Noritake Proposal

Featured Products and Technology

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Porous structure with improved dispersion that reduces Grinding burns and extends wheel life.

Vitrified-bond CBN wheels are particularly effective in grinding efficiency and long life.
Despite seeing an increase in cases demanding even better sharpness, we cannot neglect wheel life. Noritake has developed “VP WHEEL” offering excellent sharpness and long wheel life through the adoption of abrasive grain dispersibility and multi-pore structure technology.

Vitrified-bond CBN wheel

VP WHEEL

[Scope of application and expected benefits]

Metallic material		Non-metallic material		Other
Ferrous material	Non-ferrous material (Al, etc.)	Inorganic material (glass, ceramics)	Organic material (rubber, plastic)	Advanced material
●				

Shorter cycle time	Improved tool life	Improved machining quality	Improved workability	Environmental consideration
●	●	●		

Benefits of Vitrified-bond CBN Wheel Using hollow filler

Grinding burn - the barrier to improved productivity

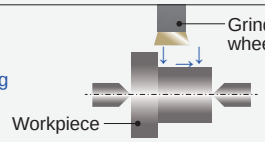
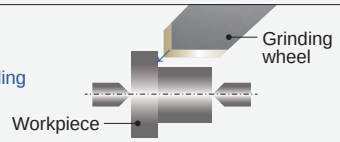
Machining method	Schematic drawing	Merit
❶ **Plunge cutting** or **plunge cutting + traverse grinding**	Plunge cutting  	· Low grinding wheel cost · High versatility suited to multi-stage grinding
❷ **Angular grinding**	Angular grinding  	· Fewer grinding man-hours · Short cycle time

Fig. 1 Method combining plunge cutting and traverse grinding, and angular grinding

Grinding often needs high-accuracy for both cylindrical and end face parts. The grinding method used in such cases are mainly ❶ “plunge cutting with traverse grinding”, or ❷ an “angular grinding” method in which the grinding wheel is tilted and fed at an angle to grind surface and end face simultaneously.

Grinding schematic drawings and merits for both methods are shown in Fig. 1.

Angular grinding is a method used to simultaneously machine workpiece cylindrical parts and end face parts, and contributes to productivity improvements such as reducing grinding cycle time .

Conventional grinding wheels have generally been a popular choice for angler grinding. However, nowadays we are seeing more cases where vitrified-bond CBN wheels are being used. Vitrified-bond CBN wheels offer higher grinding efficiency and longer life than conventional grinding wheels, which can also be expected to deliver productivity improvements from a total cost viewpoint.

In an angle grinding, there are 2 main concerns that needs to be addressed. One is the wheel life, which is usually focused on the surface of the part. The other is the burning that happens on the face of the part. To counter the burning issue, porous structured wheels are recommended, especially if CBN wheels are being used.

However, due to recent manufacturing cost reduction demands, we are also forced to look into improvements in wheel life and cutting ability.

Original Noritake technology

Porous structure vitrified-bond CBN wheels are vitrified-bond CBN wheels with low to medium CBN concentration, and are original Noritake wheels employing a hollow ceramic filler (hereafter referred to as hollow filler), which place emphasis on sharpness. Aggregate* is normally used for the filler, however, this wheel has achieved better sharpness than the conventional wheel by using a hollow filler in place of aggregate (Fig. 2).

