EVALUATION OF SELECTED PARAMETERS OF SURFACE TOPOGRAPHY OF METAL MATERIALS OBTAINED BY ADDITIVE TECHNIQUES

SUMMARY

This doctor's thesis presents the results of identification, comparison and assessment of the selected parameters of surface topography of metal materials obtained by the incremental techniques to the parameters of the same materials made by the metallurgical technique. 3D roughness measurements are utilized for better understanding of the surface nature. All aspects of two surfaces matching are three-dimensional phenomena and, therefore, the description of them cannot be limited to the profile analysis. The comparison comprised two materials: titanium alloy, Ti6Al4V and Inconel 625 alloy. Additionally, measurement and analysis of selected surface topography parameters of metal material obtained by the incremental techniques have been performed for: hot working tool steel, bronze alloy, stainless steel and aluminium alloy. Examinations with the use of modern topography measurement techniques by means of a focal differentiation microscope and a stationary device for measuring roughness and contour have been performed. An analysis of pairs of parameters of the surface obliqueness coefficient, *Ssk*, and the surface inclination coefficient, *Sku*, has been presented. Once the parameters of the surface roughness have been determined, a technological surface has been shown in a graphic form. The analysis consists in the assessment of the collected 3D points of the surface and showing them in the form of contour maps and isometric images. In order to obtain a more detailed image, the recorded alterations of the isotropy degree for the sample surfaces have been shown. The next analysis after the process of turning has been performed by means of the analysis of the power spectrum density |(PSD). The PSD analysis consists in determination of the energy spectrum or the signal power. Another topography element under analysis was the Abbott-Firestone curie which describes the material distribution in the profile. The next stage was the assessment of the functional parameters, such as: the depth of the core roughness, *Sk*, reduced height of the vertex, *Spk*, reduced valley depth, *Svk*, top bearing surface,*Sr1*, bottom bearing surface, *Sr2*, the area of upgrades filled with material, *Sa* , and the area of pits free from material, *Sa2*. The further considered parameters of the group of the Abbott Firestone curve parameters were those concerning the volume. The functional surface analysis has been based on four volumetric parameters: the material peak volume, *Vmp*, the material core volume, *Vmc*, the volume of the void core space, *Vvc*, and the volume of the valley void space, *Vvv*. The obtained investigation results prove the correctness of the first thesis stating that the parameters of the surface topography after the process of turning metal materials made by the incremental techniques are comparable to those of the material obtained in the traditional manufacturing techniques. The other thesis, stating that, in hybrid processing (incremental techniques + turning), there is a possibility of controlling selected surface topography parameters in the range of predetermined technological parameters of machining.