding**, profiled wheels are used to machine outer peripheries. The workpiece itself determines which wheel is used, along with the wheel's specifications. We manufacture grit sizes and bonds especially adapted for specific radii and profiles, for example, to provide you with a wheel with excellent cutting characteristics, and less need for dressing and truing. We can handle the roughing of the wheel in order to save you set-up time.

**Roll grinding** involves workpieces that require extremely intensive grinding. The wide range of rolls are matched by an equally wide range of materials and dimensions that can be selected to produce the most suitable wheel. Vitrified-bonded CBN and diamond wheels have generally proven to be the most efficient for this.

**Non-round grinding** of items such as camshafts or pump rings is one of the most complex of grinding tasks. The non-round contour leads to changing contact and motion ratios. Deviations from dimensional and shape tolerances are strongly influenced by the quality of the grinding tool. We match our tools precisely to these requirements.

Whatever you need to grind and whatever method you use, we can produce the perfect tool for you to get the job done. Maintains a profile on the outside, streamlined on the inside: We're experts in specialties such as the 3-zone wheel for flawless machining of crank-

shafts.

K&R for bore grinding, cone grinding, non-round grinding, jig grinding, grinding wheels with shank and threaded mandrel, tandem grinding wheels, and more.

K&R for surface grinding, deep grinding, and profile grinding of bardened steels.

K&R for cylindrical grinding, straight and angular infeed grinding, and centerless grinding of cylinders, rolls, shafts, bolts, and more.

K&R for individual solutions for cam contours, crankshafts, gear cutting, thread profiles, and more.

K&R for the future. New procedures, materials, and machines? We're at the forefront for you!









#### The hardest abrasive material in the world.

As always, the hardest materials in the world - CBN and diamond - offer the greatest precision when grinding extremely hard iron and steel alloys or hard, brittle materials, and offer the best stock removal rates and the longest wheel life.

### Synthetic. Even better than the real thing.

Cubic boron nitride, or CBN for short, is synthesized, similar to diamonds, from a hexagonal boron nitride at 50 to 90 kbar and 1,800 to 2,700°C. It is especially suitable for hard-to-machine or high-alloy hardened steels starting at 54 HRC, such as high-speed, tool or chrome steels, nickel-based alloys, powder metallurgical steels, or white cast iron.

#### Learning a few tricks from Mother Nature.

The hardest natural material in the world - the diamond - has been synthetically produced for more than 50 years now. It is synthetically produced from graphite carbon at pressures of 70 to 120 kbar and temperatures of around 2,000°C. Diamonds are primarily used to machine brittle materials such as cemented carbide, ceramics, glass, granite, GFRP, semiconductor materials, or wear coatings.

#### Putting our expertise to use.

We can target specific properties for the CBN and diamond grains by selecting the crystallization conditions in special synthesis reactors, an example of this, the belt chamber.

The shape and color are signs of various grain strengths and cutting and splintering behavior. We put our knowledge of these properties to good use.

The belt chamber: This is where the material for superb grinding results is created.



#### Irregularities: The light, geometrically irregular grain of mediur strength is suitable for almost any application

This dark, high-strengt grain is preferred for internal grinding of hardened steels.

#### Pointed:

Blocky:

Dark brown grains with high thermal stability cut hard-to-machine, harde ned steels.

#### Diamond:

Synthetic diamond grains can be used to machine hard, brittle materials such as hard metal, ceramic, gra nite, and others.











#### An abrasive material is only as good as its bond.

Outstanding wheel life, profiles that keep their profile, are easy to dress and true, with cool grinding and high cutting force. Benefits that are especially in demand in the automotive and roller bearing indus-tries, in tool design and construction, and in making cutting tools. Our ceramic-bonded grinding wheels are distinguished by these properties and more.

We've been producing them for you for more than 20 years now. During this time we've developed numerous types of bonding agents, which not only promise but also deliver optimal grain bonding in a wide range of selectable porosities. The strength and hardness of the grinding wheel depend here not only on the proportion of bonding material; in fact, we adapt our bonding material precisely to the chemical interfacial reaction of the individual abrasive grains.

#### A matter of being well-adjusted: The vitrified bond and its structure.

You shouldn't have to adapt to our wheels - we ad-just the bonding and thus the properties of the wheel precisely to your needs. Whether you need less fusible, soft and brittle wheels or fusible, hard and strong ones. Or anything in between - we adjust all that for you.

Being well-adjusted pays off: Our vitrified-bonded wheels are distinguished by their greater efficiency and productivity. Along with long wheel life, they offer great cutting performance at cool tempera-

trued with lasting results.

goal-oriented tool.

