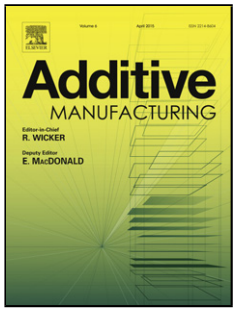

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The Effect of Interlayer Cooling on the Mechanical Properties of Components Printed via Fused Deposition

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Abstract:

This paper investigates the effect of interlayer cooling on the mechanical properties of acrylonitrile butadiene styrene (ABS) structures that are 3D printed using fusion based material extrusion. Two different types of samples were prepared, one designed to measure the compressive strength of the structural material, and the other designed to measure the shear strength of the structural material. Both types of samples were printed with various interlayer wait times by pausing for an allotted amount of time to allow for additional cooling before printing the sequential layer. The samples were then compressed using a Mark-10 ESM 1500 Tension and Compression Tester in accordance with ASTM D695-15. As the wait time in between layers was increased, the effective yield strength was decreased for both types of samples. Temperature data was collected from the top layer of the structures after each successive layer deposition. This data revealed significant cooling over the wait times being considered. These trends prove that additional care needs to be taken when selecting the print settings for structural components that are manufactured using fused filament fabrication. This study shows that printing processes that require additional time (i.e. larger parts, finer geometries, etc.) will inherently lead to a reduction in the mechanical strength of the printed structure.

Keywords: 3D Printing, Mechanical Properties, Fused Filament Fabrication, Interlayer Cooling