Fully automatic grinding of radii on diamond segments

Because of their low rigidity and the absence of a dressing device, the radius grinding machines available on the market are often not able to maintain the accuracy on the base of the segment which is required in the manufacture of diamond saw blades for dry cutting. **S. Burckhardt** and **E.-V. Urtel** describe a new, fully automatic machine which is not only capable of grinding the radii on the diamond segments to the degree of precision required, but which also makes a significant contribution to the economics of the manufacturing process as a whole.

Because of its speed, laser welding is particularly well-suited to the economic manufacture of small diameter diamond blades for cutting construction materials. When using this method, however, because of the temperatures generated in the welding process, segments must be used which have no diamond in their base. Diamond segments such as this are made up of different materials, with the part of the segment that will later be in contact with the blade centre being free of diamond. The specifications on the geometry of the segments are very strict and require the use of precision machinery.

It is not only the sintering equipment that has to operate to within tight tolerances. In order for it to operate efficiently, modern laser welding equipment uses a laser beam just 0.1 mm wide. Therefore the radius on the base of the segment must also be produced with very great precision in order to ensure that the segment will subsequently be firmly attached to the blade centre.

A disadvantage is the fact that a graphite die of the correct size must be available for each different radius during segment manufacture. The great range of different blade diameters on the market therefore requires the toolmaker to have a large number of these graphite dies. A further problem arises from the need to keep a stock of the various different shapes of segment in order to be able to respond quickly and efficiently to the requirements of each individual customer.

RSM 360 radius grinding machine

With the RSM 360 radius grinding machine, Dr Fritsch Sondermaschinen GmbH, Fellbach, Germany, now provides a machine for grinding segments with a diamond-free base (Fig 1), which improves still further the economics of diamond tool manufacture.

Designed for mass production use, the machine is capable of handling segments from 20 to 51 mm in length, 1.8 to 12 mm in thickness and 5 to 30 mm in height. Radii from 42 mm to almost straight ($R \approx \infty$) can be ground.

One of the most important features of the machine is the fully automatic pre-sorting of the segments, for which a measurement system was developed in-house. The workpieces are fed to the grinding machine by a helical conveyor or a magazine. Operation is controlled from a central control panel with the radius, segment height and pre-sorting height range being input.

Because of the soft bond at the base of the segment, the grinding wheel slowly becomes loaded. An automatic dressing unit built into the machine dresses the wheel at programmable intervals.

