Invited lecture

STRAIN RATE DEPENDENT MECHANICAL PROPERTIES OF 3D PRINTED ABS AND PLA RESINS USING THE DLP TECHNIQUE

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Abstract

The most commercially widespread extrusion-based additive manufacturing technologies use thermoplastic filament materials, as opposed to vat polymerisation technology, which uses photopolymer resins. Thus,, for non-industrial applications and customised parts, ABS and PLA thermoplastic materials were mostly used for FDM printers, until the appearance of PLA and ABS resin for DLP. The development of a new resin material, ABS and PLA, presents a great challenge for customising 3D printing, as well as the comparing their mechanical properties.

In the present study, we focus on investigating the tensile, flexural, and compressive mechanical properties of ABS and PLA materials used in the DLP process. Five specimens for each resin were modelled and printed according to standard ISO 527-2, and tested on a standard testing machine. The analysis included additional processing of collected data using Matlab, and comparison of fractured surface images acquired by microscopy.

The obtained results showed that the differences in the mechanical properties of ABS resin in comparison to PLA resin are not unilateral. PLA specimens' ultimate tensile strength (UTS) is higher for tensile and flexural test and lower for compression tests. In the case of elastic modulus, PLA specimens exhibit higher values for all three mechanical tests. Elongation at yield has higher values for ABS specimens in tensile and compression tests compare to PLA specimens. Definitely, both resin materials after DLP processing reveal better mechanical behaviour under compression compared to tension stress. Selection between these two is case sensitive and strongly depends on the 3D printed part application.

Keywords

Additive manufacturing, DLP, ABS resin, PLA resin, Mechanical properties.

Acknowledgement

This research was financially supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia by Contract No. 451-03-47/2023-01/ 200105 from 03.02.2023.