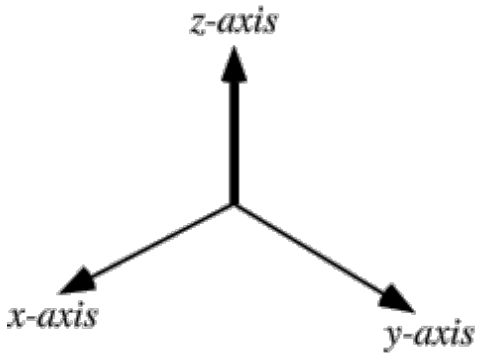
THE IMPORTANCE OF Z-STRENGTH IN 3D PRINTING

INTRODUCTION

With the widely forecasted and massive growth of industrial and direct manufacturing applications for 3D printing, numerous commercial 3D printer manufacturers are making bold claims about the superior strength of their 3D printed parts.

However, a 3D printed part is only as strong as its weakest point and some companies omit independent lab data regarding Z-directional (vertical) strength in their material specification documents and marketing claims, for a reason.

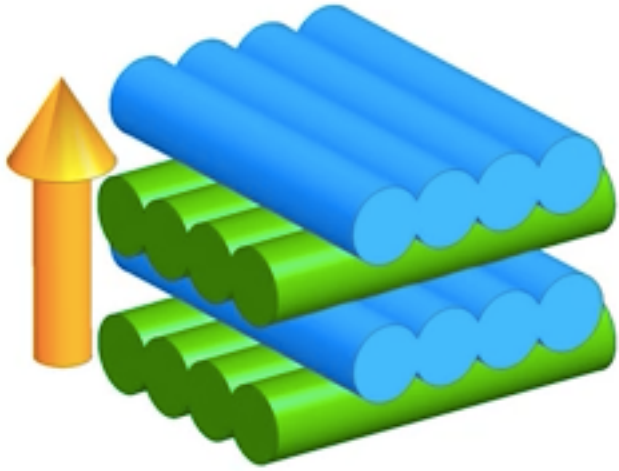


Z-axis is the axis in 3D Cartesian coordinates which is typically oriented vertically.

In this white paper, you'll learn the Z-strength of 3D printed parts built using Rize's Augmented Polymer Deposition (APD) 3D printing process and how it compares to similar technologies.

UNDERSTANDING Z-STRENGTH

Z-strength is impacted by the strength of the internal bond between the layers of a part, which is built up layer by layer.



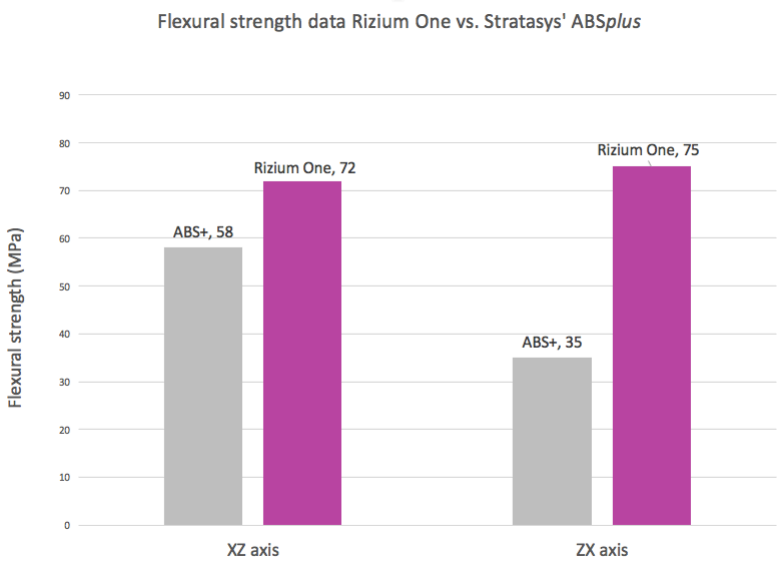
The strength of the internal bond between the layers of a 3D printed part, which is built up layer by layer, impacts Z-strength.

Most 3D printing technologies are unable to create parts that are as strong in the Z-axis as they are in the X- and Y-axes due to weak bonds that form between each layer of material. These bonds are referred to as anisotropic. That is, their physical properties have different values when measured in different directions.

It is imperative for industrial and commercial 3D printer users to understand the critical impact that Z-strength has on the overall strength of the part, especially in functional and end-use applications and to learn the Z-strength capability of the 3D printers they are evaluating.

