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Abstract

Compression set of 3D-printed parts

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3D-printing of soft materials is a technology that is actively used in various industries: soft robotics [1], implants [2], bioelectronics [2] and many others. The mechanical behavior of 3D-printed parts is defined by the selected printing method, material, and other factors. Understanding of the mechanical properties of the printing material is an important factor affecting the success of adoption of this technology, especially for medical applications such as implant production, and its further development.

Polyjet printing is one of the technologies, used in additive manufacturing. Some printers, exploiting this technology, allow the mixing of materials with different characteristics, so to print a part that has aspects of each component. The aim of this work is to measure the compression set of different polymer hardness combinations used for polyjet printing. The compression set is defined as the permanent deformation remaining after applying mechanical force to the part [3]. This property usually is not listed in datasheets provided by the manufacturer, but its measurement is important, since it provides information as to how a part or component will behave when deformed and to what degree its initial geometry will be restored during its utilization.

The selected materials were compositions of Agilus30 and Vero photopolymers, produced by Stratasys Ltd. and used in 3D printers of the company. The printer used for the experiment was the Stratasys J850 Prime. It can print polymer composition with a predefined ratio of components, resulting in parts with different mechanical behavior.

The compression set experiment was run according to ISO 815-1:2019 standard [4]. Three specimens of a specific cylindrical form were printed of each of compositions involved in the testing. The thickness of all specimens was measured before the deformation. The specimens were compressed for 24 hours, after which the thickness was measured again. In both cases the computer tomograph YXLON FF35 CT was used to measure the thickness with a high degree of precision. The compression set was calculated from that data and represented in dependency of the composition.

The results of the experiment will be used by the Fraunhofer IMTE for calculations of the size of 3D printed parts undergoing deformation when in operation.

AUTHOR'S STATEMENT
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