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INFLUENCE OF FDM PRINTING PARAMETERS ON THE COMPRESSIVE MECHANICAL PROPERTIES AND FRACTURE BEHAVIOR OF ABS MATERIAL

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ABS is one of the most commonly used materials in FDM technology. ABS is a brittle material, has a longer service life than nylon and is one of the most accessible and cheapest materials in additive manufacturing. There are numerous studies on the static and dynamic behavior of ABS [1, 2]. In this research, the influence of printing parameters on compressive properties is experimentally determined. In the first part of the experiment, the effects of printing direction, printing speed and layer thickness were determined. In the second part, the influence of the infill pattern and infill density were examined. According to the experiment plan, for the printing direction parameter, horizontal (O1) and vertical (O2) direction of the sample will be considered, for the printing speed values of 20 mm/s (V1) and 90 mm/s (V2) and for the thickness of the printing layer 0.1 mm (S1) 0,2 mm (S2). In the second part, rectangular and hexagonal infill patterns and infill densities of 10%, 40% and 70% were used. Samples were made according to the ASTM D695 standard on a Makerbot replicator 2X printer. The test was performed on a Zwick Roell Z100 material testing machine.

a) b)

Fig. 1. Samples a) before testing b) after testing

The results showed that better compressive properties were achieved for the vertical (O2) direction. The printing speed has little influence, while the highest values of compressive strength are achieved for a layer thickness of 0.1 mm. Better results achieved with a rectangular than with a hexagonal infill pattern, that is, the S/W (strength to weight) coefficient has a higher value. An increase of the infill density leads to an increase in the value of the compressive strength. The results of the experiment will be used for further research, topological optimization and field driven design of dies for bending thin sheets. Given that lattice filling is increasingly used, the compression test will be repeated using numerical simulation in order to determine whether it is possible to numerically analyze the fracture of lattice structures and with what accuracy.

Key words: ABS, additive manufacturing, printing parameters, infill pattern, compressive strength

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