This newsletter appears several times a year, informing Menzerna customers about Menzerna projects and innovations.

Improving the economic efficiency of steel polishing

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Contact

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The polishing paste with its influence on temperature significantly affects the economic efficiency of the polishing process. Knife blades made of stainless steel overheated during the polishing process at Johannes Giesser Messerfabrik, Winnenden, Germany, leading to smoke development. The contact pressure of the polishing rings had to be reduced in order to avoid the risk of fire, but this led to quality problems and longer processing times. By collecting process data from tests in the technical centre, Menzerna was able to identify the cause of overheating and find an economical and quality-optimised combination of a polishing paste and polishing tool.

The most important insights at a glance:

- Problem cases in the polishing process can be reproduced on equipment in the technical centre
- Comparative polishing tests identify the causes of problems
- The variation of process parameters produces data as the basis for decision-making
- The temperature behaviour of the polishing paste is the crucial factor when polishing cutlery steel
- Heat development can be tested using various polishing rings and polishing pastes at different contact pressures. The removal rate of the paste and therefore its economic efficiency can be represented relative to the contact pressure and other process parameters

Smoke development as the starting point for analysing the polishing process

During a test conducted by the knife manufacturer Giesser, the automated polishing of cutlery steel led to pronounced smoke development in the robot cell. As a result, the desired surface quality could not be obtained. Initially the cause of this problem was not understood.

Reproduction of the polishing process

Polishing processes can be reproduced true to the original in the Menzerna technical centre, which is equipped with the required measuring technology. The causes of problems can be clearly identified by varying the following parameters: the polishing ring, polishing paste, application of paste to the wheel, rotational speed and contact pressure. In the Giesser case, it quickly became clear that the knife blade was overheating due to insufficient wheel adhesion of the polishing paste 3 that was used. The cause for smoke development had been found. Frictional heat is produced in the polishing process depending on the adhesion of the polishing paste on the polishing tool, the contact pressure and the rotational speed. The component heats up at the contact surface to the polishing ring. Grease in the polishing paste softens and ensures the adhesion of the polishing grit within the grease matrix on the polishing ring. The cutting effect of the polishing grit produces additional heat on the work piece surface. Due to the sum total of heat, the grease in the polishing paste begins to smoke.

