IMPROVING THE OPERATIONAL DURABILITY OF ELEMENTS PREPARED IN 3D PRINTING TECHNOLOGY BY USING AN ADDITIONAL TEMPERATURE REGULATION SYSTEM IN THE CONSTRUCTION OF THE PRINTER

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The 3D printing has been developing very intensively in recent years, both in industry and in private use. This technology makes it possible to quickly, easily and economically obtain prototypes on which the assumed operation can be tested. Due to the low costs of devices and printing materials, this technology can also slowly replace small-lot production. Nevertheless, 3D printing technology also has its limitations. One of the most important is that the properties of the printout are anisotropic, and the printed element has the lowest strength in the axis perpendicular to the printing platform. The aim of the project was to add new solutions that introduce improvements in the 3D printer (Fig. 1) and to determine the printing parameters, thanks to which it is possible to eliminate this defect of printed objects. The research team carried out work on improving the adhesion of the next layer to the previous one using an additional temperature control system. Improved layer adhesion results in increased durability of printed elements, and thus reduced operating costs. This, in turn, has a utilitarian overtone, and in the era of climate change, it is advisable to look for solutions that will lead to energy and material savings.

Figure 1. The 3D printer with an additional temperature regulation system

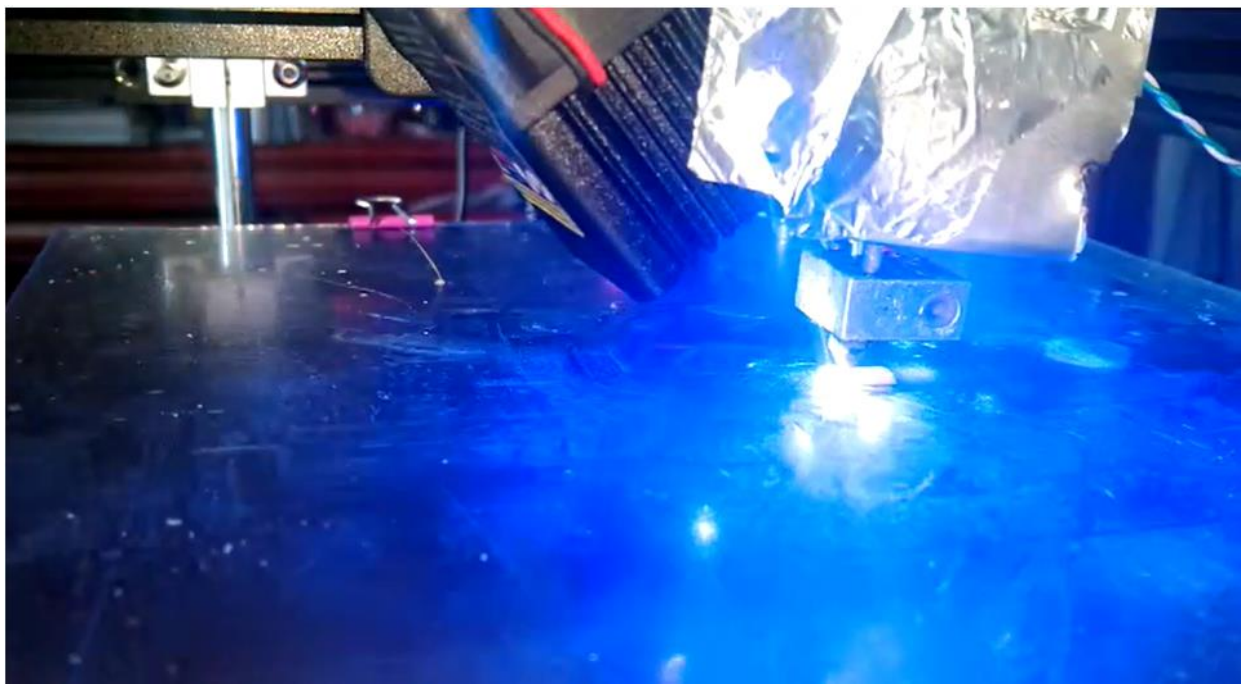

Figure 2. The 3D printer with an additional temperature regulation system during printing

The aim of the project was to develop, design and implement such elements or subassemblies in 3D printing technology so that it is possible to increase the strength between the layers in printing plane. Direct exposure of a fragment of an object during printing to a short-term effect of elevated temperature causes an increase in layer adhesion. To achieve this, a diffused laser beam and hot air blowing were used to liquefy the material or direct contact with the heated element of the printer (Fig. 2). The research allowed to optimize the technological conditions for the formation of polymer bonds between the layers of a given material in order to give the layer a specific structure, ensuring increased strength properties (Fig. 3).

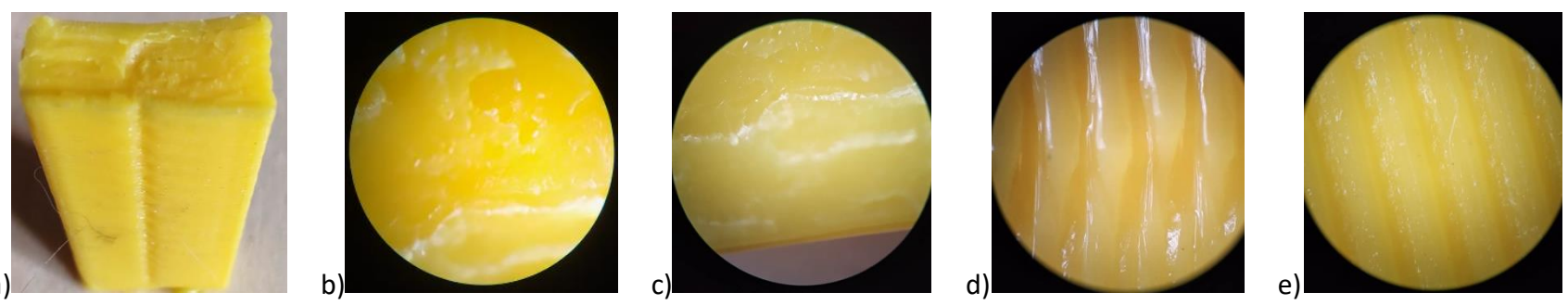

Figure. 3. Images of a sample printed on a 3D printer with an additional system equipped with an additional temperature regulation system:
a) macroscopic view; b-c) stereoscopic image of the sample surface; d-e) stereoscopic image of the printed sample surface in the Y axis and Z axis, respectively

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