Problem solving tips **03**

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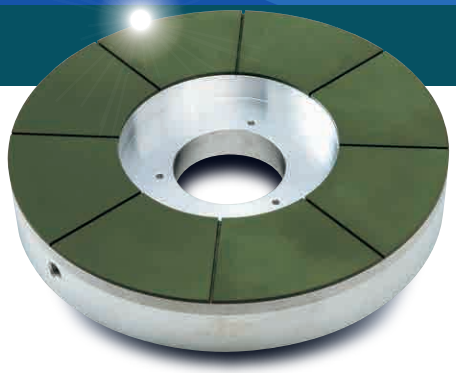
KEY WORD
Maintaining cutting ability | Grinding burn | Extending dressing interval | High hardness materials

Q Would like to improve the double-disc surface grinding productivity when grinding high hardness material.

A Try this product for these concerns

Resin Bonded Double-disc Surface Grinding Wheel Focused on Maintaining the Cutting Ability

BRZ Wheel



Traditionally when you grind high hardness material, such as iron based sintered parts, with a double-disc surface grinding your wheel would lose sharpness very quickly. If you don't maintain that sharpness, you will not be able to make good parts, so you are constantly dressing, which leads to low production. In order to solve this problem, we have developed a resin wheel "BRZ Wheel" that has longer lasting cutting ability compared to the traditional resin bonded wheel.

What Is Double-disc Surface Grinding?

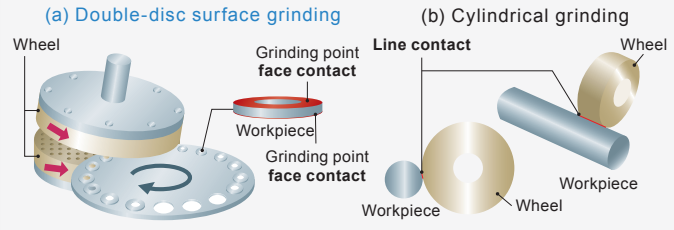
There are parts in automotive and other types of mechanical parts that require two flat surfaces on each side of the work part with high precision. This is achieved by sandwitching the work part between two abrasive surfaces (or wheels in this case) and grind both surface at the same time. There are two types of workpiece conveyance methods, namely infeed and carrier, and the conveyance method is selected according to the type and cutting stock of the workpiece. In either grinding method, both sides of the workpiece must be ground with high efficiency and high precision. In order to further improve productivity, it is essential to maintain the cutting ability of the resin wheels.

Issues of Double-disc Surface Grinding

Unlike traditional grinding method, such as a cylindrical grinding, double-disc surface grinding's abrasive wheels has a large contact area to the work piece (Fig. 1 (a)). Since the contact area is large, the load per grain will be

smaller. This leads to the tip of the grain to become dull. As the dull grain increases, this will reduce the cutting ability of the wheel, and produce parts with low quality. To fix this, you would dress the wheel to regain the cutting ability of the wheel. As your dressing interval decreases, your productivity is also decreasing.

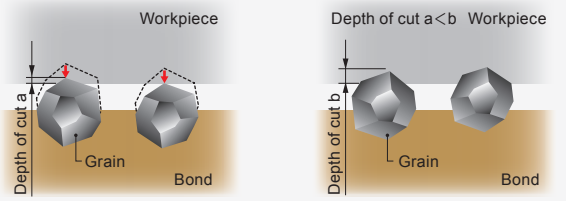
Recently, to improve on fuel efficiency and part life in automotives, the industry is moving towards utilizing materials with increased hardness. When grinding materials with such increased hardness, it is difficult for grains to bite into the workpiece. Instead, the force that is supposed to help the grain cut into the work piece will push the grain back into the bond, reducing the intended cutting depth. This also increases the amount of grain contact to the work part as well. This disperses the focal grinding pressure, and will reduce the cutting ability of the wheel (Fig. 2 (a)).



