Reducing Costs by Determining Polishing Wheel Service Life

New method for determining the service life accurately uncovers differences in quality and potential savings.

I. Summary

In practice, it is often difficult to accurately determine the differences in service life between polishing wheels from different manufacturers or manufactured with different methods. The method presented here for determine the service life solves this problem. In addition, it also generates data which can be used to help optimise the contact pressure - a key factor in polishing tool wear - without having to accept a reduction in surface quality. For companies which operate automated polishing systems, this provides an interesting opportunity to lower process costs in a targeted manner by providing a factual basis for making decisions.

II. Initial situation

A broad range of different polishing wheels and discs is available these days for machine polishing. The purchasing decision is typically based on the surface quality achieved in polishing tests, and on the price. The service life of the polishing tools is mostly disregarded even though it has a significant effect on the polishing costs per piece. After all, approx. 80 % of the cost for materials consumed during polishing is due to polishing tool wear, while only approx. 20 % is due to polishing agent consumption. However, the service life of a polishing tool is often very hard to quantify under ongoing production conditions with changing work pieces and changing operating personnel.

Within the framework of a consulting project for a polishing wheel manufacturer, Menzerna Consulting has therefore developed a method with which the differences in service life between polishing wheels can be determined quickly and reliably under close to real life conditions.

III. Procedure

The method is based on measuring the disc wear on an automated polishing system. Standardised test specimens are polished with a range of contact pressures in several passes. The automated system is able to measure the contact pressure of the work piece against the polishing tool precisely at all times with a sensor, and moves the robot arm closer to the polishing disc with millimetre accuracy when the contact pressure drops due to wheel wear and the resulting lower wheel diameter. The data which describe this robot feed movement can be downloaded and analysed. Precise information on the change in wheel diameter over time at a specific contact pressure is obtained in this manner.

Polishing wheels vary in terms of hardness and abrasiveness. Therefore the contact pressure has to be normalised for every polishing wheel before starting the actual test. This is necessary because for a given contact pressure, the work pieces penetrate deeper into a flexible polishing wheel than into a hard polishing tool. In addition, differences in the type of fabric, processing and impregnation influence the abrasiveness of a wheel, especially for pre-polishing wheels. If such varied polishing wheels were subjected to long-term testing at the same contact pressure, then the resulting service life values would not be very meaningful.

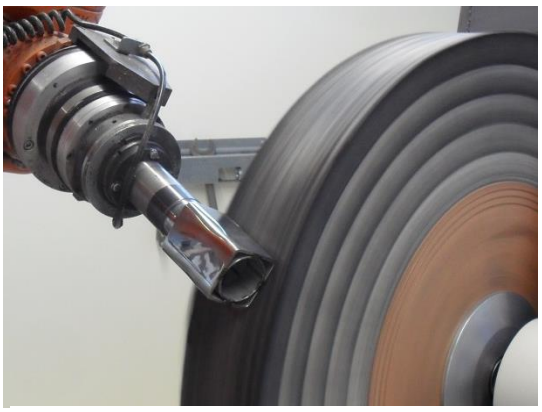

Fig. 1: Polishing wheel long-term testing

To determine the abrasiveness, uniformly ground test specimens are processed at different contact pressures with a polishing wheel, and the degree of material removed through polishing is determined. The contact pressure required in order to achieve a standardised surface quality with a polishing wheel can be determined in this manner.

The hardness of a polishing tool is determined by using the tool being tested first at a low contact pressure, and then at a high pressure. The distance which the robot arm has to traverse in order to achieve the desired increase in contact pressure is a precise indicator for the hardness of a polishing wheel.

Only after performing these preliminary tests is a decision made on what contact pressure to use for a specific wheel in the long-term test. As a result, it is possible for one wheel to be tested at a contact pressure of 30 % and another at 40 % in order to achieve close to real life test results.

IV. Results

As part of the contract, the Menzerna technical centre performed service life tests with two pairs of pre-polishing wheels (1a/1b and 2a/2b in Fig. 2), with the wheels in each pair being identical in all but one processing parameter. Fig. 2 shows the wheel wear relative to the - calculated - polished area, with the contact surfaced being increased after processing a total of approx. 20m². The wheel pair 1a/1b already showed significant differences in wear at a contact pressure of 30-40%. Wheel 1b exhibited approx. 25% less wear than wheel 1a after polishing an area of 20m². For the wheel pair 2a/2b, it wasn't possible to show any significant differences in wear during the low contact pressure phase of the test. Only after increasing the contact pressure to 40-50% was the wear significantly higher for wheel 2a.

