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Evaluation of surface grinding of the Woodceramics using by the 3-D Measurement

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Woodceramics, which are formed by impregnating phenolic resin into wood or woody materials and burning at high temperature in a vacuum furnace. Woodceramics have the superior mechanical properties, wear properties,electrical properties and electromagnetic shielding properties. However, woodceramics have hard and fragile character, and processing is difficult at such a reason. For this reason, it is indispensable to utilization of woodceramics to clarify the processing characteristic. In this study, it investigated about the workability of the woodceramics in grinding processing.

Key word: Woodceramics, grinding

1.Introduction

Woodceramics are new porous carbon materials which are made by carbonizing wood impregnated with phenolic resin in vacuum furnace.[1] Woodceramics have many advantage such as lightness and hardness in keeping the properties of porous wood, corrosion resistance, electromagnetic shield, far-infrared emission, etc.[2][3] However woodceramics have hard and fragile character processing is difficult at such a reason. For this reason, it is indispensable to utilization of woodceramics to clarify the processing characteristic. On this study, we had investigated about the workability of the woodceramics in grinding processing.

2.Experimental procedure

We performed grinding processing by dry type for the reason why wood ceramics are weak in water. We used surface grainding machine (Okamoto Machine Tool Works, Ltd. PSG52EX) for the processing machine. All processings excluded 2mm portion of surface with much pregnancy of phenol in order to make conditions uniform. Also we excluded in the experiment the place where pregnancy of the phenol of the wood ceramic central part is not fully performed. The processing conditions at the time of creation of a reference planeare feed speed 6.3m/min. Wheel grain size # 230, wheel peripheral speed 1700m/min, and depth of cut 0.5mm/pass.

2-1 Observation of a grinding side(The difference from a wheel grain size)

We performed grinding processing with the wheel of #230～#1200、surface roughness (Ra、Rz) was measured using the contact-type surface roughness meter (Mitutoyo, Ltd Surftest 401) . In addition, for grinding conditions, the

sending speed was 6.3m/min and wheel speed was 1700m/min, Depth of cut 0.1mm/pass

2-2 Observation of a grinding side(The difference from carbonization temperature)

We ground woodceramics which carbonization temperature 650℃, 750℃, and 800℃,the amount of grinding per one path on condition that 10 μm,100 μm,1000 μm. After processing, we observed the chip and the crack. Grinding conditions were the sending speed 6.3m/min and wheel peripheral speed was set at 1700mm/min.

2-3 Observation of a SEM photograph

We did the grinding of two kinds of woodceramics(600℃,800℃) by 0.5 to 0.001mm /path. And observed by SEM. At that time grinding conditions were the sending speed 6.3m/min and wheel circumferential speed was 1700mm/min grain size was #230.

2-4 Observation which used 3D measuring instrument

After performing the above mentioned SEM observation, we used 3-dimensional measuring instrument (COMS Co.,Ltd. EMS98AD-3D), and measured the grinding side. We classified by color every 0.01mm from the surface using the computer graphics after measurement, and compared surface form at the amount of grinding, and carbonization temperature.

3 Results

3-1 Observation of a grinding side (difference arising from a wheel grain size)

Fig.1 shows the result which measured surface roughness, after performing grinding processing at the carbonization temperature of 650℃ wheel grain size #230 to #1000. It was shown clearly that surface roughness was in inverse proportion to a wheel grain size between #230 to #800 (the grain size of a wheel).

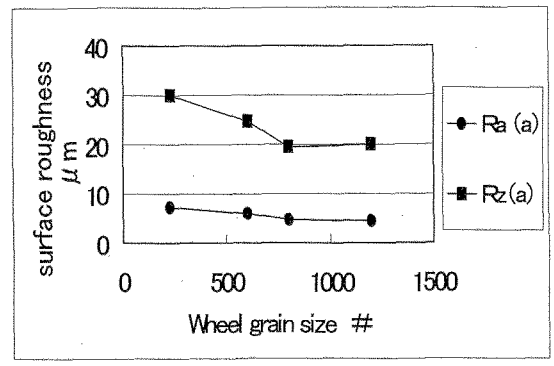
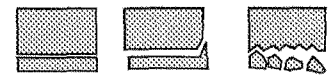


Fig.1 Relation between a wheel grain size and surface roughness

Table.1 Observation of a chipping and a cracking

Carbonization temperature	The amount of grinding(mm/pass)													
	0.001	0.005	0.01	0.05	0.01	0.05	0.1	0.5	1	2	3	4	5	6
800℃	○	○	○	○	○	○	○	△	×	--	--	--	--	--
750℃	○	○	○	○	○	○	○	△	×	--	--	--	--	--
650℃	○	○	○	○	○	○	○	○	○	○	○	○	△	×



○ △ (Chipping) × (Cracking)

3-2 Surface observation

Table1 show that the surface observation result was performed which changed amount of grinding of the woodceramics at each carbonization temperature.