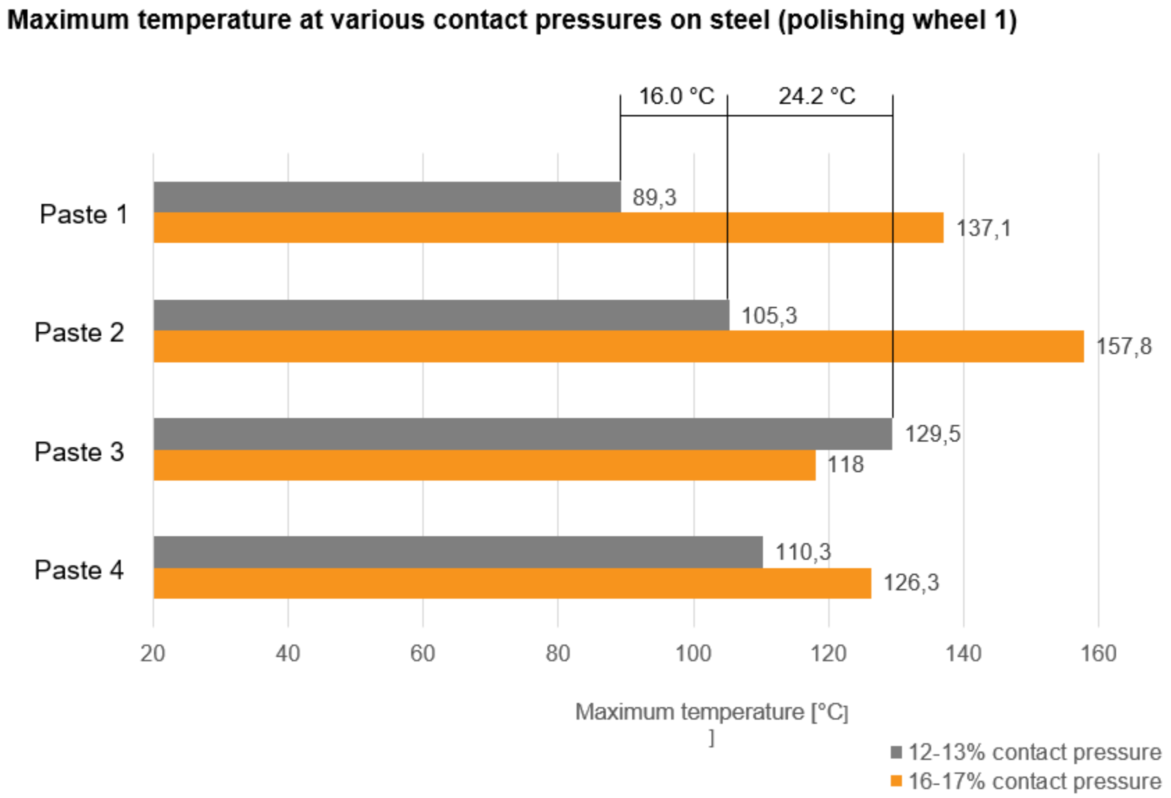

Figure 1: Temperature behaviour of various polishing pastes on steel

Comparative polishing tests reveal optimisation potential

The comparative polishing tests with other polishing pastes at various contact pressures have a positive side effect: cause-effect relationships between the individual parameters and the optimum combination of parameters can be determined based on the collected data. Polishing paste 1 produces a significantly higher cut at a contact pressure of 12-13% than the previously used paste 3 and the polishing pastes 2 and 4. An expected higher cut when choosing a greater contact pressure does not occur for any of the four polishing pastes that were tested. This is because the application of polishing paste to the polishing ring is insufficient.

