

Grinding Tool for Processing 8-inch SiC Wafers: Nanomate Masspower IIB

1. Outline

The silicon carbide (SiC) power device market is growing each year due to the rapid proliferation of electric vehicles and photovoltaic power generation systems. Accordingly, there is an upward capital investment trend, such as planned increases in production volume by a factor of two to five within a couple of years. Meanwhile, there is a trend towards the development and commercialization of 8-inch (200 mm) SiC wafers, with 6-inch (150 mm) SiC wafers currently being the mainstream. Technology development is actively underway to manufacture SiC power devices at a reduced cost.

Compared to silicon (Si), SiC is a material of higher utility value due to its high-speed switching at high voltages and currents and low power loss. However, the material is more difficult to grind than Si because its hardness is third to that of diamond and cBN. Compared to 6-inch wafers, the wafer removal volume of 8-inch wafers is larger by a factor of 1.8 and the area of action in which the wafer comes in contact with diamond abrasive grains is also larger by a factor of 1.4. Therefore, the previous product (Nanomate Masspower) had problems such as a shorter tool life and higher grinding resistance. For these reasons, there was an urgent need to develop a suitable grinding tool for the development of large wafers. Having addressed this challenge, A.L.M.T. Corp. applied its proprietary tool design and succeeded in developing a tool with both a satisfactory tool life and grinding resistance. This tool was launched in October 2023 under the name Nanomate Masspower IIB. Meanwhile, the grinding tools described in this article are categorized as a super abrasive wheel used on a vertical rotary surface grinder, as illustrated in Fig. 1.

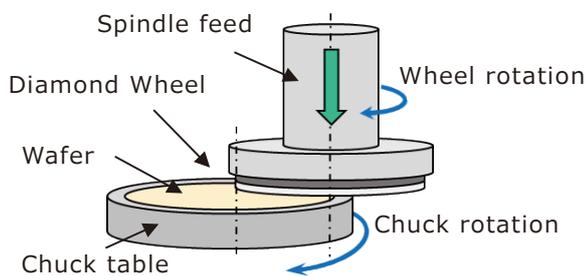


Fig. 1. Vertical rotary surface grinding

2. Processing Example

2-1 Processing results for 8-inch SiC mono-crystal wafers

Using 8-inch SiC mono-crystal wafers, a processing evaluation was conducted to compare the processing performance of the new product Nanomate Masspower IIB and the previous product. The processing test used a

vertical rotary surface grinder owned by the Customer Solution Center (CSC), which is the evaluation group of A.L.M.T. Corp. For wafers, 8-inch SiC mono-crystal wafers (dummy grade) of the 4H-N type were used, which are widely used as a material for SiC power devices.

The evaluation results showed that the tool life and grinding resistance of Nanomate Masspower IIB are 100% longer and 30% lower, respectively, than that of the previous product. Thus, Nanomate Masspower IIB offers both a long tool life and low grinding resistance.

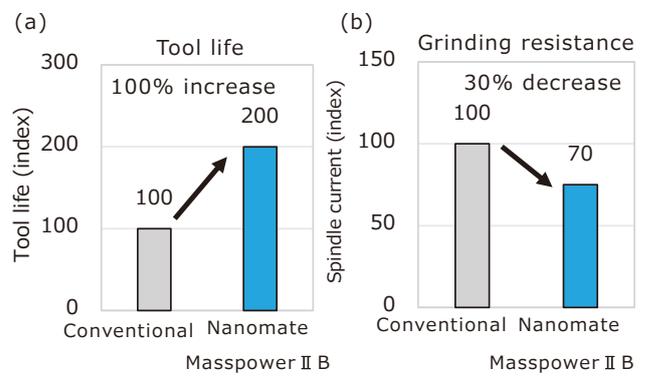


Fig. 2. 8-inch SiC wafer processing examples: (a) tool life and (b) grinding resistance

2-2 Quality of processed surfaces of 8-inch SiC mono-crystal wafers

The quality of processed wafer surfaces is an important evaluation indicator of wafer thickness machining in the SiC power device manufacturing process. Therefore, after the processing test, various measurements were conducted: surface roughness measurement with a white light interferometer owned by the CSC, total thickness variation (TTV) measurement with a noncontact flatness tester, and damage layer depth measurement with a scanning transmission electron microscope (STEM).

Table 1. Quality of Processed Surfaces of 8-inch SiC Wafers

Product name	Surface roughness Sa (nm)	TTV (μm)	Damage layer (nm)
Conventional	1.8	1.54	< 180
Nanomate Masspower IIB	1.4	1.55	< 130

The measurement results revealed that Nanomate Masspower IIB improved in terms of surface roughness and damage layer depth and demonstrated excellent performance as compared to the previous product.

Consequently, in the grinding of 8-inch SiC wafers,

the new product offers superb performance in terms of the quality of processed surfaces as well as machining performance—a long tool life and low grinding resistance—as compared to the previous product.

Nanomate Masspower IIB is expected to contribute to the development of manufacturing technology for power devices that use 8-inch SiC wafers and to the greater use of SiC power devices.

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