

# Technical Data Sheet

## Advanced PLA

### General Information

3D Fuel™ Advanced PLA Filament is being produced from high heat grade PLA, which was developed specifically for the manufacturing of 3D printer filament.

High heat grade resin exhibits improved heat-resistance and has faster crystallization rates.

When using 3D Fuel filament made from this resin, you can expect: low odor, higher print detail/resolution, excellent first layer adhesion, improved adhesion between layers, and reduced warping, curling and failed prints. (1)

### Printing Information

To get the maximum strength out of your 3D printed part, we recommend a post-annealing procedure that could be done in your oven (at a range of 176-266°F (80-130°C) to promote increased crystallization and further improve the heat deflection temperature (1) (check our website for

more annealing information). It is essential to ensure filaments are dry prior to printing. Our filament will run best at an extrusion temperature of 190-230 °C. It is recommended to use high water content hair spray (as opposed to high ethyl alcohol content) or painter's tape on the build plate to ensure the first layer of the print sticks to the plate. For more stability and a higher quality print: Reduce the speed of the extruder to 30-60mm/second; Increase infill to 30%; Reduce layer height to 0.10mm. For prints with curvatures, it is recommended to turn on rafts and supports in your settings. Print in an area with good airflow. Clean the base plate after each day of printing. Clean the nozzle after every use.

### Comparative Data

The following table provides information comparing several common plastics used in the 3D printing industry to make filament.

| Comparative Date Points for High Heat Grade PLA vs Standard PLA vs ABS (Data according to ASTM specifications.) |                         |                  |              |
|---|-------------------------|------------------|--------------|
| Properties  | High Heat Grade PLA (1) | Standard PLA (6) | ABS (7)      |
| Heat Distortion Temp (HDT)  | 144°C (291°F)           | 55°C (131°F)     | 85°C (185°F) |
| Flexural Modulus, psi (MPa)   | 646,000 PSI             | 555,000 PSI      | 298,000 PSI  |
| Flexural Strength, psi (MPa)  | 18,300 PSI              | 12,000 PSI       | 8,500 PSI    |
| Tensile Yield Strength, psi (MPa)   | 9,500 PSI               | 8,700 PSI        | 5,900 PSI    |

(6) Ingeo 4043D Biopolymer PLA TDS.

(7) Samsung SD-0150 GP ABS TDS.

Heat Deflection Temperature: measure of a polymer's ability to bear a given load at elevated temperatures; the temperature at which it deforms.

Flexural Modulus: pressure required to start the bending; stiffness; the tendency of the material to bend.

Flexural Strength: pressure required before a certain degree of deformation; degree of deformation at which the test fails.

Tensile Yield Strength: maximum stress before breaking when being stretched from both ends.

| Resin Typical Material Properties (1,2)             |                                   |             |
|---|-----------------------------------|-------------|
| Physical Properties                                 | PLA Resin                         | ASTM Method |
| Specific Gravity, g/cc                              | 1.24                              | D792        |
| MFR, g/10 min (3)                                   | 7-9                               | D1238       |
| Relative Viscosity (4)                              | 4.0                               | D5225       |
| Peak Melt Temperature, °C                           | 165-180                           | D3418       |
| Glass Transition Temperature, °C                    | 55-60                             | D3418       |
| Mechanical Properties (molded crystalline) (5)      |                                   |             |
| Tensile Yield Strength, psi (MPa)                   | 9,500 (65.5)                      | D882        |
| Tensile Elongation, %                               | 4.3                               | D882        |
| Notched Izod Impact, ft-lb/in (J/m)                 | 0.75 (40)                         | D256        |
| Flexural Strength, psi (MPa)                        | 18,300 (126)                      | D790        |
| Flexural Modulus, psi (MPa)                         | 646,000 (4357)                    | D790        |
| HDT - Heat Distortion Temp ,°C<br>66 psi (0.45 MPa) | 144                               | E2092       |
| Clarity   | Opaque (when crystalline)         |             |
| 3D Printing Temp                                    | 190-230°C                         |             |
| Annealing Temp                                      | 80-130°C                          |             |
| Print Bed Temp                                      | None Needed (50-70°C if required) |             |

(1) As reported by the resin manufacturer.

(2) Typical properties for injection molded bars. Not to be construed as specifications.

(3) 210 °C / 2.16 KG

(4) RV measured at 1.0 g/dL in chloroform at 30

(5) Injection molded part, with 120 °C mold temperature.