Superb results with the new SF stream finishing machine from OTEC

More innovative, faster, more economical and with outstanding technical data: over the last few weeks OTEC, as a specialist in precision finishing, has carried out an extensive series of tests with the new SF machine and achieved excellent results. The focus was mainly on the polishing of carbide drills, edge rounding of inserts and the deburring and polishing of drill, cutting tool and lathe tool shanks**. The new SF machine also proved to be a major advance in terms of processing time and precision for the deburring, rounding and smoothing of the tooth flanks of gear wheels.**

Polishing carbide drills

Twenty to thirty minutes' finishing time in DF machines; only 4 to 8 minutes in the new SF machine! The test items used in this case were drills with a diameter of 10 mm, and their cutting edges were rounded to 8 – 10 µm. The roughness values in the chip flute also showed how very efficient the SF machine is: a reduction from Ra 0.19 µm, Rz 1.1 µm to Ra 0.10 µm, Rz 0.5 µm.

Fig. 1: Carbide drill clamped in collet chuck

Fig. 2: Drill during finishing

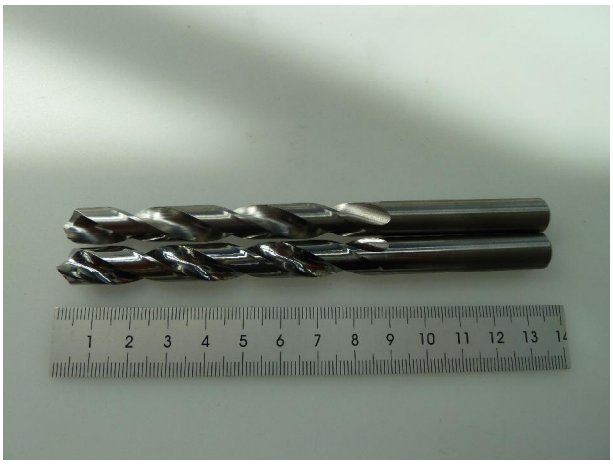

Fig. 3: Drills before and after finishing

Edge rounding of indexable inserts

The SF machine has also proven to be far superior for finishing this type of workpiece, too. The background in brief: in order for the edge rounding of exchangeable inserts to be carried out efficiently (in terms of throughput per time unit) in DF machines, large quantities of workpieces have to be clamped in place and subsequently unclamped. This involves a manual process of up to half an hour in each instance – reflecting down time for the machine. Since inserts are usually processed in very large quantities, it would be more efficient to automate the clamping process. With the DF machine, however, this is a complicated and expensive matter.

This is quite different with the SF: Here up to 5 workpieces can be directly affixed in the bore hole. The medium used for finishing is wet QZ 1-3 W. The workpieces can be changed during the process, giving a cycle time of approx 6 seconds per workpiece. In addition, it is a simple matter to automate the clamping process or even to integrate the entire machine into a production line for inserts. A few important items of technical data: the K factor which is so important for the life of the workpiece can be adjusted within a range of 0.5 to 2.0 by changing the direction of rotation of the process drum. The processing time is usually about 30 seconds. There is no measurable change to the very good initial jaggedness of 0.5µm, whereas the surface of the rake face improves considerably from Ra 0.38 µm to Ra 0.18 µm.

The bottom line is that the SF-wet enables edge roundings of 10-200 µm to be achieved in extremely short finishing times with a very low degree of jaggedness at the cutting edge whilst at the same time considerably improving the tool surface. The K factor, which is becoming more and more important, can be varied within a range of 0.5 – 2 by selectively targeting the insert in the stream.