Also, the thing of low carbonization temperature (650℃), even as the big amount of grinding (1~3mm), was missing and the crack was not observed. However, in the high carbonization temperature (800℃), the chip occurred in the amount of grinding of 0.5mm. The amount of grinding beyond it, the crack was derived and it was checked that processing is difficult. The woodceramics with a high carbonization temperature have bad processability compared with a low thing.

3-3 Observation of a SEM photograph

Fig.2 shows SEM photograph carbonization temperature at 650℃, the surface became flat as the volume of material removed increased.

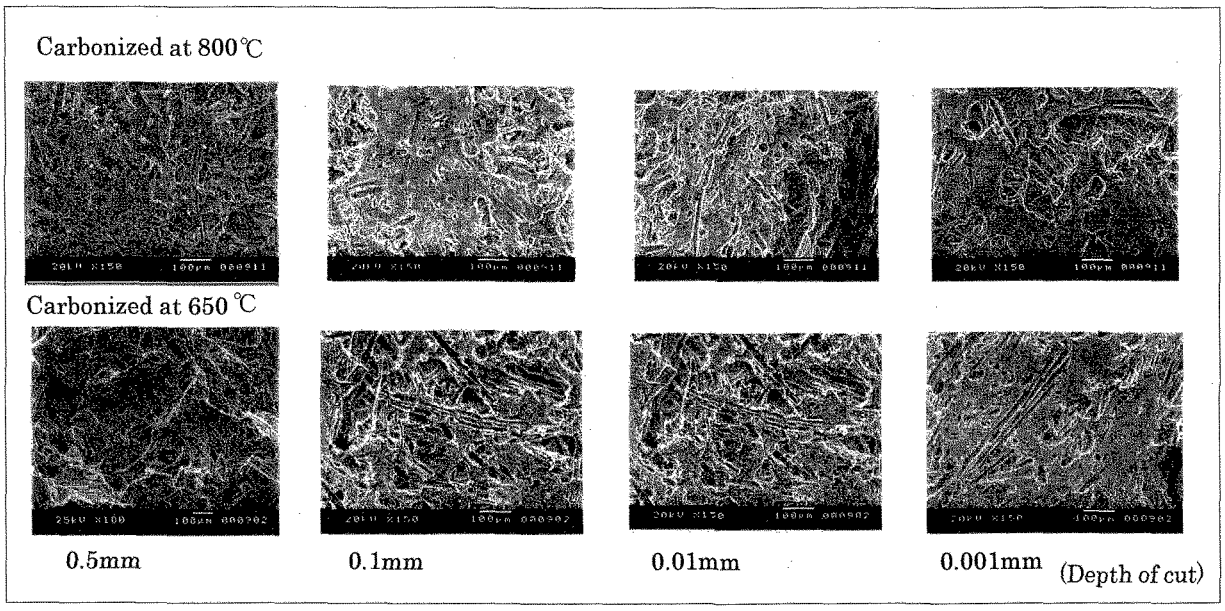


Fig.2 SEM microstructure of Woodceramics

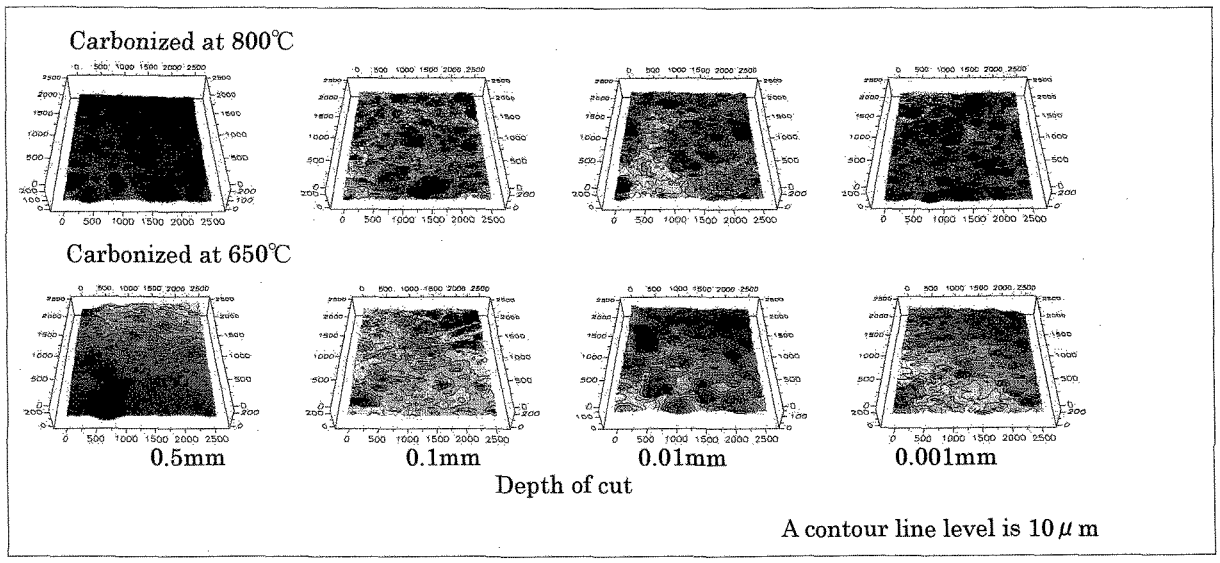


Fig.3 Surface observation by 3D-CG

From experiment result ,we have checked that in a high carbonization temperature, the processing accuracy is better than a low temperature in the big amount of grinding. Moreover, at the carbonization temperature of 800℃, since a processing side does not change a lot even if it makes the amount of grinding small, it is not necessary to make the amount of grinding small. Conversely, in order to finish flat and smooth at 650℃, processing is required of the smaller amount of grinding.

