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INFLUENCE OF GEOMETRIC SURFACE STUCTURE FEATURES ON WEARING PROCESS AFTER ELECTRICAL DISCHARGE MACHINING

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Introduction

The surface layer characteristics are detrmined, to the greatest extend, by parameters describing the stereometric surface structure more frequently called the geometric surface structure (GSS). This structure is created by surface unevenness, i.e. odds and dimples which are wavy finish of realized processing or effects of the wear process. Depending on the distribution of the GSS characteristic elements, the surface may be either anisotropic or isotropic. The basic parameters describing the geometric surface structure are: surface roughness, wavy finish directivity, waviness, defects in geometric surface structure.
Mainly, the two firstly mentioned parameters have an impact on the tribological characteristics of cooperating machine elements surfaces. The influence of the others is not as much significant. Moreover, their importance is not the same in all friction pairs of operating conditions.

The aim and the methodology of experimental tests

The assumption of experimental investigations was to determine the influence of distribution and orientation of the machining traces after erosive treatment, which followingly depend on the kind of machining process, as well as the assumed parameters and on the intensity of wear process of exanimated surfaces. They were conducted in two ways, i.e. the first part of tested surfaces had an anisotropic character, obtained as the result of electro-erosive abrasive honing, however the second one was isotropic - after EDM.

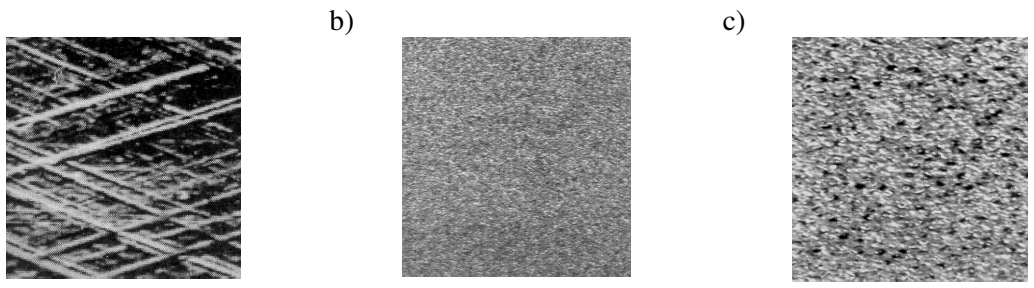

Fig. 1. Surface structure after erosive treatment: a) after electrochemical abrasive honing, b) after electro-erosion treatment at 1 A discharge current and 3.2 µs discharge time, c) after electro-erosion treatment at 6 A discharge current and 100 µs discharge time

In order to conduct the the aim of investigations, a special test stand has been designed and built. In case of which the surface structure of specimens surfaces has an anisotropic character the relative movement of counter-specimen was reciprocating (Fig. 2a), however, in case of isotropic structures of surface, the relative movement was oscillative (Fig. 2b).

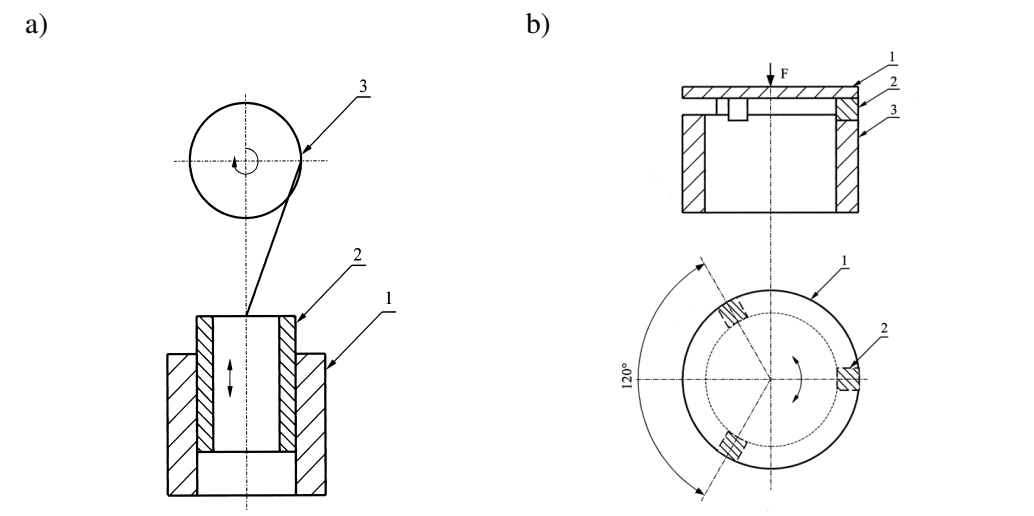

Fig. 2. The idea of cooperating frictional surfaces during experiments; the movement of counter-specimen is given: a) reciprocating, b) oscillate

Experimental tests results

The results of experimental tests have been presented in the form of graphs - Figures 3 and 4. The change of the geometric surface structure condition has been described by the change of the surface roughness parameter Ra value as a function of the friction path. Figure 3 shows the results for the obtained honed surface structure - Fig. 1a. Whereas Fig. 4 shows the results for the surface structures obtained by electro-erosion treatment and presented in Fig. 1b and c. The structure of Fig. 1b on the graph (Fig. 4) has been designated as "structure A" and the structure of Fig. 1c on the graph (Fig. 4) as "structure B".

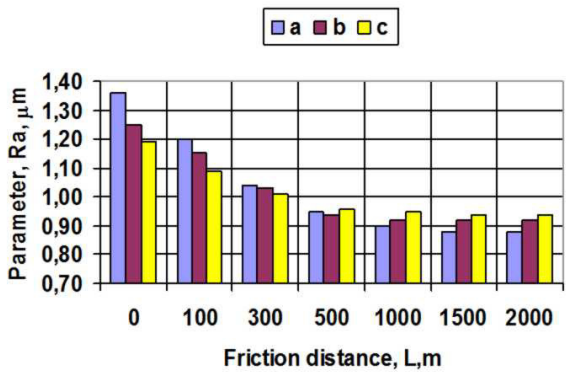

Fig. 3. The values of roughness parameter Ra as a function of friction path for surfaces after honing and for the following angles of marks after treatment: a) $\alpha = 0°$; b) $\alpha = 45°$; c) $\alpha = 180°$

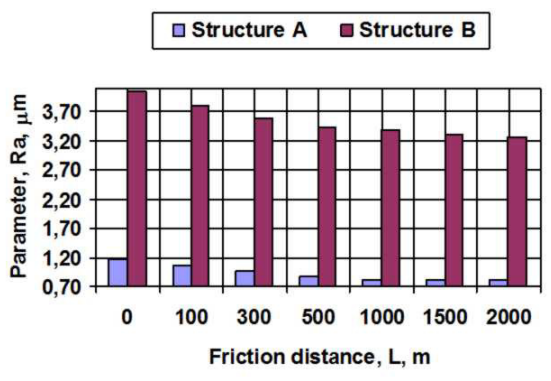

Fig. 4. Surface roughness Ra parameter value as a function of friction path for surfaces after electrical discharge machining

Conclusions

The experimental tests have showed that the intensity of the wear process depends on geometric surface structure features shaped at the manufacturing process. It has also been found that the EMD parameters not only affect the condition of the technological surface layer, but also significantly determine the tribological characteristics of elements and influence the nature of the wear process.