#### A strong bond:

The tool is defined by the grinding task for which it is intended. We define its optimal form and specifications, the ideal grain, the perfect bond, and the right structure in the right place. To meet your needs exactly.

The sintered bond is soft and brittle and can be dressed with excellent results and minimal wear to the dressing tool.

tures and without sharpening. And of course, they can also be asily

> A clear result of a well-adjusted outlook: An uncompromisingly

Good cutting properties. Due to the high grain protrusion with low bond content and high strength, it's one of the easiest tasks for the grinding wheel with a fusible bond.





#### Your KREBS & RIEDEL grinding wheel starts out as grains and bonding material.

Wheels according to strength ranges:			K&R base structure versions	
Operating speed m/sec	Machining dimens ons Ømm	i- Base structure	Base structure	Damping
bis 63	bis 900	Ceramic, aluminum, steel, composites	Ceramic (standard)	Good
80	20 - 750	Ceramic, steel, ceramic-steel	Aluminium	Good
125	200 - 750	Ceramic-aluminum, steel	Resinoid	Good
140	200 - 750	Ceramic-steel, steel	Steel	Low
180	200 - 750	Ceramic-steel, steel	Steel/ Ceramic bond	Good

## Solidly built. From the inside out.

To ensure this, we consider the tasks you assign to the wheel. We select the corresponding base structure and determine the appropriate active surface.

The base structure is of great importance at low cutting speeds as well. We select from a wide array of materials depending on the grinding and centrifugal forces, the heat build-up and dissipation, and the vibration of the machine and workpiece.

Grain size and concentration have a direct influence on the performance of the wheel and on the surface quality that can be achieved on the workpiece. As a rule, we use grains in the particle size range of 46-251 µm in accordance with FEPA.

#### CBN/DIA grain sizes (in accordance with FEPA/DIN narrow, compared to international standards):

K&R diamond according to FEPA or DIN 848 narrow	K&R CBN according to FEPA or DIN 848 narrow	Nominal machine width according to ISO 565 (µm)	US standard ASTM E 11 70 Particle size (mesh)	Japan JIS 6002-63 Designation (µm)	GUS GOST 3647-71 Designation (µm)
D251	B251	212 - 250	60 / 70	250 / 210	250 / 200
D213	B213	180 - 212	70 / 80	210 / 177	250 / 200
D181	B181	150 - 180	80 / 100		200 / 160
D151	B151	125 - 150	100 / 120	149 / 125	160 / 125
D126	B126	106 - 125	120 / 140	125 / 105	125 / 100
D107	B107	90 - 106	140 / 170		100 / 80
D 91	B 91	75 - 90	170 / 200	105 / 74	
D 76	В 76	63 - 75	200 / 230	88 / 63	80 / 63
D 64	B 64	53 - 63	230 / 270		63 / 50
D 54	В 54	45 - 53	270 / 325	53 / 44	60 / 40
D 46	B 48	38 - 45	325 / 400	44 / 37	50 / 40
	B 30	40 - 25			40 / 28
D 25		52 - 32			



#### K&R CBN/DIA concentrations: Carat/cm<sup>3</sup> Concentration

50	2,2
75	3,3
100	4,4
125	5,5
150	6,6
175	7,7
200	8.8



A classic: For wheels up to 400 mm with speeds of

63 m/s, we place what is

usually a closed layer on

a ceramic base structure.

We manufacture grinding wheels – big and small.

With outer diameters from

Naturally, we're also happy to supply you with pre-

profiled wheels. This allows you save on the materials

and time required for

truing.

3 mm to 900 mm.

The core of the wheel: Aside from classic ceramic, we also employ aluminum or steel materials and steel/ ceramic composites.

CBN volume %/ dia- mond, rounded
12,50
18,75
25,00
31,25
37,50
43,75
50,00

Rough, fast or special: We produce anything that is larger than 400 mm, has speeds up to 160 m/s or has a special a shape in segments on an appropriate base structure.











#### Form follows function. A selection of wheel shapes in accordance with DIN / ISO.

















# 4A2



#### Diameters and thicknesses, base structures and coating layers, as well as compositions and profiles are at least as diverse and often just as unique as the

The wheel is round.

tasks and challenges they face.

Since we began producing vitrified-bonded diamond and CBN wheels, we've developed and produced countless special shapes.

That's the one thing that all wheels have in common.

Because wheels can vary widely, we place a priority on working with you to determine exactly what your needs are. What workpiece do you need to process on which machine, and what is the goal? Then we construct a wheel for you that not only gets you close to your goal, but that actually lets you achieve it. Safely and efficiently. No matter what the wheels of the future will look like, you'll get the one you need from us.

