NatureWorks

Ingeo Biopolymer 3D450 Technical Data Sheet

3D Printing Monofilament Break-away Support Grade

Monofilament Applications

Ingeo™ 3D450 is a fully formulated grade that delivers excellent performance, when used to print support structures in fused filament fabrication processes. Monofilament made with Ingeo 3D450 offers an optimum balance between adhesion and ease of removal from the build substrate. This minimizes post-processing time and can result in parts with high accuracy and quality finishes.

PHYSICAL PROPERTIES [1]	3D450	ASTM METHOD
Specific Gravity, g/cc	1.32	D792
MFR, g/10 min[2]	18-26	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

FILAMENT PROCESSING TEMPERATURE PROFILE [3]	ENGLISH	METRIC
Feed Throat	113°F	45°C
Feed Section	360°F	182°C
Compression Section	390°F	200°C
Metering Section	400°F	204°C
Adapter	410°F	210°C
Die	410°F	210°C
Melt	410°F	210°C
Screw Speed	20-150 rpm	
Filament Diameter Inspection (on-line)	Essential for quality monofilament (+/- 3% max. deviation)	

(3) Starting points only. May need to be optimized depending on your system.

Processing Information

Ingeo 3D450 is available in pellet form. Drying prior to processing is essential. The polymer is stable in the molten state, provided that the extrusion and drying procedures are followed. See the NatureWorks document, “Ingeo Best Practices” for more insights on processing and handling Ingeo resins.

Machine Configuration

Ingeo polymers will process on conventional extruders using general purpose screws with L/D ratios from 24:1 to 30:1 and compression ratio of 2.5:1 to 3:1. Smooth barrels are recommended. Optimization to your specific equipment may require NatureWorks technical support.

Process Details

Startup and Shutdown

Ingeo 3D450 is not compatible with a wide variety of resins, and special purging sequences should be followed:

1. Clean extruder and bring temperatures to steady state with low-viscosity, general-purpose polystyrene or high MFR polypropylene.
2. Vacuum out hopper system to avoid contamination.
3. Introduce Ingeo polymer into the extruder at the operating conditions used in Step 1.
4. Once Ingeo polymer has purged, reduce barrel temperatures to desired set points.
5. At shutdown, purge machine with high-viscosity polystyrene or polypropylene.

Drying

In-line drying is required. A moisture content of less than 0.025% (250ppm) is recommended to prevent viscosity degradation. Typical drying conditions are 8 hours at 122F (50°C) or to a dew point of -30°F (-35°C), with an airflow rate greater than 0.5 cfm/lb. of resin throughput. The resin should not be exposed to atmospheric conditions after drying. Keep the package sealed until ready to use and promptly reseal any unused material.

Printing Recommendation

PRINTING PROFILE [4]	ENGLISH	METRIC
3D Printing Temperature	374-428°F	190-220°C
Print Bed Temperature	None needed (or 50-70°C if applicable).	

(4) Temperatures may need to be optimized depending on your system.

Removing Supports from Printed Part

While Ingeo 3D450 is designed to easily separate from the main part, it is recommended that gloves (e.g.- leather work-gloves) and tools such as pliers, be used to pry off the support structures to protect user from any sharp edges.

Food Packaging Status

This grade is not certified for food contact applications

Safety and Handling Considerations

Safety Data Sheets (SDS) for Ingeo biopolymers are available from NatureWorks. SDS's are provided to help customers satisfy their own handling, safety, and disposal needs, and those that may be required by locally applicable health and safety regulations. SDS's are updated regularly; therefore, please request and review the most current SDS's before handling or using any product.

The following comments apply only to Ingeo biopolymers; additives and processing aids used in fabrication and other materials used in finishing steps have their own safe-use profile and must be investigated separately.

Hazards and Handling Precautions

Ingeo biopolymers have a very low degree of toxicity and, under normal conditions of use, should pose no unusual problems from incidental ingestion or eye and skin contact. However, caution is advised when handling, storing, using, or disposing of these resins, and good housekeeping and controlling of dusts are necessary for safe handling of product. Pellets or beads may present a slipping hazard.

No other precautions other than clean, body-covering clothing should be needed for handling Ingeo biopolymers. Use gloves with insulation for thermal protection when exposure to the melt is localized. Workers should be protected from the possibility of contact with molten resin during fabrication.

Handling and fabrication of resins can result in the generation of vapors and dusts that may cause irritation to eyes and the upper respiratory tract. In dusty atmospheres, use an approved dust respirator.

Good general ventilation of the polymer processing area is recommended. At temperatures exceeding the polymer melt temperature (typically 175ºC), polymer can release fumes, which may contain fragments of the polymer, creating a potential to irritate eyes and mucous membranes. Good general ventilation should be sufficient for most conditions. Local exhaust ventilation is recommended for melt operations. Use safety glasses (or goggles) to prevent exposure to particles, which could cause mechanical injury to the eye. If vapor exposure causes eye discomfort, improve localized fume exhausting methods or use a full-face respirator.

The primary thermal decomposition product of PLA is acetaldehyde, a material also produced during the thermal degradation of PET. Thermal decomposition products also include carbon monoxide and hexanal, all of which exist as gases at normal room conditions. These species are highly flammable, easily ignited by spark or flame, and can also auto ignite. For polyesters such as PLA, thermal decomposition producing flammable vapors containing acetaldehyde and carbon monoxide can occur in almost any process equipment maintaining PLA at high temperature over longer residence times than typically experienced in extruders, fiber spinning lines, injection molding machines, accumulators, pipe lines and adapters. As a rough guideline based upon some practical experience, significant decomposition of PLA will occur if polymer residues are held at temperatures above the melting point for prolonged periods, e.g., in excess of 24 hours at 175°C, although this will vary significantly with temperature.

Combustibility

Ingeo biopolymers will burn. Clear to white smoke is produced when product burns. Toxic fumes are released under conditions of incomplete combustion. Do not permit dust to accumulate. Dust layers can be ignited by spontaneous combustion or other ignition sources. When suspended in air, dust can pose an explosion hazard. Firefighters should wear positive-pressure, self-contained breathing apparatuses and full protective equipment. Water or water fog is the preferred extinguishing medium. Foam, alcohol-resistant foam, carbon dioxide or dry chemicals may also be used. Soak thoroughly with water to cool and prevent re-ignition.

Disposal

DO NOT DUMP INTO ANY SEWERS, ON THE GROUND, OR INTO ANY BODY OF WATER. For unused or uncontaminated material, the preferred option is to recycle into the process otherwise, send to an incinerator or other thermal destruction device. For used or contaminated material, the disposal options remain the same, although additional evaluation is required. Disposal must be in compliance with Federal, State/Provincial, and local laws and regulations.

Environmental Concerns

Generally speaking, lost pellets, while undesirable, are benign in terms of their physical environmental impact, but if ingested by wildlife, they may mechanically cause adverse effects. Spills should be minimized, and they should be cleaned up when they happen. Plastics should not be discarded into the environment.

Product Stewardship

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