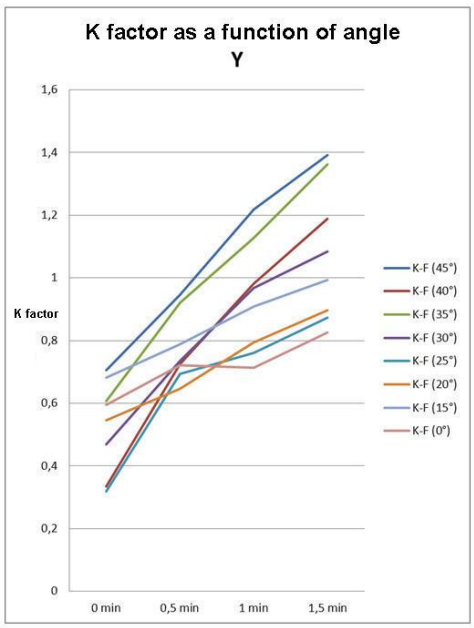

Fig. 4: K factor >1

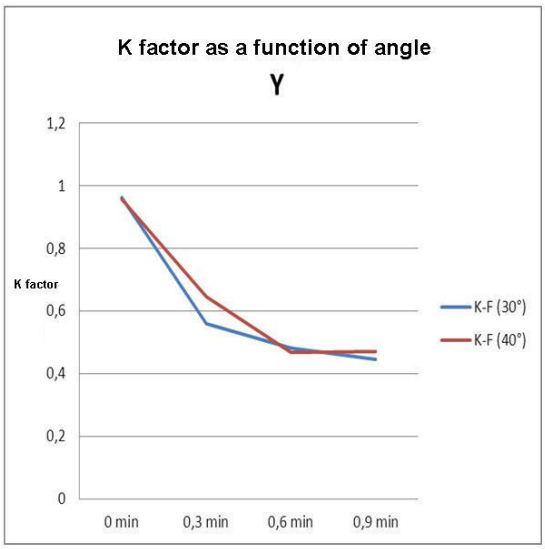

Fig. 5: K factor <1

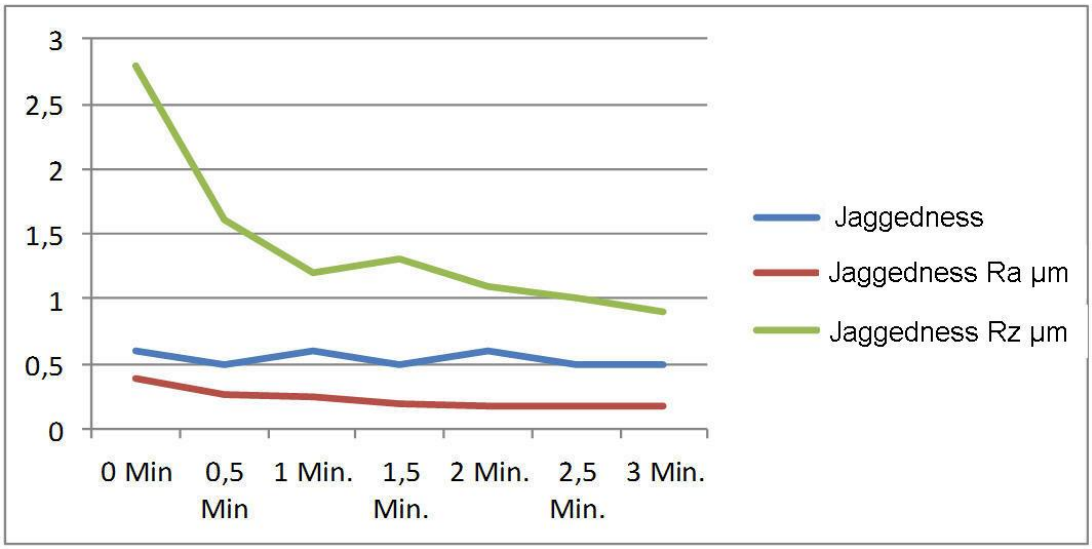

Fig. 6: Jaggedness, roughness

Fig. 7: Indexable insert clamped in chuck

Deburring and polishing drill, milling cutter and lathe tool shanks

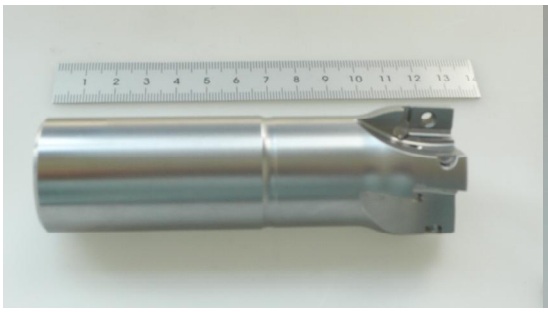

Fig. 8 Milling cutter shank

Fig. 9 Drill shank

These tools act as holders for exchangeable inserts are made from temperable steel, then milled, deburred, tempered and ground to their final dimensions. In our series of tests, the QZ 1-3 W medium with added water and the compound SC 15 were used for deburring. After a processing time of 1 – 5 minutes (depending on the extent of the size of the burs, a very smooth surface with a Ra value of up to 0.13 µm was obtained.
A layer of e.g. hard chrome is often added as an anti-corrosive; however, this can very quickly be damaged and worn away by chips. The OTEC-preferred alternative of polishing gives considerably better protection against oxidization and therefore increases the life of the tools. Furthermore, this type of finishing taking only 8 – 12 minutes gives improved chip flow in the flute.
A mixture consisting of M 1/300 and the polishing powder M 18 has proved to be a suitable medium.
The effect in numbers: from an initial roughness of Ra 0.1 – 0.15 µm, the Ra value of the polished surface is down to 0.03 – 0.05 µm. Perfect!