An idea takes form: We offer you advice for every grinding task and work with you where needed to develop your own special grinding wheel.

Marking system and composition of the grinding layer:

4B	126	X 15	VP	7338
Abrasive material	Grain size in mesh	Hardness/grain structure	Type of bond	Bond coo number
B = CBN D = Diamond	36 – 252 μm	X 4 30	V = Ceramic (vitrified) VP = increased porosity	Internal ke

## 2A2







1A8

25

643×

1201





















**Optimal performance, optimal** benefits, and optimal efficiency.

#### **Combined for strength: Machine,** coolant, and grinding wheel.

You shouldn't use a compact car to tow a 60-foot yacht. Likewise, your machine and abrasive need to be compatible. In order to get optimal use from your CBN and diamond grinding wheel, you also need a certain amount of machine rigidity, the right guide mechanism, and spindle bearing arrangement. The ability to use a rotary dressing and truing system is a major advantage. You can use the abrasive more efficiently with the speed control of the grinding spindle and the use of oil emulsions or grinding oil as coolants.

As a rule, wet grinding is the method used, with plenty of coolant that should be fed and adapted to the contour, especially where profile wheels are involved. The influence that the amount of coolant and the feeding method used have on grinding results and efficiency should not be underestimated. While you may also use synthetic or semisynthetic solutions, experience has shown that you can most effectively use the wheels with oil emulsions or pure grinding oil.

With dressing or truing you determine the precise geometric shape of your grinding wheel and ensure that your wheel runs perfectly true. With the correct parameters, you also achieve even better cutting properties for your wheel and can actively influence the actual surface roughness.

The infeed increments when dressing and truing are in the micrometer range. The wheels are then ready for immediate use, without further sharpening.

Rotary tools are ideal for dressing and truing. These tools run in the same or opposite direction depending on their task.

Crush dressing is a special form of dressing with steel rolls that allows tiny profile radii to be achieved. We employ a crushable bond for this purpose.

Naturally, we can also supply you with suitable dressing and truing systems for our wheels.

Please discuss your objectives with our application technology staff. That's the first step to achieving fantastic grinding results.

Cool grinding is better grinding: We recommend the use of oil emulsions or pure oil as a coolant under all circumstances.













#### Intolerant and uncompromising.

Where quality is involved, we don't kid around. And we never have. We've been producing grinding wheels for more than 100 years now, and have produced CBN and diamond grinding tools for more than 20 years. Always under uncompromising quality criteria. From the idea to the finished product, from the receipt of the raw materials to the dispatch of the balanced wheels. From your first phone call to the service and consultation lasting long beyond the sale. We critically examine each step we take, and continuously integrate your ideas, desires, and objectives. Today, this is called "quality in process". To us, it's always simply been our way of doing business.

Our way of doing business also involves fulfilling the strictest national and international standards. Not only when it comes to product quality, but also where it relates to the environment and occupational safety.



We follow these unconditional quality standards not only where our CBN and diamond tools are involved, but also throughout our entire production range:

- Corundum and silicon-carbide wheels in ceramic and resinoid bonds and with outer diameters up to 900 mm for cylindrical grinding, surface grinding, tool grinding, centerless grinding, rough grinding, and more.
- Abrasive cutting wheels in a resinoid bond, with or without fiber reinforcement and up to 600 mm outer diameter for wet and dry chop cutting, for pendulum and rotary cutting, and more.
- Rough and pendulum grinding wheels with and without fiber reinforcement for contract blast cleaning and for foundries, for pendulum grinding machines, wheel stands, grinding manipulation, and more.









#### Always the right tool for every task.

We've been developing and producing CBN and diamond tools for more than 30 years. This experience and visionary far-sightedness are our foundation for continuous innovation. Our service is based on our unconditional desire to always be able to offer you the ideal solution for your task.

Our well-grounded expertise in materials, processes, and machining equipment allows our application technicians to provide you with extensive, precise consultation and assistance, from the planning phase on. Through all the usual channels of communication, here at our facilities or at yours. Anytime.

Unusual applications represent an especially exciting challenge for us. We conduct tests along with you whenever needed, until we've developed the solution that precisely meets your requirements.

We look forward to seeing you!



KREBS & RIEDEL Schleifscheibenfabrik GmbH & Co. KG Bremer Straße 44, 34385 Bad Karlshafen, Germany Telephone +49 56 72 184-0, Fax +49 56 72 184-218 mail@krebs-riedel.de, www.krebs-riedel.de