- The contact area between the wheel and the workpiece is large.
- Large amount of grinding heat is generated, and heat dissipation is poor.
- Grinding wheel with good cutting ability is required to prevent grinding burn

- The contact area between the wheel and the workpiece is small.
- Low grinding heat and good heat dissipation

Fig. 1 Comparing of grinding method



(a) Traditional wheel (b) Direction of development

Fig. 2 Relationship between wheels and workpieces during grinding

To counter this issue, the wheel is required to have grains sharp enough to be able to dig into the work part, and maintain that sharpness (Fig. 2 (b)).

Features of the BRZ Wheel

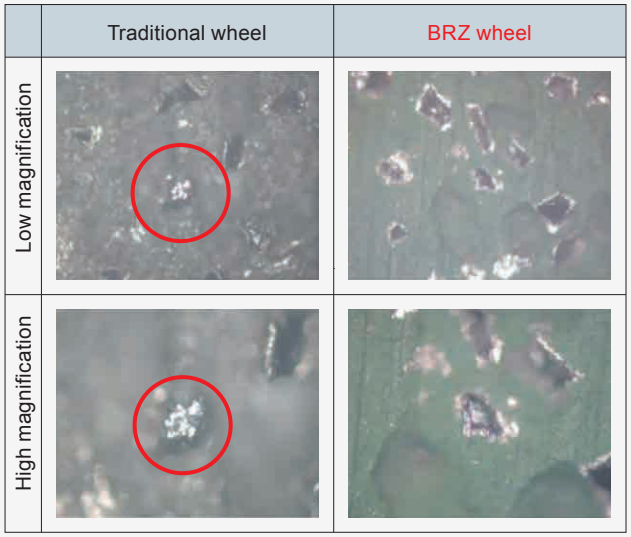
In order to solve the above-mentioned problems, it is required to suppress the grains sinking into the bond. For this reason, we have developed the BRZ wheel that focuses on the resilience of the grain layer, which includes the grain, bonds, and fillers*. The BRZ wheel uses a new bond that reduces the grains sinking into the bond, which will help maintain excellent cutting ability. As a result, the dressing interval can be extended compared with traditional resin wheels, which will improve productivity.

Examples of Processing of Iron-based Sintered Metals

Hydraulic parts in automobiles are required to be extremely airtight. We conducted a comparative tests between the traditional and BRZ wheels against a high-harded iron-based sintered metals used in such hydraulic parts. The power consumption value of BRZ wheels was reduced by 30% compared to traditional wheel (Fig. 3 (a)).

Although the BRZ wheel has been shown to improve cutting ability, it does require periodic dressing to maintain consistant grind. Instead we would like to show the difference in the grinding wheel surface condition after dress. To see this, we ground 500 pieces with both traditional and BRZ wheels and dressed the two wheels under the condition shown in Table 1. Generally, if the wheel is dressed poorly, the power consumption value tends to be higher right after dress. If that trend remains constant, the grinding performance will be different after each dress, and therefore the grinding process will not be stable. On the other hand, the power consumption value of BRZ wheels was consistant right after dress. This consistancy proves that the dress ability of the wheel is very good, since it is able to replicate the sharpness of the grain every time the wheel is dressed (Fig. 3 (a)).

Fig.3 Test results



[Dressing Conditions]

Dresser	Whitestone*(WA150H)
Dressing method	Dry dressing
Wheel speed	100min^{-1}
Carrier speed	10min^{-1}
Amount of dressing	37.5cc

[Processing condition]

Grinding machines	Double-disc surface grinding machine
Grinding method	Vertical infeed system
Wheel specification	CBC120P65BRZ
Wheel dimensions	φ305 × T50 × H80 × W50mm
Wheel speed	24m/s
Workpiece material	Iron-based sintered metal
Workpiece dimensions	φ75×H44mm

Table 1 Test conditions

Regarding the surface finish, the traditional wheel's finish tends to sway between Ra0.4μm and 0.6μm as the wheel grinds more parts. While the BRZ wheel will maintain about Ra0.5μm (Fig. 3 (b)). If we observe the wheel surface after grinding, we can see that the grain is dulled on the traditional wheel, whereas the BRZ grain is still sharp (Fig. 3 (d)). So, this shows that as the traditional wheel grinds more work pieces, more grains will become dull, and tend to produce a smooth/inconsistant surface. Whereas the BRZ wheel will maintain the sharp grain, which will maintain the consistancy of the grinding surface.

