METHODS AND APPROACHES TO IMPROVING THE DESIGN OF FLEXIBLE BACKING GRINDING TOOLS

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Flexible backing grinding tools have more favorable conditions for the grain performance, as a result of which they can provide the following positive points:

- a larger number of the grains participate in the process of cutting at the same time
- the time of interaction between a single abrasive grain and the surface to be ground increases;
- shock loads reduce when the grains cut into the surface to be ground; the temperature in the cutting zone reduces, etc.
In practice, the performance of flexible backing grinding tools is increased in the following ways:

- Changing designs of flexible backing grinding tools
- Selecting the optimal cutting conditions
- Using an overlapping tooth design
- Using lubricant coolant
- Cleaning the sandpaper
However, the use of standard flap wheels and grinding belts demonstrates their performance because they are produced from abrasive grains of uncontrolled shape and unoriented relative to the backing plate surface.

Therefore, control of the shape of the grinding grains in the manufacture of tools, along with their focused orientation, is a promising solution to improve the performance of flap wheels and grinding belts.

In the course of research, the flap wheel was designed and manufactured, for which RF patent No. 2240224 was granted.
The figure shows the following positions:

1 – the metal washer (wheel housing);
2 – the flap;
3 - the part of the flap surface with non-abrasive layer;
4 - the part of the flap surface with abrasive grains;
5 - cloth backing;
6 - the base layer of the binder;
7 – the top layer of the binder;
8 – the controlled-shape abrasive grains oriented using the electrostatic method.
In the course of the improvement of designs of flexible backing grinding tools based on the systematic approach to the orientation of abrasive grains and their geometric shape, the following tasks were fully solved:

- vibration (patent for invention of the Russian Federation No. 2248851) and electrostatic (patent for invention of the Russian Federation No. 2223603) separators used to divide the standard abrasive mass into 3 fractions with isometric, intermediate and lamellar grains were designed and manufactured
- the calculation of the shape factor of grains of various fractions was made using the special software
- the new flexible tools was designed
- the original technology for the manufacture of new tools is developed
- the equipment for the manufacture of new tools - a compact electrostatic abrasive application line and heat chamber - was designed and manufactured
- the methods for assessing the performance of flexible backing grinding tools are developed
- the tests of tools prototypes were carried out to determine the following indicators: cutting ability, wear, cutting forces, temperature in the cutting zone and surface roughness
- the mathematical models showing the impact of the grinding grain shape factor on the performance of flexible tools are developed
- practical recommendations for the application of new designs of flexible tools are formulated
Change in cutting ability ($Q$) of standard grinding belt and grinding belts with various shapes ($K_f$) and orientations ($\gamma$) of grinding grains when machining steel S 235 during time ($t$)
Experimental samples of flexible tools were successfully tested, both in laboratory and in industrial environments, where they proved their advantages in comparison with standard tools.

Thus, a focused approach to the choice of the shape and the orientation of grinding grains at the stage of manufacturing flexible tools provides a more complete use of their potential.
Non progredi est regredi*
(*lat.) Not to move ahead – means to go back!

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