INFLUENCE OF TECHNOLOGICAL MODES ON THE ELASTIC-STRENGTH CHARACTERISTICS OF FDM-PRINTED SAMPLES

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The influence of technological modes (number of layers and degree of filling) on the change of elastic-strength indicators of FDM-printed samples was studied. The yield and impact strength of samples of polymer material based on PETG were fixed. Optimal printing modes were identified taking into account the orientation of FDM-printing.

Over the past few decades, additive technologies for manufacturing products and structures of various functional purposes have become widespread. This method is most widely used in medicine, aerospace, aviation and automotive industries, electrical engineering, construction industry, etc. Despite all the advantages of the additive approach, for the implementation of products manufactured in this way in the practice of real production, it is necessary to ensure their compliance with the full list of requirements, especially regarding durability.

The additive manufacturing method, regardless of the material used, involves the emergence of emergent properties in the final product that are not inherent in the elements of the system separately. Thus, the performance characteristics of products obtained by the FDM printing method consist not only of the properties of the source material, but also of the printing parameters - nozzle and table temperature, layer thickness, printing speed, direction of layer stacking, their mutual arrangement, etc. Thus, when designing 3D printed polymer products with specified characteristics, the "material - printing parameters" system should be considered as a whole

The following batches of samples were manufactured: samples with thicknesses of 2 layers with grid infill and samples with 2 layers with hexagonal infill. All samples had an infill percentage ranging from 20 % to 80 %. All samples were tested for destructive stress during impact and bending.

The maximum destructive stress values were achieved in samples with two-layer walls and hexagonal infill with a 60 – 80 % infill degree–9,9 kJ/m² for impact and 850 MPa for bending. Among the tested samples, the optimal results were found with a perimeter of two layers and 80 % infill degree using the hexagonal model.

Research shows that as the degree of sample infill increases, both the destructive stress during impact and bending increase, which simultaneously raises the mass of the samples. Comparing different infill types, it can be noted that samples with hexagonal infill demonstrate better results in terms of destructive stress during bending compared to grid infill, as well as slightly higher destructive stress during impact. Increasing the wall thickness from one layer to two significantly enhances the destructive stress in both impact and bending, while also increasing the sample mass, creating a trade-off for achieving greater strength.