WORKSHOP ON SURFACE ENGINEERING

THE INFLUENCE OF STAINLESS STEEL SURFACES AFTER GRINDING ON ITS DECORATIVE AND ADHESIVE CHARACTERISTICS

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Summary

Preliminary studies showing the relationship between microstructure of non-directional surfaces made of stainless steel and aluminum were conducted, evaluating their structure on a macro scale characteristic for normal use. For this purpose, surface analysis was performed using a digital microscope and a contactless profilometer, followed by adhesion testing (wetting angle) and corrosion of selected samples to determine how the particular microstructure material would change under the influence of corrosion. Next stages of the research will be extended by additional experiments to determine the suitability of unloaded surfaces made of stainless steel for daily use, taking into account their ease of cleaning in service.

Introduction

The tests carried out are intended to determine the characteristics of surface parameters obtained by the smoothing method in drum grinders or spray nozzles in such a way as to obtain non-directional surfaces on samples of stainless steel or aluminum. Surfaces of this type can have a wide design application because the non-directed surface structure disperses light incident on the surface resulting in visually satin effect. Surfaces of this type are also pleasant to the touch and do not show excessive slippage in contact with the human hand. They can be used as handholds (for egzample handles) in public utilities and vehicles such as buses.

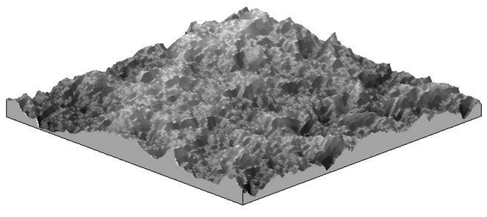

Fig. 6. 3D view of sample surface.

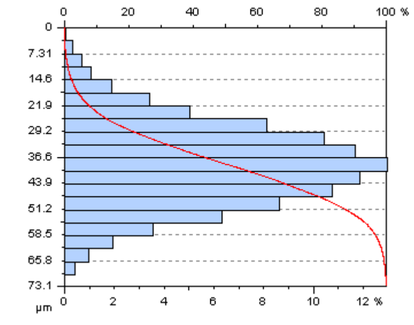

Fig. 7. Distribution of vertices of inequality.

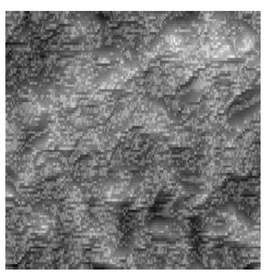

Fig. 1. View of 2D structure.

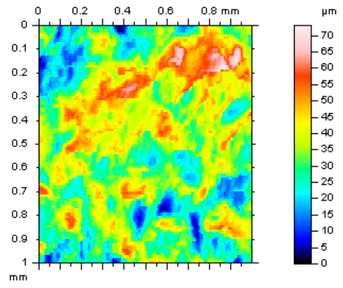

Fig. 2. View 2D. Height of vertices.

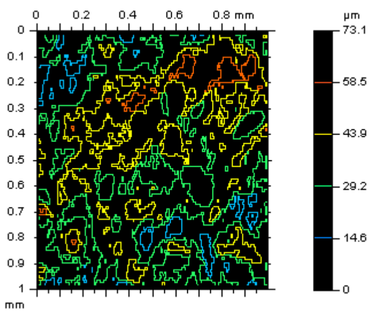

Fig. 3. Isometric structure.

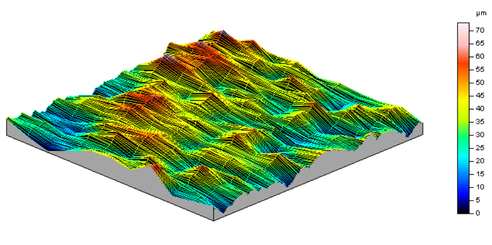

Fig. 4. 3D surface structure.

Preliminary tests were carried out on aluminum plates with non-oriented surface structure obtained by sanding method. These surfaces were analyzed using non-contact optical measurement, which is based on the chromatic aberration technique. The study was conducted using the Nanovea PS50 Profilometer (Figure 5). Figures 1-4 and 6-8 show in turn the surface texture, the unequal distribution map, the isometric structure, the three-dimensional surface view image, and roughness altitude parameters.

Fig. 5. Research stand - Nanovea PS50 profilometer.

In order to obtain information about the potential ease of cleaning of the non-directional surface tested, we investigated the wettability of the angle on aluminum samples using H2O. The preliminary results of this study are presented in fig. 9. These studies will be continued taking into account various machining parameters to obtain non-oriented surfaces and then contact angles will be measured on these surfaces. On this basis, information will be provided on how the surface topography parameters affect the fluid adhesion on the examined structure.

Parameters calculated on the surface D

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Amplitude Parameters

   Sa     = 9.1 µm
   Sq     = 11.4 µm
   St     = 73.1 µm
   Sz     = 70.9 µm

Area & volume Parameters

   Smmr   = 0.0346 mm3/mm2
   Smvr   = 0.0385 mm3/mm2
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Fig. 8. Selected parameters of surface structure.

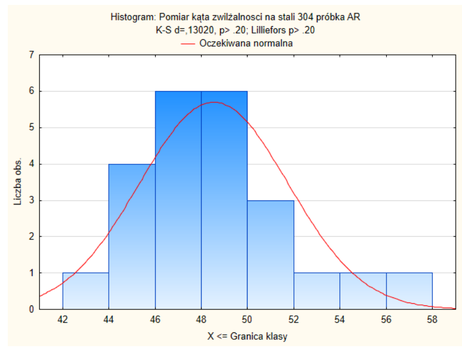

Fig. 9. Distribution of contact angle.

Conclusion

Further researches will be aimed at finding optimal machining parameters in rotary smoothing machines to obtain a non-directional surface structure that will allow for the least possible adhesion, which will allow for easier cleaning of the surface.

It is assumed that such unloaded surfaces can be used as utility elements and ornamental surfaces, for example in all types of handles, utilities or public transport.

The information obtained during the study of the parametric surface structure of materials can be used to design and apply materials in a more thoughtful manner. It is possible, among other things, to take into account the type of roughness of the surface, which may be important for the object being designed.

Literature:

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