

## The Influence of Layer Thickness on the Tensile Properties of 3D Printed PLA

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### Structured Abstract

**Background:** Nowadays, 3D printing is gaining popularity in the manufacturing sector due to its ability to produce complicated shapes more quickly than conventional procedures. However, several relationships between printing parameters and factors remain unclear, necessitating further research to achieve the best results. Therefore, to enhance the usage of 3D printing technology, more information is needed. The printing parameters, such as infill pattern, infill density, layer thickness, temperature, and printing speed, need to be optimized to ensure good tensile properties for 3D printed parts. Although parameters like infill pattern and infill density have been extensively studied, the effect of layer thickness is less well-known.

**Methods:** In this study, PolyTerra™ Polylactic Acid (PLA) filament with a diameter of 2.85 mm produced by Polymaker was used. The Type I standard ASTM D638 was employed to model the standard sample for the tensile test in Solidworks software, and the test was carried out using a testometric tensile tester. The layer thickness used in this research ranged from 0.1 mm to 1.2 mm, while keeping other parameters, such as infill pattern and infill density, constant. The infill pattern used was a triangle pattern, with an infill density set at 20%.

**Results:** The results indicated that increasing the layer thickness from 0.1 mm to 0.4 mm had a more positive effect on the tensile properties. It was found that when increasing the layer height further, the tensile strength decreased. Lower layer heights improved print quality and surface finish as the layers became less visible and details more defined. Smaller layer heights required more layers to be printed, resulting in increased print time. Conversely, larger layer heights reduced the number of layers and significantly decreased the print time.

**Conclusion:** The study found that the layer thickness had an effect on the tensile properties of PLA samples. The optimal tensile strength of PLA samples was achieved at a layer thickness of 0.2 mm. Choosing an appropriate layer thickness is essential, as it can impact printing time, quality, cost, strength, surface finish, and more.

**Keywords:** PLA; 3D printing; Fused Filament Fabrication; Layer thickness; Tensile test

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