

## The problem

During the manufacture of tablets the process of pressing can cause changes in the contact surfaces of the punches and dies used. Depending on the nature of the tablet material, the surfaces of the tool can become considerably rougher. In some cases this can lead to a drastic increase in the tendency of the tablets to adhere to the press tool.

This in turn gives rise to the following problems:

- Especially when pressing with profiled punches (with a score line, logo, brand or company name) the tablets may stick to the tools for too long or may break up. This reduces the reliability of the process.
- Rough surfaces are detrimental to the flow characteristics of the tablet material at the punch surface and increase the pressing cycle. This in turn reduces productivity.
- It reduces the useful life of dies and punches.

Tablet tools are therefore often polished by hand, which is very time consuming and does not always give all the punches used in a press the same surface finish. Depending on the shape and size of the pressing surface it can take up to 5 minutes to polish a simple punch by hand. Complex shapes such as oblong tools, maybe with an imprint or score line on both sides, can hardly be polished by hand. And even when they have been polished by hand, punches with complex geometries reveal the greatest variations in shape and surface finish within a given set, since all the parameters of this polishing process, such as pressure, polishing time, use of polishing paste, etc. are a matter of feel and depend on the skill of the polisher. As a rule, tablet presses have systems for monitoring pressure forces, such as expansion measuring strips. The variations in the pressures resulting from manual polishing then often cause the production line to stop and make it necessary to change or repolish the tool.

## Process description:

The punches are mounted on workpiece holders and dragged through a plastic granulate (DFP 0/400) medium. For polishing, a polishing paste is used, which is added to a granulated plastic carrier medium. A relative motion between the carrier medium and the punch is generated by the circular motion of the punch through the granulate. All punches receive the same, even treatment. There is no danger of a change in the dimensions of the tool, since the polishing process only removes the peaks in the roughness of the profile.

The test of the roughness depth of differently stressed tablet press punches<sup>1</sup> made of material 1.2363 yielded the following Rz and Rt values:

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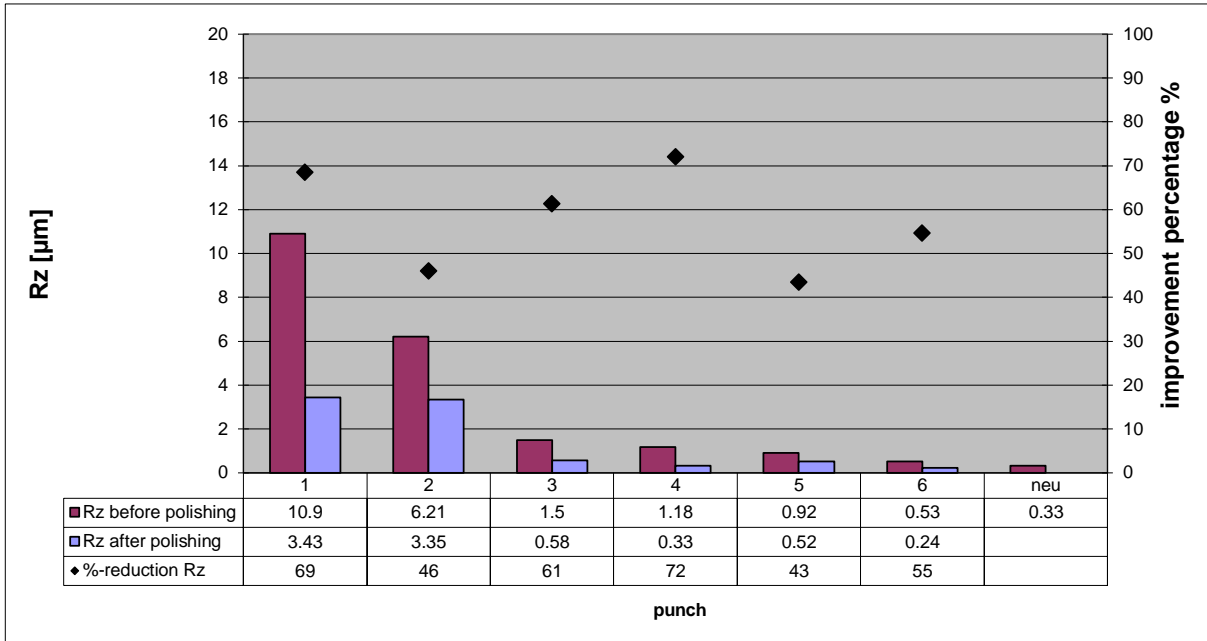


Figure 8: Reduction of the roughness depth (Rz) for differently stressed tablet punches