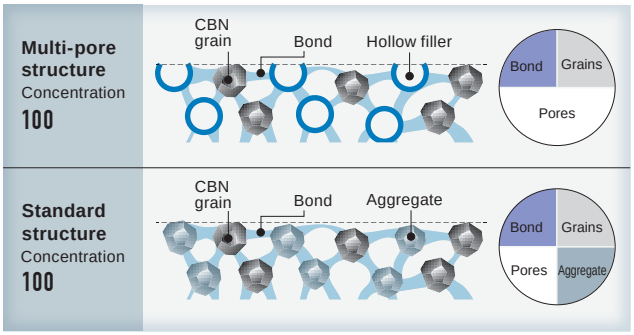


Fig. 2 Vitrified-bond CBN wheel structure

Porous homogeneous structure

Generally speaking, the pursuit of sharpness for grinding tools often results in sacrificing tool life. There has been many request in recent years to improve life without affecting sharpness for grinding, so Noritake developed “VP WHEEL”, a new porous structure vitrified-bond CBN wheel. To deliver both sharpness and long life, VP WHEEL employs a new technology which homogenizes the “dispersibility of CBN grains” in addition to employing hollow filler. We’ll now take discuss why we decided to pursue development focusing on CBN grain dispersibility.

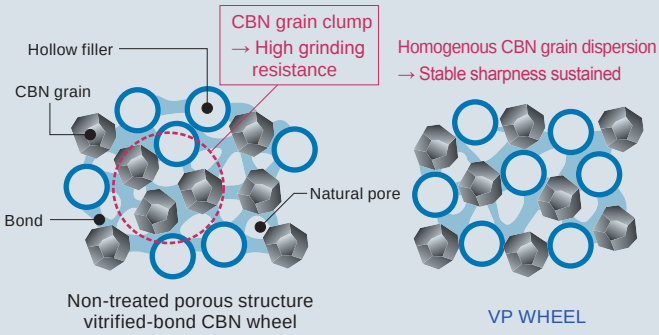


Fig. 3 CBN grain dispersion state schematic diagram

With the porous structure vitrified-bond CBN wheel using hollow filler, CBN grains are pushed by the hollow filler, and end up clumping together.

Glazing or loading often occurs at locations with these clumps of CBN grains, which leads to increased grinding force and CBN grain loss. To prevent these conditions, the operators would dress the wheel, which in turn reduce the wheel life. In response to those customers who want to extend wheel life, we focused our efforts to develop a wheel with high level of homogeneity.

It is believed that by improving CBN wheel homogeneity, if would decrease the number of areas in which CBN grains form clumps, ensure that uniform grinding force is applied to the working CBN grains, breaking down can be suppressed, and extend the wheel. With VP WHEEL, by ascertaining the spacing between the grains with homogenously dispersed CBN grains, and using an appropriate amount of filler to match the amount of CBN grains, we are able to realize higher dispersibility than the traditional wheel (Fig. 3). The evaluation results for traditional wheel and VP WHEEL dispersibility are shown in Fig. 4. The red areas in the photo in Fig. 4 show CBN grains on the measured wheel surface, showing the VP WHEEL lower standard deviation and greater dispersibility than the traditional wheel.

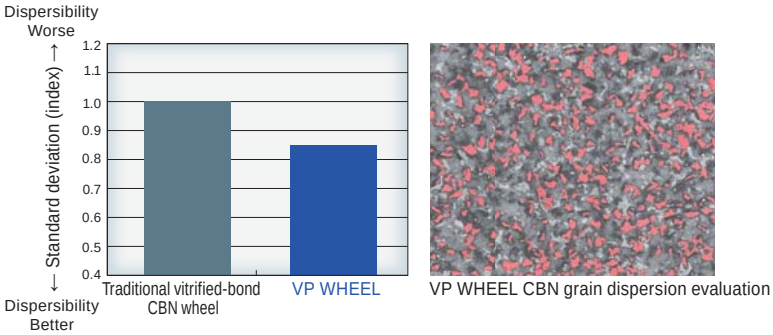


Fig. 4 VP WHEEL dispersibility evaluation results

VP WHEEL capability evaluation

We conducted a grinding test in order to verify VP WHEEL performance. The test conditions are shown in Fig. 5. It is compared again 2 types of the traditional vitrified-bond CBN wheel: “Traditional wheel” is focused on wear resistance, “Traditional wheel 2” is focused on the cutting ability.