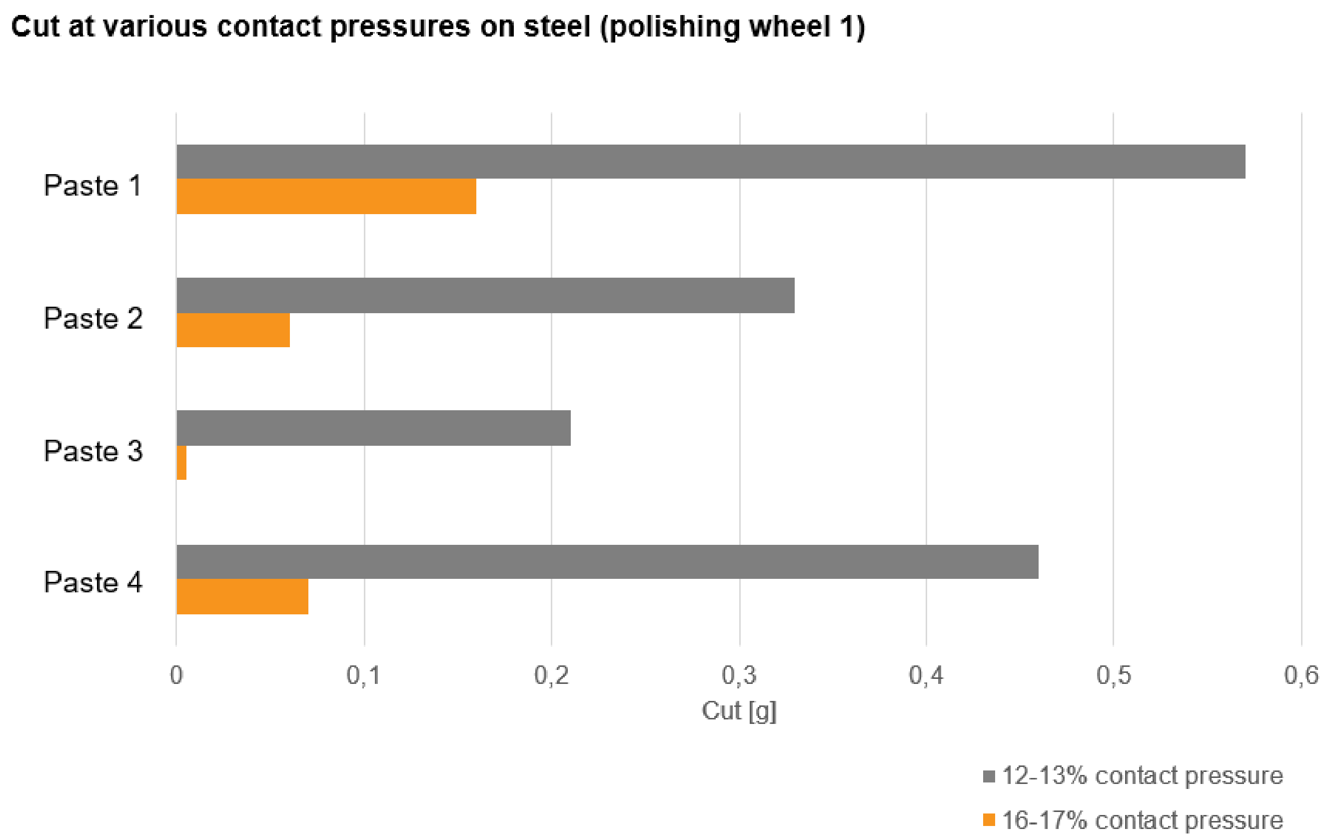

Figure 2: Cut behaviour of various polishing pastes on steel

The cut of polishing paste 1 is significantly higher compared to the other polishing pastes that were tested. Nevertheless the polished parts exhibit considerably less heating. Compared to the previously used paste 3, the measurable temperature difference on the work piece surface is approximately 40 degrees Celsius (see Figure 1). With well-balanced polishing processes, heating is largely limited to the chip removed from the work piece. This reduces heating of the work piece surface. When the process is not optimised, the removal rate is too low or no chip at all is removed, for example because the rotational speed is too low or not enough polishing paste is applied. If the melting point of the grease in the polishing paste is too low, the polishing paste does not adhere to the polishing ring. This significantly reduces the removal rate. The temperature increases at the same time.

Process data visualise the improved economic efficiency of the polishing process

Even more data can be collected about the ongoing variation of the process parameters. These data illustrate the concrete optimisation potential. Figure 3 shows that choosing a different polishing ring with improved paste application in combination with optimised bonding in paste 1 results in a considerably higher cut. This leads to significant shorter cycle times.

Cut at various contact pressures (polishing wheel 2)

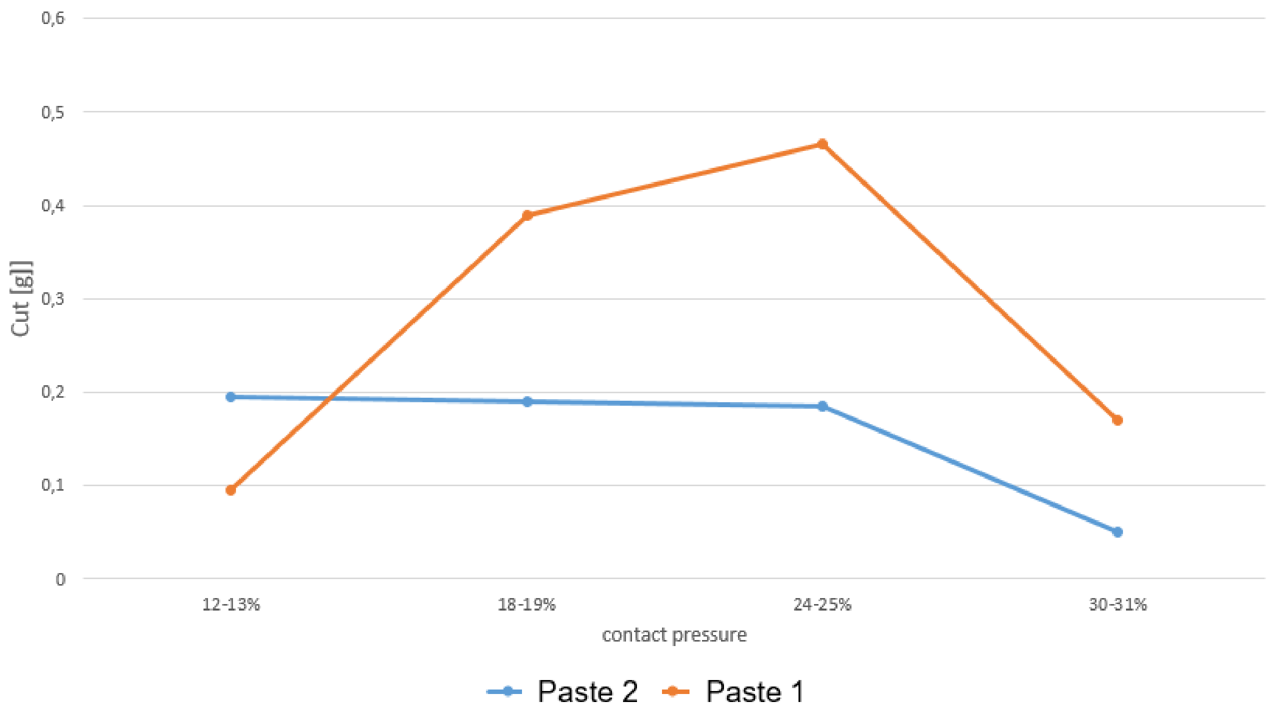

Figure 3: Comparison of two polishing pastes in regards to cut at various contact pressures

The known correlation between temperature development and the contact pressure is proven in Figure 4. Paste 1 generates somewhat more heat than paste 2 in the middle of the working range. The wheel adhesion of the polishing compound is not sufficient at higher contact pressures. This makes the application of paste to the wheel insufficient. Friction develops between the wheel and work piece with no polishing grit. The work piece heats up while the cut drops simultaneously due to the lack of polishing compound.

