

# Technical Data Sheet Pro PLA

## General Information

3D-Fuel™ Pro PLA (formerly Advanced PLA+/APLA+) Filament is a high heat and impact grade monofilament developed specifically for 3D Printing. Engineered to deliver improved heat-resistance and high impact strength to 3D printed parts, this formulated grade achieves thermal and mechanical properties similar to ABS while offering an alternative to styrenic-based materials. Pro PLA provide excellent 3D printing characteristics such as precise detail, good adhesion to build plates, less warping or curling, and low odor. Pro PLA is manufactured using virgin Natureworks 3D870.

Physical Properties <sup>(1)</sup>	Pro PLA	ASTM method
Specific Gravity, g/cc	1.22	D792
MFR, g/10 min <sup>(2)</sup>	9-15	D1238
Peak Melt Temperature, °C	165-180	D3418
Glass Transition Temperature, °C	55-60	D3418

(1) Typical properties; not to be construed as specifications.

(2) 210°C / 2.16 kg

Mechanical Properties <sup>(3)</sup>	XY Axis	YX Axis	ZX Axis	ASTM method
Tensile Strength, psi (MPa)	5,802 (40)	4,641 (32)	3,481 (24)	D638
Tensile Modulus, kpsi (MPa)	416 (2,865)	355 (2,447)	359 (2,477)	D638
Flexural strength, psi (MPa)	10,588 (73)	7,106 (49)	6,672 (46)	D790
Flexural modulus, kpsi (MPa)	350 (2,414)	287 (1,979)	341 (2,352)	D790
Notched Izod Impact [amorphous], ft-lb/in (J/m)	2.99 (160)	2.26 (21)	2.04 (109)	D256
Notched Izod Impact [crystalline], ft-lb/in (J/m)	4.37 (233)	3.74 (200)	1.19 (64)	D256
Heat Distortion Temperature (°C) 66 psi (0.45 MPa)	75-85			E2092

(3) All 3D printed parts printed at 100% infill and annealed at 110°C / 20 min unless otherwise noted.

## Annealing Printed Parts

Ingeo 3D870 is formulated to crystallize when annealed post-printing. Crystallization is a simple and effective route to improve the thermal performance and further enhance the impact properties of Ingeo 3D870. The recommended anneal temperature is in the range of 110°C-120°C. Annealing can be carried out in an oven or some other medium of heat-transfer, such as a hot-water bath. Make sure to follow safety procedures that are appropriate for working around elevated temperatures. Below is a general guideline to anneal parts printed with Ingeo 3D870:

Processing Temperature File <sup>(4)</sup>	English	Metric
3D Printing Hot End Temperature	190-230°C	
Annealing Temperature	110-120°C	
Print Bed Temperature	None needed (or 50-70°C if applicable)	

(4) Starting points only, and may need to optimize depending on your 3D printer.

1. Pre-heat oven to an anneal temperature range of (110°C-120°C).
2. Measure temperature at various locations in the oven to ensure absence of hot/cold spots. Uneven heating can lead to unexpected warpage and sub-optimal performance of the part
3. Place printed part in oven and start timer. Typical time to anneal parts with wall-thickness of 0.125 in (~3.18 mm) is around 20 minutes, but this time is dependent on wall thickness.
4. For large dimension parts, it is common to use support fixtures (e.g. -aluminum jigs) during the annealing process
5. Once removed from the oven, let the part cool in ambient conditions. Minimize handling, as inside of the part will likely remain at elevated temperatures longer than the outside.
6. If using a water-bath to anneal, the part may have to be at temperature for a slightly longer time to crystallize (since the water-bath cannot be at 110°C-120°C).
7. Measure dimensions of the part prior to annealing and again after, to determine shrink.

## Food Packaging Status

This grade is not certified for food contact applications.