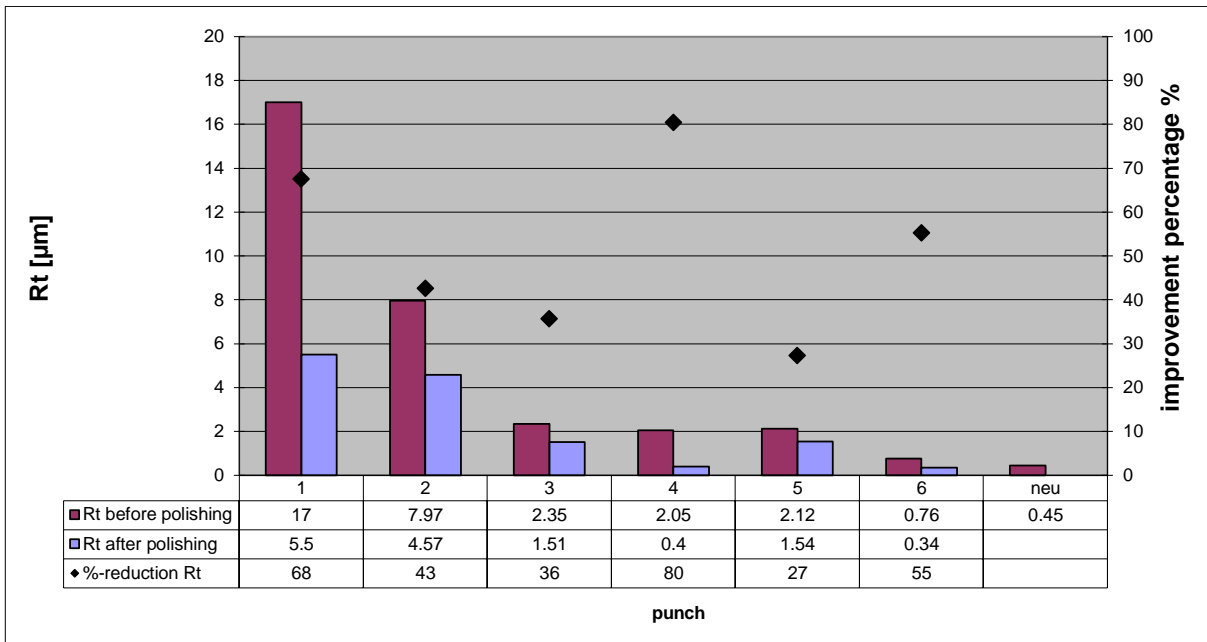
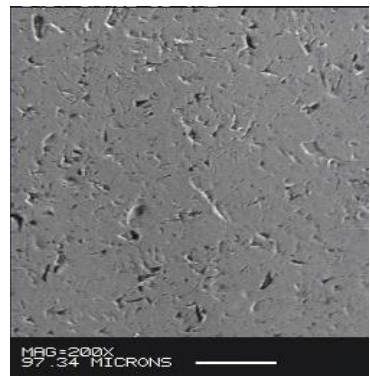
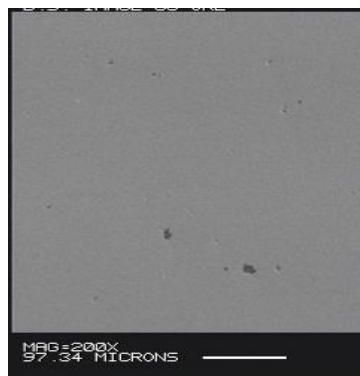
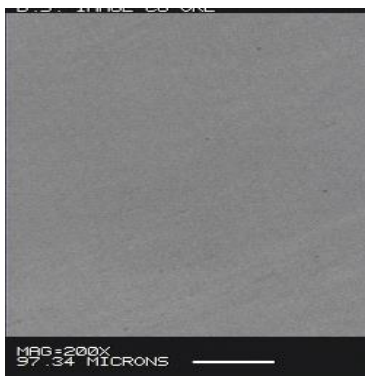


Figure 9: Reduction of the roughness depth (Rt) for differently stressed tablet punches



A study of the roughness depths of tablet punches subjected to different loads and made from material 1.2363 provided the Rz and Rt values given above. Here there is a strikingly significant reduction in the roughness depth of on average over 50% after only 30 minutes' polishing time. In the punches subject to considerable stress (groups 1 and 2) over a long period of time, the rough areas are so high that longer polishing times must be expected. (Experience has shown that the required polishing time can be as much as 60 minutes). In the case of punch groups 3 – 6 the quality of the punch clearly approaches that of a new one. As a typical example, the three photographs shown above (with a magnification factor of 200) illustrate the positive effect of polishing. Here there is no longer any perceptible difference between the contact surface of a new punch and that of a polished one.

In order to eliminate any operator-specific variations in the polishing process, all parameters (processing time, speed, cycle times, paste dosing etc) are controlled by a programmable logic controller. This enables the polishing process to be clearly defined and reproducibly mapped.

Depending on the size of the equipment and the format of the tool, up to 120 punches can be repolished in a single operation. As a rule a processing time of 30 minutes is sufficient.

From the polishing paste only a very thin layer of glycerine remains on the surface of the workpiece, which protects it from oxidation.

Immediately before the workpieces are used for pressing again, they should be cleaned with isopropanol or another suitable cleaner.

## **Advantages of polishing by machine**

- A consistent polish is obtained for all punches. The polishing process can be repeated regularly with the same parameters, which ensures consistent quality. (A high degree of reliability)
- The contact surface of the punches becomes smooth.
- The thin film of glycerine which remains on the surface after polishing, prevents the workpieces from oxidising.
- The tablets adhere to the polished punches less readily, which means that the presses can be operated at high speed.