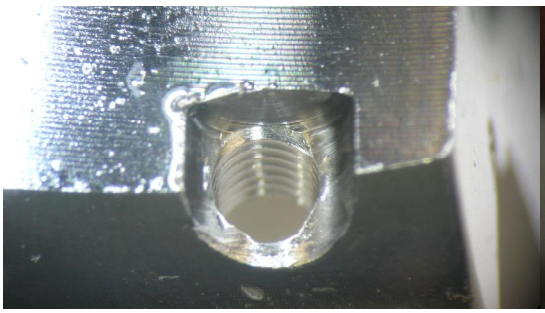

Fig. 10: Before

Fig. 11: After

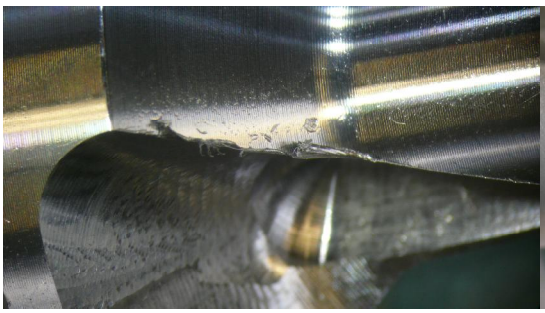

Fig. 12: Before

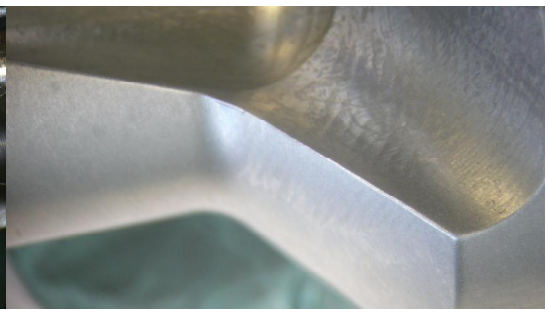

Fig. 13: After

Gear wheels: deburring, rounding and smoothing tooth flanks

Here, the new technology of the SF enables very short processing times of less than 2 minutes to be achieved. Since up to 5 workpieces can be finished simultaneously and the workpieces can be loaded and unloaded either manually or by means of a robot, the throughput time is down to 24 seconds per workpiece.

A practical example: the workpieces are clamped in a three-jaw gripper on a diagonal holder (Fig. 14). Fig. 16 shows the unrounded edge of the tooth flank. Now the workpiece is immersed in the streaming medium (Fig. 15). In this case, the medium used is QZ 1-3, an aluminum oxide with a grain size of 1 – 3 mm to which water and a compound (e.g. SC 15) are added. During processing, the workpiece rotates around its own axis according to a preset program (e.g. 30 seconds clockwise and 30 seconds counter-clockwise) whilst the process drum containing the medium carries out the same changes of direction in a 1-minute cycle.
After a processing time of 2 minutes, the job is finished (Fig. 17). The results are outstanding. The roughness at the tooth flanks, initially Ra 0.92, now only measure a value of 0.51. In the case of a different customer, the Rz value was reduced from 1.5 to a mere 0.4.
The SF machine has therefore also successfully demonstrated its excellent performance and efficiency for the finishing of gear wheels.

Fig. 14: Gear wheel clamped in place

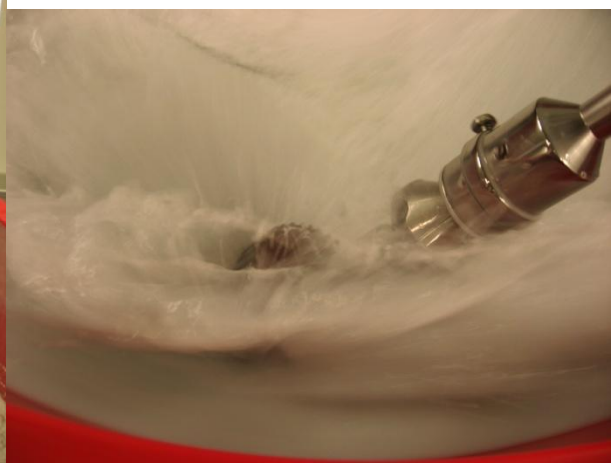

Fig. 15: Gear wheel during finishing

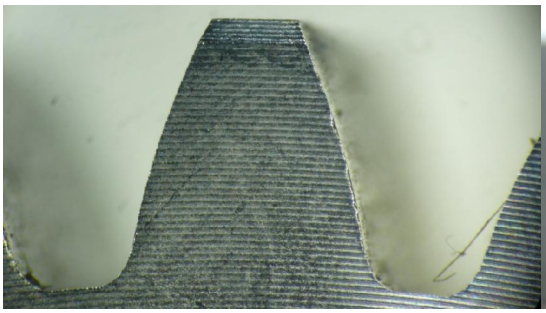

Fig. 16: Tooth flanks before finishing

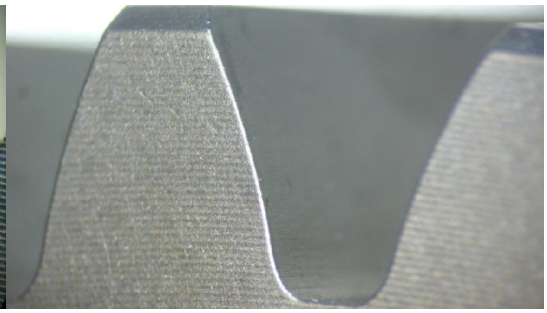

Fig. 17: Tooth flanks after finishing