Dimensional Analysis in Additive Manufacturing Processes with PLA+Carbon Fiber

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Abstract The rise of Additive Manufacturing (AM) processes is due to the need to reduce material and energy costs. It has the capacity to achieve specialized tools fast while offering the possibility of customize products for the end user. Unlike the majority of the traditional manufacturing processes, AM generally generates the part by depositing material in layers that fuse and create a specific geometry, like Fuse Deposition Modeling (FDM). This comparatively recent technology is still being developed and adapted to the industry and materials requirements. Thus, im-provements are needed in areas like dimensional accuracy, geometric repeatability and material defects, among others, to be able to compare and have the same relia-bility that the products obtained by conventional manufacturing processes. Present work aims to carry out a dimensional control of workpieces designed to fit (axis-hole), so that the influence of certain printing parameters and the final dimensional precision of the specimens can be stablished. The printing parameter relation is studied for a composite material with a PLA matrix, reinforced with Carbon Fibers (PLA+CF), studying the influence of the printing temperature, the layer thickness and the printing direction. This material has been selected because PLA, together with ABS, is one of the most applied materials in AM. Notwithstanding, PLA is easy to process but lacks on resistance, which can be improved introducing carbon fiber as reinforcement. The best result is obtained decreasing the thickness. Also, In comparison with the vertical printing direction, the results of the horizontal speci-mens show a higher dimensional deviation.

Keywords: Additive Manufacturing; Dimensional Analysis; Carbon Fiber; PLA.

For the part height, a clear influence of the layer thickness is appreciated. The greater the thickness, the greater the value of the height. This can also be explained due to the oval deformation. The thinner the layer, the easier the deformation overcomes and so, the less height.

Finally, indicate that, among the parameters studied, the most decisive for the surface and geometric quality of the parts is the layer thickness and the printing orientation, observing in most cases that to obtain better results, it is best to print vertically and reduce thickness.

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