If the wheel is very sharp, it would also mean the wheel wear will be very high. However, the wheel wear amount of BRZ is very similar to the traditional wheels, even though the BRZ has high cutting ability (Fig. 3 (c)).

Case Study of Hardened Steel Processing

Test of the traditional and the BRZ wheels against the hardened steels such as the SUJ2 used in automotive and bearing parts (Table 2, Fig. 4).

Power consumption value was reduced to about 1.5kW by about 10% for BRZ wheels compared to about 1.7kW for traditional wheel (Fig. 4 (a)). The surface roughness was equivalent to Ra0. 2μm for both the traditional wheel and BRZ wheels (Fig. 4 (b)). The parallelism of the workpiece improved to 1μm for the BRZ wheel compared to 2μm for the traditional wheel (Fig. 4 (c)).

[Processing condition]

Grinding machines	Double-disc surface grinding machine
Grinding method	Vertical infeed system
Wheel specification	CBC140P75BRZ
Wheel dimensions	φ305 × T50 × H80 × W50mm
Wheel speed	9.6m/s
Workpiece material	SUJ2(JIS)/52100(AISI)/100Cr6(DIN) (HRC62 level)
Workpiece dimensions	φ80 × H57mm

Table 2 Test conditions

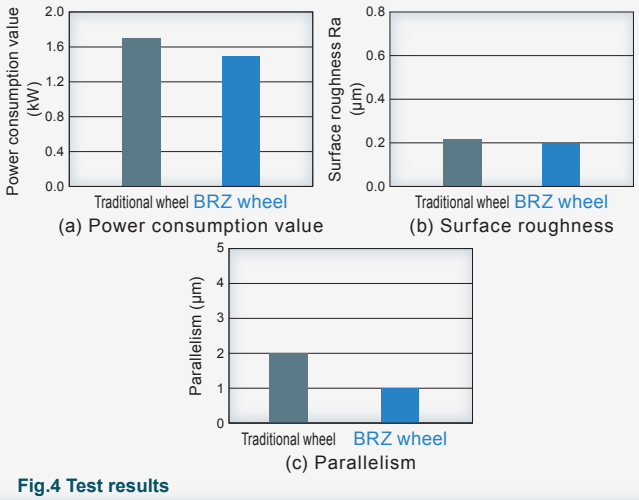


Fig.4 Test results

Contributing to the Request for Improved Productivity

BRZ wheels have excellent cutting ability against hardened steel such as iron-based sintered metals and SUJ2. This will help with increasing the dressing intervals, thereby contributing to the improvement of grinding productivity.

[Notes]

* Wheel: Generally, in Japanese, a grinding wheel composed of diamond or CBN grains is referred to using the English word "wheel" rather than a the native Japanese term for a grinding wheel, "toishi." This can cause confusion among Japanese engineers.
* Filler: Fillers are added to adjust the properties of the grain layers.It does not have a direct effect on grinding like grain type, but the characteristics of the grain layers can be adjusted according to the type, size, quantity, etc.
* Whitestone: Abrasive stone for dressing diamond/CBN wheels using WA grain.

[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
●	●		●	

Q What are the criteria for dressing the BRZ wheel?

A In general, dressing must be done before workpiece quality deviates from specifications. The reason for the deterioration of workpiece quality is considered to be 1) wheel profile breakdown and 2) decrease in cutting ability. Since BRZ is a wheel with excellent cutting ability, the main dressing reason is 1) wheel profile breakdown.

Q Please tell us how to dress the BRZ wheel.

A Since BRZ wheels have good dressing capability, and you currently use a resin wheel, dressing under the same conditions is considered to be applicable. Whitestone is recommended for simple cleanup. Dress, if the wheel profile collapses and it is difficult to recover with the dressing stone, return the wheel to Noritake for repair.

Q What are the workpieces that can be processed or ground?

A This product shows high grinding capability against sintered metallic components and high-hardness bearing steel. On the other hand, BRZ wheels are not suitable for workpiece materials such as unhardened steel. The bond will have a high wear rate, which generates large chips during grinding. If the workpiece is made of unhardened steel, we propose a wheel with more emphasis on wear resistance than the BRZ wheel.

Q&A