Fig 1 RSM 360 fully automatic radius grinder

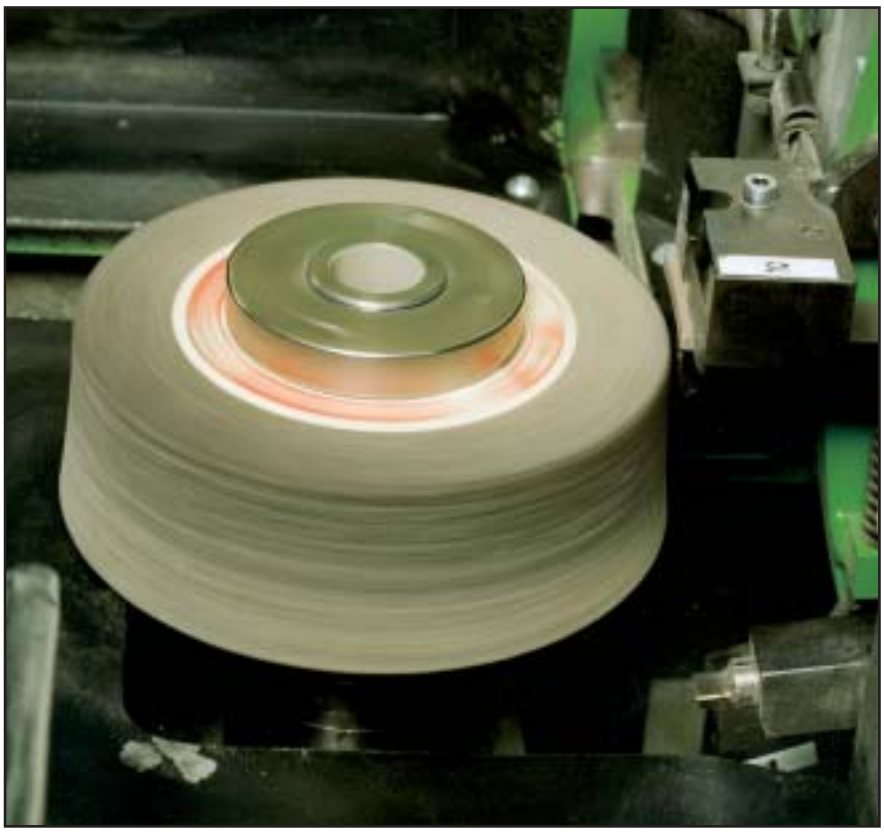

Fig 2 Machining the radius on a diamond segment

Advantages

The use of the RSM 360 in industrial practice results in a number of economic benefits. When a large number of different blade diameters are being produced, first of all storage problems are eased, since there is no longer the need to manufacture every single size.

The ability to grind the correct radius on a segment taken from stock means that a pre-set range of diameters can now be covered by a single segment type. Manual grinding of the segments, which still takes place frequently, or new sintering of the required segment type, is now no longer needed. Also, only a small number of graphite dies is now needed for segment production.

The high specifications set with regard to the precision of the segments are reflected in a number of the machine's features. For example, the diameter of the grinding wheel is measured by means of a light barrier throughout the grinding process. Unlike other grinding machines available on the market, with this method it is possible to compensate accurately for tool wear and, consequently, for any possible deviation from the required radius. To maintain a constant peripheral speed, the CNC control steplessly regulates the spindle speed on the basis of the data provided.

A key factor for the subsequent successful use of the sawblade is a consistent segment height - and therefore minimal deviation over the whole of the diameter of the blade. But a greater degree of accuracy is also beneficial during manufacture.

While hitherto all segments have had to be reduced to a consistent height by grinding, now, sorting them to within a tolerance of ± 0.3 to 0.5 mm means that the welding operation can be carried out with segments of almost identical size. A much shorter time is therefore required later on for grinding the external diameter of the blade to truth.

Example

The prototype machine has been in use at Diamanttechnik Urtel GmbH, which claims to be the most modern diamond segment manufacturer in Austria, since September 1999. The company has a broad product range which requires a large number of different segments to be processed in a variety of sizes. Here it is not only the laser welding process that benefits from the use of the new machine; segments for brazing are also polished flat on the RSM 360 machine to ensure an improved bond between the blade centre and the segment.

The segments are ground with a 175 mm diameter aluminium oxide grinding wheel at a cutting speed of 35 m/s. A larger grinding wheel with a longer life could be used on the machine, but then it would not be possible to grind the smaller diameters required.

The flexibility of the machine can be seen when radii are produced which would otherwise be designated as specials. Generally, the segment base has to be 'hollow' for laser welding, i.e. the segment only makes contact with the blade centre at its outer edges. Because of the steplessly adjustable pre-setting capability of the control system, it is now simple to program the machine to grind on the base of the segment the 193 mm radius required for a blade centre 195 mm in diameter.

All in all, even at this early stage of its use it appears that the RSM 360 radius grinding machine is a 'must' for the laser welding of diamond sawblades. The instability observed in comparable, but less strongly built machines, and hence any accompanying deflection of the segment during the grinding process, is not seen with this machine. No radius errors are observed and there is no difficulty in meeting the strict requirements regarding the accuracy of the segment. ◆

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Illustrations: Dr Fritsch Sondermaschinen GmbH, Fellbach, Germany.