DE GRUYTER

Unlicensed | Published by De Gruyter | October 20, 2023

Effect of post-processing treatment on 3D-printed polylactic acid parts: layer interfaces and mechanical properties

Satthiyaraju Mani, Ananthakumar Kasi, Rajeshkumar Guruswamy, Karthik Babu Nilagiri Balasubramanian and Arvinda Pandian

From the journal International Journal of Materials Research
https://doi.org/10.1515/ijmr-2022-0280

Abstract

The post-processing treatment of isostatic compression with different temperatures is improved with the interlayer bonding of the polylactic acid (PLA) parts. This bonding enhanced the tensile strength, percentage of strain, and elastic modulus of post-processed PLA samples through the tensile test. Here, the tensile strength is improved by about 127 % compared to untreated PLA due to interlayer bonding and the compressive force with 140 °C. Compression and flexural tests are utilized to examine the post-processed parts' compression and flexural strength. It significantly improves the compressive and flexural strength of the post-processed parts, increasing to about 55 % and 64.5 % compared with the untreated PLA parts. Additive manufacturing of PLA parts is significantly progressed in the 3D printing of biodegradable and eco-friendly components through a layer-by-layer deposition.

Keywords: 3D printing; PLA; post-processing treatment; interlayer distance; mechanical strength

Corresponding author: Ananthakumar Kasi, Department of Mechanical Engineering, Karpagam College of Engineering, Coimbatore, 641032, India, E-mail: ananthakumar.k@kce.ac.in

Research ethics: Not applicable.

Author contributions: S. Mani: conceptualization, data curation; A. Kasi: formal analysis, resources, editing; R. Guruswamy: investigation, methodology; K. B. Nilagiri Balasubramanian: validation, writing; and A. Pandian: writing, review, editing.

Competing interests: The authors state no conflicts of interest.

Research funding: None declared.

Data availability: Not applicable.

References

1. Tofail, S. A. M., Koumoulos, E. P., Bandyopadhyay, A., Bose, S., Donoghue, L. O., Charitidis, C. *Mater. Today* 2018, 21, 22–37. https://doi.org/10.1016/j.mattod.2017.07.001 (https://doi.org/10.1016/j.mattod.2017.07.001) .

2. Dickson, A. N., Abourayana, H. M., Dowling, D. P. *Polymer* 2020, 12, 2188. https://doi.org/10.3390/polym12102188 (https://doi.org/10.3390/polym12102188) .

PubMed (https://pubmed.ncbi.nlm.nih.gov/32987905/)
PubMed Central (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7601740/)

3. Medellin-Castillo, H. I., Zaragoza-Siqueiros, J. *Chin. J. Mech. Eng. Addit. Manuf. Front.* 2019, 32, 53. https://doi.org/10.1186/s10033-019-0368-0 (https://doi.org/10.1186/s10033-019-0368-0) .