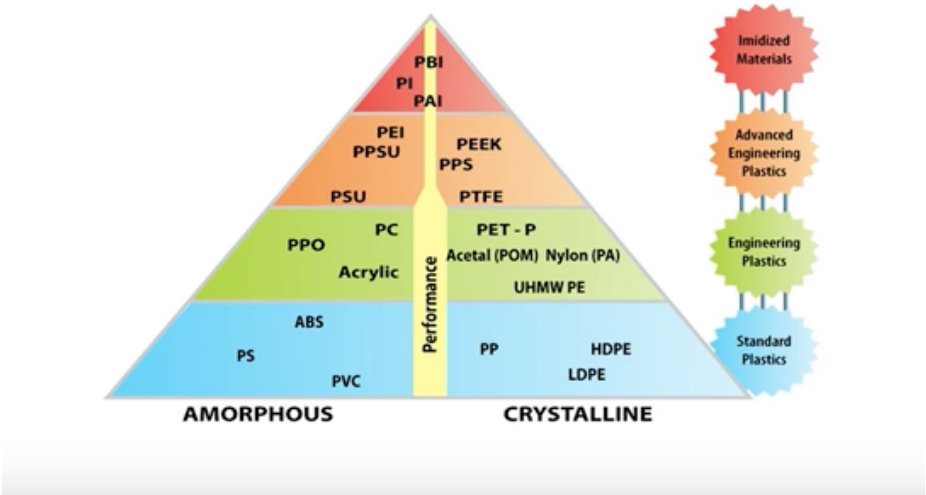
Z-STRENGTH COMPARISON

Due to the way that the material bonds during the Rize APD 3D printing process, our Rizium™ One engineering- and medical-grade thermoplastic is able to retain its isotropic properties. That means parts printed with Rizium One have the same strength in all directions (X, Y and Z).



Rize parts are isotropic and twice as strong as ABSplus.

Rizium One is a proprietary compound thermoplastic that is high on the engineering thermoplastic pyramid. It is not a single material, such as polycarbonate (PC), acrylonitrile butadiene styrene (ABS) or polylactic acid.



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Mechanical Properties[1]	Test method	English XZ Axis	English ZX Axis	English XY Axis	Metric XZ Axis	Metric ZX Axis	Metric XY Axis
Flexural Strength At 3.5% strain, 23°C Maximum, 23°C	ISO 178 (method A)	 9,427 psi 10,443 psi	 9,427 psi 10,878 psi	 8,876 psi 10,442 psi	 65 MPa 72 MPa	 65 MPa 75 MPa	 61 MPa 72 MPa
Flexural Modulus		266,869 psi	285,724 psi	282,824 psi	1840 MPa	1970 MPa	1950 MPa
Flexural Strain		No break	No break	No break	No break	No break	No break

Data presented are actual values measured by certified external testing lab.

Rizium One is actually stronger than PC in the Z-axis and twice as strong as ABS*plus* in the Z-axis. Whereas parts made with the Rize™ One 3D printer experience zero loss in isotropic properties, compared to stock material, typical FDM parts lose approximately 40-percent of their Z-strength and, therefore, are not nearly as strong as Rize parts.

CONCLUSION

Since 3D printed parts are only as strong as their weakest point, and that point is typically along the Z-axis, it is important to learn the Z-axis strength of the material you are considering and how it compares to that of the X and Y axes, as well as those of other systems' materials.

Parts built with Rize 3D printers are isotropic, that is, uniform in X, Y and Z, stronger than polycarbonate and twice as strong as ABS*plus*. Combined with unique zero-post-processing and color capabilities, Rize's isotropic part strength makes it the only feasible 3D printing solution for producing industrial-grade functional and end-use parts on demand in the lab or the office, wherever and whatever that office might be.

ABOUT RIZE

Rize is unlocking 3D printing for new markets and driving the next wave of innovation and advancement in manufacturing with our patented APD (Augmented Polymer Deposition) technology that is the only efficient means to 3D print one-offs of injection molded-quality parts on demand. Our deeply experienced team of former Z Corporation, Objet and Revit materials, hardware and software experts, with over 20 patents, is fulfilling an unmet need for a completely office-safe and affordable 3D printing platform that can be used successfully across a wide variety of commercial applications, including, production parts, tooling, fixtures and jigs and customized end-use products. http://rize3d.com

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