NatureWorks
TECHNICAL DATA SHEET

INGEO BIOPOLYMER 3D300

For Faster 3D Printing

DESCRIPTION

Ingeo 3D300 has been developed for production of filaments for today's high-speed printers, while maintaining premium performance and user experience, characteristic of NatureWorks' portfolio of 3D grades.

Ingeo 3D300 is supplied as pellets that can be directly printed using fused granulate fabrication (FGF) systems, or can also be first converted to filament, for use in fused filament fabrication (FFF) platforms.

PROCESSING INFORMATION

Due to the variety of printer-platforms on the market, the table presented only contains general ranges in which Ingeo 3D300 may be processed. Conditions may need to be optimized for specific printers. Drying prior to melt extrusion is essential to ensure premium quality and consistency.

Screw-cooling in the feed section may be necessary in some cases, to prevent resin from sticking to screw.

BULK MECHANICAL PROPERTIES*		
Tensile Modulus	488 kpsi	ASTM D638
Tensile strength	9.3 kpsi	ASTM D638
Flexural strength	16.2 kpsi	ASTM D790
Flexural Modulus	527 kpsi	ASTM D790

** Typical properties measured on injection molded bars; not to be construed as specifications or properties of 3D printed part.*

PHYSICAL PROPERTIES		
MFR, g/10 min (210ºC, 2.16kg)	14-18	ASTM D1238 *(adapted to include best practices to dry Ingeo)*
Density	1.24 g/cc	ASTM D1505
Glass transition temperature	55-60 ºC	ASTM D3418

PROCESSING TEMPERATURE PROFILE	
Feed Throat	45 ºC
Feed Temp.	190 ºC
Compression section	190-200 ºC
Metering section	190-200 ºC
Die	200-210 ºC
Screw Speed	20-150 RPM
Filament Diameter Inspection (on-line)	Essential for quality monofilament
3D Printing Temp	190-230°C
Print bed	50-70 ºC, if needed

DRYING

In-line drying is required. A moisture content of less than 0.025% (250 ppm) is essential to prevent viscosity degradation. Typical drying conditions are 6-8 hours at 113°F (45 °C) or to a dew point of -30 °F (-35 °C), with an airflow rate greater than 0.5 cfm/lb of resin throughput.

BULK STORAGE RECOMMENDATIONS

The resin silos recommended and used by NatureWorks are designed to maintain dry air in the silo and to be isolated from the outside air. This design would be in contrast to an open, vented to atmosphere common when processing polystyrene. Key features that are added to a typical (example: polystyrene) resin silo to achieve this objective include a cyclone and rotary valve loading system and some pressure vessel relief valves. The dry air supply to the system is sized in proportion to the resin flow rate through the silo. Often, the necessary flow of dry air is minimal and there may be excess instrument air (-30°F dew point) available in the plant to meet the needs for dry air supply. Our estimate is 10 scfm for a 20,000 lb/hr rate resin usage. Typically, resin manufacturers specify aluminum or stainless-steel silos for the resin manufacturing operation and avoid epoxy-lined steel.

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 dust 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 175 ºC), 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, pipelines 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 the 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

NatureWorks has a fundamental duty to all those that use our products, and for the environment in which we live. This duty is the basis for our Product Stewardship philosophy, by which we assess the health and environmental information on our products and their intended use, and then take appropriate steps to protect the environment and the health of our employees and the public.

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