Grinder	Horizontal spindle surface grinder
Workpiece material	SKD-11
Workpiece dimensions	100L × 10W mm
Grinding wheel speed	1,800 m/min
Grinding method	Creep feed
Table feedrate	300 mm/min
Infeed	0.2 mm/pass 10 cuts
Grinding fluid	Water solubility (SEC700 diluted 50 times)

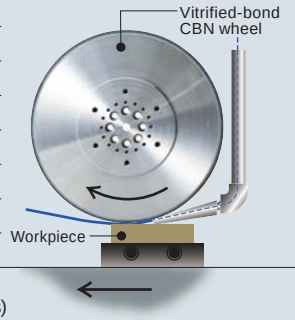


Fig. 5 Test conditions

Creep feed grinding* application, in which grinding burn tends to occur easily, was used for the grinding method. The test will evaluate the “limit for the depth-of-cut up until which grinding burn occurs”, “wheel wear”, and “surface roughness (Fig. 6). The VP WHEEL would approximately 1.4 times the cutting depth before showing any signs of burning compared to Traditional wheel 1. It also matched the same cutting depth as “Traditional wheel 2”, so we can conclude the wheel is very sharp. Generally speaking, it is

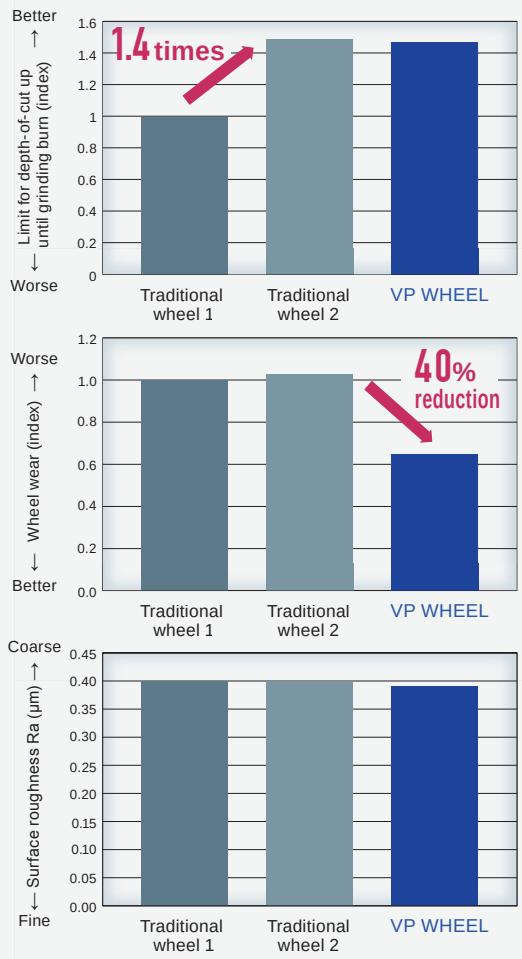


Fig. 6 Test results

not easy to achieve both sharpness and long life. So there are concerns on the possibility in increased wheel wear. This can lead to issues such as rough finish and high tool cost due to short wheel life. However, we confirmed that VP WHEEL wear is approximately 40% less than that of conventional 1 and 2, hence a long wheel life. VP WHEEL also achieved similar surface finish as the traditional wheels.

Market adoption

VP WHEEL benefits were confirmed particularly for applications that has burning issues. Moreover, in addition to creep feed grinding that we presented the test results, benefits were also confirmed for applications requiring good cutting ability, angular grinding which was discussed at the beginning, and grinding with poor coolant supply.

[Notes]

* Aggregate: Substitute material for CBN grains used for vitrified-bond CBN wheels with low concentration
* Creep feed grinding: Grinding method with deep infeed and low feedrate

Q&A

Q **Is wheel life sacrificed?**

A You can expect long wheel life through sustained excellent sharpness.

Q **Does hollow filler have any adverse effect on grinding?**

A Hollow filler present on the surface is destroyed when dressing and functions as pores, and has no adverse effect on grinding.

Q **I imagine that the structure would be weak when using a hollow filler. Would the wheel breaking down easily?**

A This can be suppressed by adjusting the specs based on the Noritake's experience.