

3D printing with flexible materials – mechanical properties and material fatigue

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Abstract.

3D printed objects are nowadays not only used in prototyping, but also in small-scale production down to lot-size 1. While different 3D printing techniques can be applied for this purpose, a large amount of products is prepared by the simple and inexpensive fused deposition modeling (FDM) technique, applying a polymer which is molten, pressed through a nozzle and deposited layer-by-layer on a printing bed and on the previous layers, respectively.

This technology, however, has the disadvantage of often insufficient mechanical properties due to the available materials and due to the construction method which often supports air cavities inside objects, reducing the adhesion between neighboring strands and thus the overall mechanical properties. Such problems can partly be solved by chemical after-treatments [1].

Here we report on tensile tests and load changes of the soft FDM materials FilaFlex and soft PLA (polylactic acid) in comparison with common PLA. We show the different inner structure of objects 3D printed from these materials and their correlation with mechanical properties and material fatigue.

[1] T. Koziar, A. Mamun, M. Trabelsi, L. Sabantina, A. Ehrmann, Quality of the surface texture and mechanical properties of FDM printed samples after thermal and chemical treatment, *Strojniški vestnik – Journal of Mechanical Engineering* **66**, 105-113 (2020)