

## **The analysis of roughness surface of the samples produced by 3D printing**

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The current period in industrial production is characterized by increasing requirements for accuracy and reproducibility of production. Each technology leaves on the surface of the components certain characteristics signs. Macro-roughness and micro-roughness occur on the surface of the components. Appropriate surface quality of components is one of the prerequisites for the correct function of the equipment and significantly affects the service life of components [1].

Surface roughness is the sum of surface irregularities with relatively small distances between protrusions and depressions, which leaves a trace during cutting as a cutting tool, abrasive and the like. One of the parameters that is recommended to be used in the technical documentation for marking the surface roughness is the mean arithmetical deviation of the profile Ra. Ra is defined as the arithmetic mean of the absolute value of the ordinate Z (x) in the range of the fundamental length l [2]. Roughness parameters were detected using a surface roughness tester TR200.

The printer Creality Ender 3 Pro with a control board version 4.2.7 was used for 3D printing of samples. Samples with dimensions 20x20x20 mm were made from material of Gembird white and Verbatim, PLA, white. The following parameters of variables have been set for printing samples: print speed 30 - 50 - 70 mm s<sup>-1</sup>, layer height of print 0.1 - 0.15 - 0.2 mm, infill 25%, material temperature 200 °C, board temperature 50°C, nozzle MK8, brass, diameter of nozzle 0.4 mm. The roughness of the samples was measured only after they had cooled down to room temperature.

A factor experiment was used to analyze the measured roughness values of material [3]. The aim was to analyze the value of roughness of the samples by two factors (print speed, print layer height) at three levels. It was found that for samples made of Verbatim material, the height of layer of the print has the greatest influence on the value of the parameter of roughness Ra. The print speed has the greatest effect on the surface roughness for samples made of Gembird material. Based on the results of the experiment, the printing parameters can be set according to the desired value of the surface roughness parameter Ra.

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- [2] STN EN ISO 21920-2: 2022 Geometrical product specification (GPS) – Surface texture: Profile – Part 2: Terms, definition and surface texture parameters.
- [3] Hamblí, R. Design of Experimental Based Analysis for Sheet Metal Blanking processes optimization, Springer-Verlag London Ltd 2002, Advanced Manufacturing technology