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<https://gum.gov.pl/wye/content/current-volume/6528,Assessing-the-impact-of-lighting-during-Focus-Variati-on-scanning-on-the-quality-.html>
13.04.2026, 13:39

Assessing the impact of lighting during Focus Variation scanning on the quality of mapping surfaces produced within the MEX process based on the FFF technology

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Abstract

Additive manufacturing of polymer products via the MEX (Material Extrusion) process based on the FFF (Fused Filament Fabrication) technology is one of the most common 3D printing methods. A layered model structure significantly affects SGS, which depends on, among others, thickness of layers applied, processed material, surface inclination relative to the layer application direction and surface type. The objective of the research was to determine the impact of lighting colour as part of the Focus Variation (FV) scanning technique on the mapping quality of the surface obtained via the layered extrusion method (MEX). Surface reflexivity was also taken into account through assessing the impact of surface inclination relative to the microscope optical axis. A Sensofar neox microscope with a 10x lens was selected for the research. A clear impact of the inclination angle exhibited by the scanned surfaces and the colour of the light employed for its scanning on the mapping quality of a digital surface image was observed. A classic sample configuration, where the scanned surface was generally positioned perpendicular to the microscope optical axis (0° angle) provided very good surface mapping at a level of almost 100 %. In this case, the light colour did not matter much. Increasing the scanned surface inclination angle (15°, 30°) has an adverse impact on the quality of its digital mapping. This area recorded most non-measured points, regardless of the surface inclination, when scanning with red light, and the best mapping was provided when working with blue light. It can be assumed that light with a wavelength significantly distant from the surface colour range should be used to scan a surface

in a given colour.

Significant differences in the following mean amplitude, height, and mixed surface parameters were observed:

Sa, Sq, Sp and Sv, as well as Ssk and Sku, both in relation to the impact of surface inclination towards the microscope optical axis, and to the effect of applying digital fill of non-measured points.

Bibliography

- [1] Budzik G., Woźniak J., Przeszłowski Ł., Druk 3D jako element przemysłu przyszłości. Analiza rynku i tendencje rozwoju, Rzeszów 2022.
- [2] Dziubek T., Oleksy M., Zastosowanie systemu optycznego ATOS II w technikach szybkiego prototypowania modeli kół zębatych otrzymanych na bazie żywicy epoksydowej. Polimery, 2017.
- [3] Grzelak K., Kluczyński J., Szachogłuchowicz, I., Łuszczek J., Śnieżek L., Torzewski J., Modification of Structural Properties Using Process Parameters and Surface Treatment of Monolithic and Thin-Walled Parts Obtained by Selective Laser Melting. Materials 2020, 13, 5662.
- [4] Kluczyński J., Śnieżek L., Grzelak K., Oziębło A., Perkowski K., Torzewski J., . . . Kania B. (2020). Hot isostatic pressing influence on the mechanical properties of selectively laser-melted 316L steel. Polska Akademia Nauk. Bulletin of the Polish Academy of Sciences, 68(6), 1413-1424.
- [5] Kroczek K., Turek P., Mazur D., Szczygielski J., Filip D., Brodowski R., Balawender K.,.... Oleksy M., Characterisation of Selected Materials in Medical Applications, Polymers, 2022.
- [6] Śnieżek L., Grzelak K., Torzewski J., Kluczyński J. Study of the mechanical properties components made by SLM additive technology. In Proceedings of the 11th International Conference on Intelligent Technologies in Logistics and Mechatronics Systems, ITELMS 2016, Panevėžys, Lithuania, 28-29 April 2016.
- [7] Turek P., Automatic the process of designing and manufacturing polymeric models of anatomical structures of mandible with Industry 4.0 convention. Polimery, 2019.
- [8] Turek P., Filip D., Przeszłowski Ł., Łazorko A., Budzik G., Snela S., Manufacturing Polymer Model of Anatomical Structures with Increased Accuracy Using CAx and AM Systems for Planning Orthopedic Procedures, Polymers, 2022.
- [9] Wieczorowski M., Wyzwania metrologii w kontekście przemysłu przyszłości. STAL. Metale & Nowe Technologie, 2021.
- [10] Wohlers Report., 3D Printing and Additive Manufacturing State of the Industry, Annual Worldwide Progress Report. WohlersAssociates, USA, 2015.
- [11] Wohlers Report, 3D Printing and Additive Manufacturing State of the Industry, Annual Worldwide Progress Report. Wohlers Associates, USA, 2018.
- [12] Woźniak J., Budzik G., Przeszłowski Ł., Fudali P., Dziubek T., Paszkiewicz A., Analysis of the quality of products manufactured

with the application of additive manufacturing technologies with
the possibility of applying the Industry 4.0 conception,
INTERNATIONAL JOURNAL FOR QUALITY RESEARCH, 2022.

ISSN 3071-7647

Language english

Year 2025

Volume 30

Published 2

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