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Abstract: *This paper examines the technologies for applying compensating materials and the parameters of a promising method for refurbishing worn component surfaces.*

Keywords: *restoration, compensating layer, wear, automotive transport, gas distribution system, plasma spraying, application technologies.*

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INCREASING THE ACCURACY OF FINISHING PARTS OF TECHNICAL SYSTEMS OF THE AGRICULTURAL-INDUSTRIAL COMPLEX THROUGH THERMAL-CONTROLLED FINISHING

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Abstract: *This study investigates the effect of process medium temperature on the precision of the final machining of components. It was found that the profile of the lapping tool body significantly influences the stability of the finishing process. The most consistent results are achieved with a lapping tool featuring a profile that tapers from the center toward the periphery. The influence of the tool body material*

and the thickness of the polishing substrate on machining precision was determined. The results obtained can be applied in the manufacture and refurbishment of precision components for agricultural machinery.

Key words: *agro-industrial complex, agricultural machinery, finishing, polishing, precision surfaces, lapping, thermal deformation, temperature, polishing pad, shape accuracy.*

A promising approach is to control the shape of the working tool by varying the temperature of the process environment. The physical basis for this method is thermal modification of the lapping body's geometry, allowing for targeted adjustment of its working surface. The aim of the study was to identify design and materials factors that ensure the most stable shape formation during thermally controlled lapping. The resulting patterns are of interest for manufacturing and reconditioning processes for machine parts, where precision machining must be combined with the ability to quickly adjust process parameters.

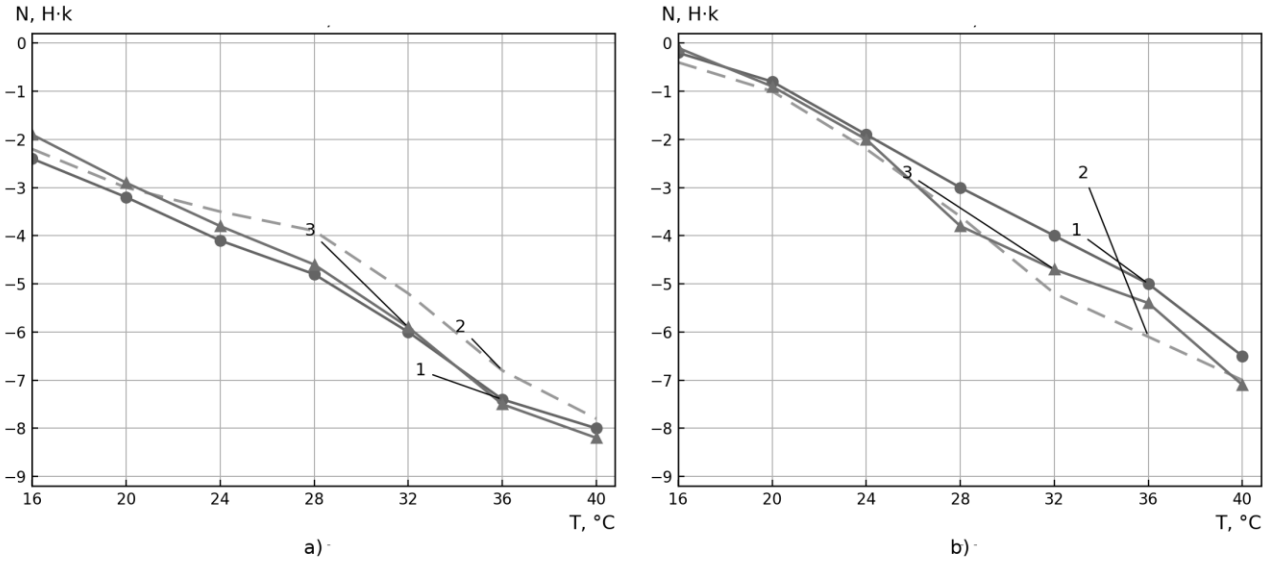


Fig. 1. Dependence of the machining accuracy N on the temperature of the polishing suspension at a rotation speed of the lower link of 180 (a) and 360 rpm (b) when machining with a lapping tool with a different cross-sectional profile of the body: 1 - expanding; 2 - concentric; 3 - tapering from the center to the edge

The experimental part was performed by machining convex spherical surfaces of optical lenses made of LK7 glass. Accuracy was assessed using an interferometric method, using the number of interference rings N and the deviation of the rings from

the ideal shape ΔN; one ring corresponded to a change in the controlled dimension of 0.25 μm. To evaluate the lapping geometry, housings made of AL2 aluminum alloy with a 1 mm thick PPM-1-1 polyurethane foam backing were used. Three housing profile variants were compared: expanding, concentric, and tapering from the center to the periphery.

It was found that changing the housing profile significantly impacts the thermal stability of the process. The greatest variation in form error was observed for a lapping tool with an expanding profile. At a lower link rotation speed of 360 rpm, the error dependence on temperature became nearly linear for both the expanding and concentric designs. The most stable form formation was achieved with a housing whose thickness decreases from the center to the periphery. This design maintained a linear relationship between error change and process temperature, creating the prerequisites for controlled dimensional adjustments.

The research has shown that the lapping machine body profile influences the stability of obtaining the specified surface accuracy parameters with changes in the process medium temperature due to various thermal deformations of the lapping machine bodies. A lapping machine with a body thickness increasing from the center to the periphery (expanding profile) demonstrated the maximum spread of error in the total (N) and local (ΔN) form error (curve 1 in Fig. 1 *a*). At an increased rotation frequency of the lower link (360 rpm) for tools with expanding and concentric profiles (curves 1 and 2 in Fig. 1 *b*), the dependence of the formation of the form error on the coolant temperature becomes linear, which indicates the preference for machining at high speeds. Lapping machines with a body thickness decreasing from the center to the periphery (tapering profile) demonstrate the most stable operation and a linear dependence of the error on temperature (curves 3 in Fig. 1 *a, b*). The obtained results allow us to say that this shape of the tool body is preferable.

The practical significance of the results for the agro-industrial complex lies in the potential for transferring the identified technological approach to precision machining and reconditioning of machine parts, where the stability of surface geometry influences the performance characteristics of the components. Controlling

tool shape through thermal influences allows finishing to be considered not only as a final operation but also as a controlled process of surface formation. This creates the basis for further adaptation of the technology to repair and production areas of agricultural enterprises and the improvement of tooling, taking into account precision and productivity requirements.

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