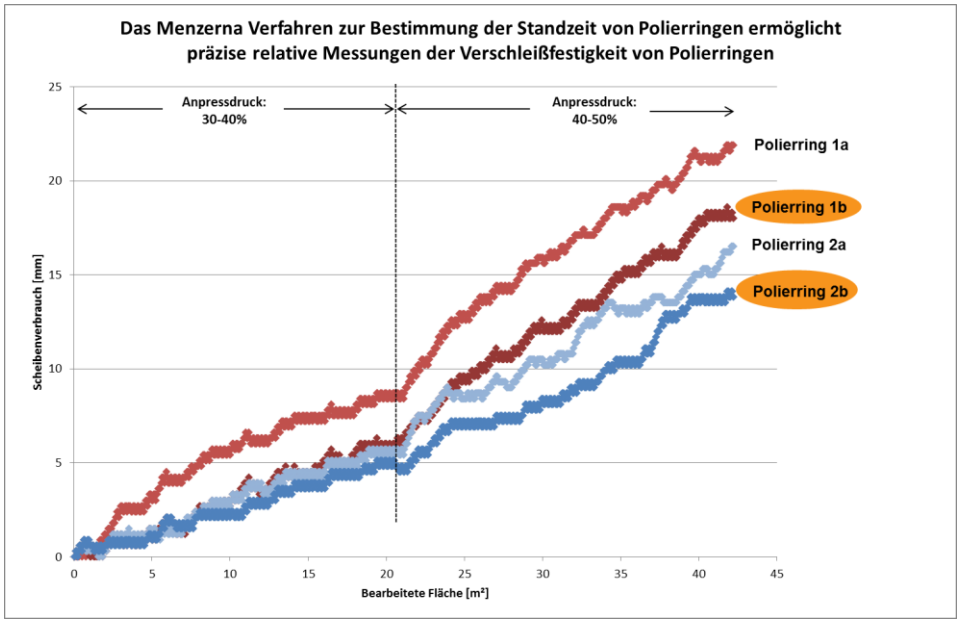

Fig. 2: Wheel wear as a function of the polished area at two different contact pressures.

The test results show that differences in service life can be determined accurately with the method presented here. It becomes clear that polishing tools can exhibit very different wear rates under the same usage conditions and identical surface quality values. This means that by simply selecting the polishing wheels with the lowest wear rate with otherwise identical process parameters can result in considerable and also quantifiable savings.

The method presented here can also be used to determine the additional costs which result if one increases the contact pressure against the polishing tool, for example in order to reduce the cycle times. As a result, it is possible to make optimal and fact-based decisions between different polishing process methods.

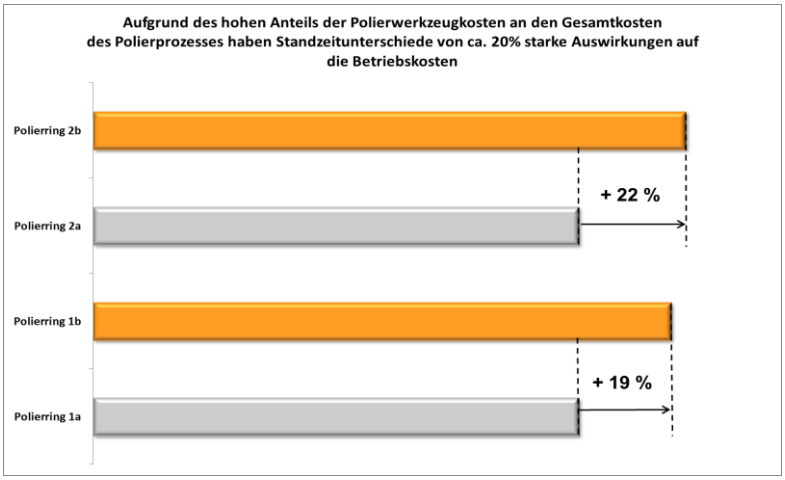

Fig. 3: Differences in service life for the tested polishing wheels

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