3-4 Surface observation by 3-D CG

Fig.3 shows the surface form where the 3-dimensional measurement machine performed CG processing after measurement of the surface.

Even if this grinding processing changed the amount of grinding with a high carbonization temperature at 800℃, it shows that surface

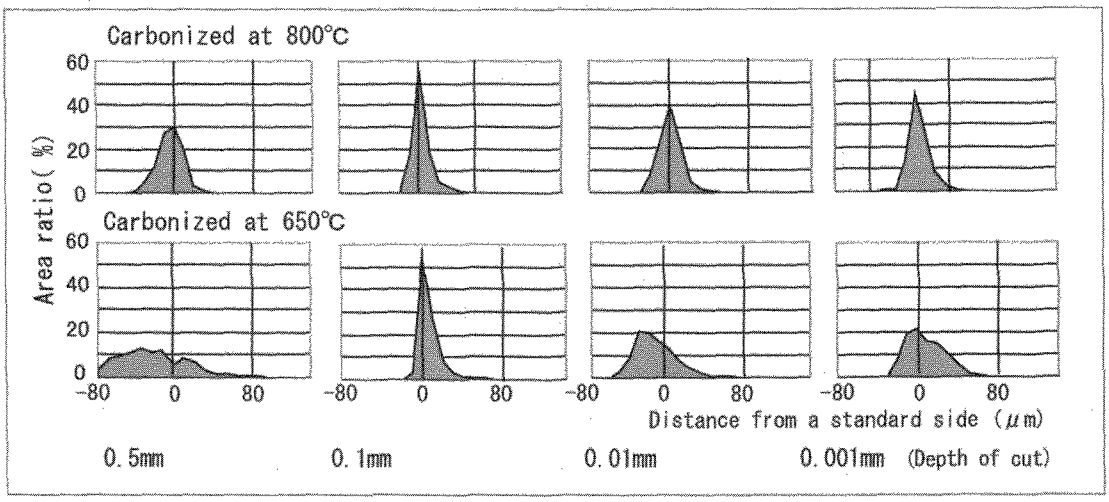


Fig.4 The distribution map for a field of a grinding surface

coarseness does not differ greatly. Also, at 650℃ carbonization temperature, we have checked that the surface became flat and smooth in proportion to it, when the amount of grinding was made small. Fig.4 shows what graph-ized the distribution of a field from this CG processing. A horizontal axis shows the distance from the surface and a vertical axis shows the rate to the field of each whole depth.

Fig.5 shows the rate of a ±10-micrometer field from the field of the peak in each volume of material removed. As a results of comparing 800℃ and 650℃, 800℃ of ground surface are flat and smooth in every amount of grinding. With the woodceramics of 650℃, we have checked that a field became flat and smooth, when the volume of material removed was made small. We think that this result occurred by the following reasons. At 650℃, carbonization of woodceramics is not fully performed, and since combination of a fiber and a fiber is weak, precision grinding is difficult. On the other hand, at 800℃, since it is fully carbonized, combination can predict that it is strong and is easy to precision grinding.

4 .Conclusions

We can conclude the following results from this experiment.

Even if 800℃ (Carbonization temperature) increases grinding compared with 600℃, a good surface roughness is acquired.

In processing of #230 (650℃) , a flat surface is acquired by making the amount of grinding per one path smaller than the fiber of woodceramics. Rough grinding is possible at 650℃. However, at 800℃, coarse grinding is impossible.

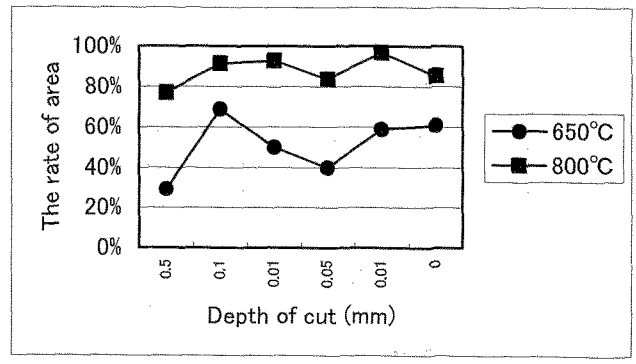


Fig.5 The rate of a standard side to ±10 μm field

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