SiC Wafer Grinding Tool “Nanomate Masspower”

1. Outline

With the rapid growth of renewable energy and electric vehicles (EVs) to realize carbon neutrality, demand for next-generation power semiconductors is expanding. In particular, silicon carbide (SiC) is beginning to be used in some application areas as a new material that achieves higher voltage resistance and less power consumption than silicon. However, the high manufacturing cost is a problem that needs to be solved before it is widely used.

In the manufacturing process of SiC wafers and devices, grinding is used to finish wafer surfaces with high efficiency. However, grinding SiC, a hard-brittle material, poses the problems of (1) a high tool consumption rate and (2) high grinding resistance. To solve these problems, the development of a high wear-resistance tool capable of grinding SiC with low cutting resistance has been desired.

Against this background, A.L.M.T. Corp. has developed a vitrified bond wheel that achieves both a long tool life and a low grinding resistance at the same time with its proprietary technology for the high-precision dispersion control of submicron structures. A.L.M.T. Corp. began marketing the new grinding tool “Nanomate Masspower” in fiscal year 2022.

2. Features

2-1 Compatibility between long tool life and low grinding resistance

The vitrified bond wheel is composed of abrasive grains and ceramic bonds that hold them, and an infinite number of abrasive grains work as cutting edges when grinding wafers. When the abrasive grains become worn, they drop from the bonds and are replaced by new grains that are constantly generated to maintain the performance of the tool. The tool life and cutting resistance are generally in a trade-off relationship: the harder the vitrified bond, the longer the tool life but the higher the grinding resistance.

As another approach, we focused on the dispersibility of the composites. We developed a technique for uniformly distributing the composites, as shown in Fig. 1, and succeeded in extending the tool life with low grinding resistance.

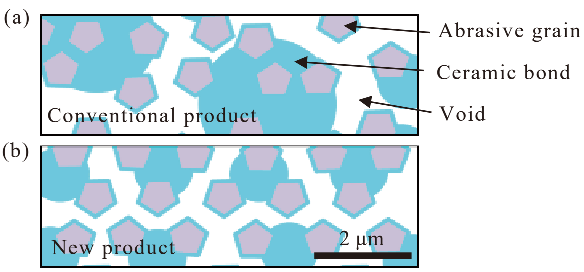

Fig. 1. Schematic illustration of submicron structures
(a): conventional product (b): Nanomate Masspower

3. Examples of Grinding SiC Wafer

3-1 Example of finish grinding mono-crystal 6-inch SiC wafers

Figure 2 shows the grinding result of the finish grinding of 6-inch SiC wafers, which are mainly used in the SiC power device market.

Compared with the conventional product, Nanomate Masspower achieved a 40% longer tool life and 30% lower grinding resistance under the same grinding conditions.

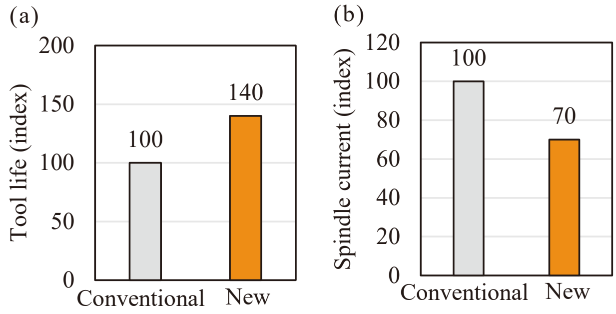

Fig. 2. Grinding result of 6-inch SiC wafers
(a): tool life (b): grinding resistance

3-2 Example of finish grinding mono-crystal 8 inch SiC wafers

There is a movement in some markets toward the use of larger-diameter wafers for the popularization of SiC power devices. In response to such movement, we tested our capability of finishing 8-inch SiC wafers.

The results are shown in Fig. 3. The conventional product failed to grind an 8-inch SiC wafer due to overload resistance, while Nanomate Masspower successfully ground 8-inch SiC wafers with a performance equivalent to that for 6-inch SiC wafers.

As discussed above, the new product demonstrated grinding performance for a long period of time with low grinding resistance, and also achieved favorable results in

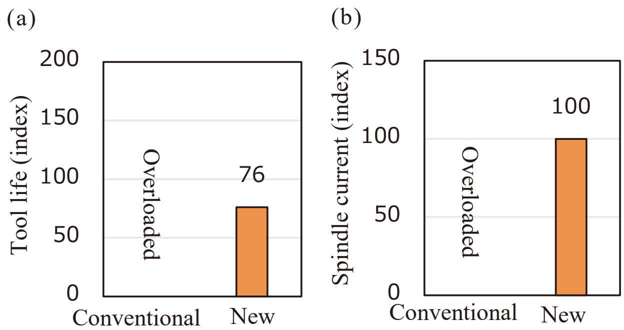

Fig. 3. Grinding result of 8-inch SiC wafers
(a): tool life (b): grinding resistance

finishing larger-diameter wafers. Thus, this product is expected to contribute not only to the improvement of productivity but also to power savings in the SiC power device industry.

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