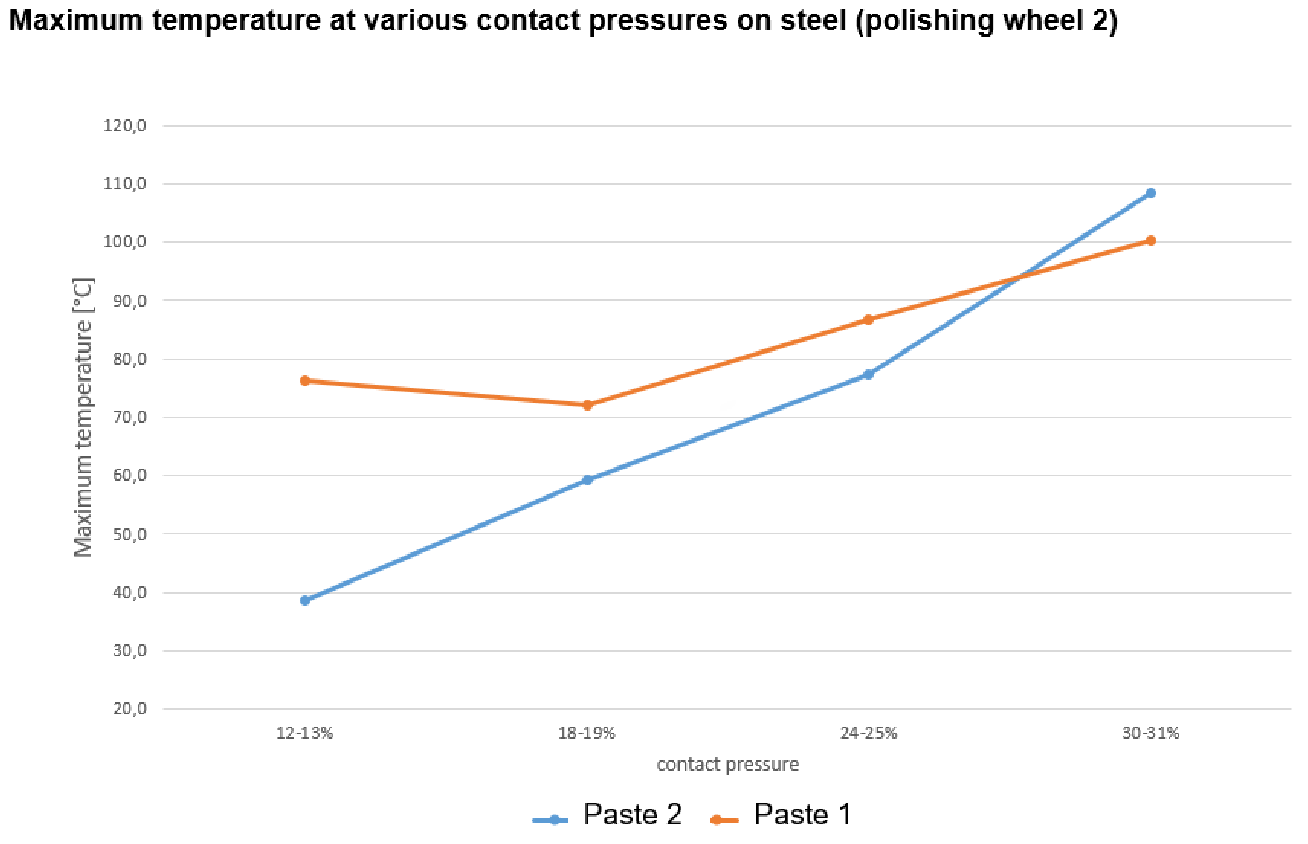

Figure 4: Comparison of two polishing pastes in regards to temperature at various contact pressures

Measuring process supplies process settings optimised for economic efficiency
Polishing paste 1 is recommended for cutlery steel. This was the insight gained by the knife manufacturer Giesser based on comparative polishing tests. That is the recommendation derived from the measurement data. They show that the temperature is limited and the quality is optimised with paste 1 and polishing ring 2.

Conclusion

The further development of industrial polishing processes is possible. Comparative polishing tests and the latest measuring technology assist with the analysis. Menzerna is able to precisely determine the parameters responsible for the economic efficiency of polishing processes. The causes of problems in the process could be identified in the Giesser case. At the same time, the economic efficiency of the processes was considerably improved. The measurement data that were obtained allow conclusions to be drawn about the correct polishing paste and polishing wheel, its temperature behaviour on steel and the correct contact pressure. Exact data can be determined based on this information, leading to an optimal result for the industrial enterprise.

About the author

Polishing processes with their influencing parameters can be made transparent with the latest measuring methods in the Menzerna technical centre. This benefits industrial enterprises. The measurement data reveal potential for optimisation and support recommendations for the further development of industrial polishing processes.