

NatureWorks® PLA Polymer 4060D

For Heat Seal Layer in Coextruded Oriented Films

POLYMER APPLICATION

PLA (polylactide) polymer 4060D, a product from NatureWorks® LLC, can be coextruded with other PLA resin to form a sealant layer for biaxially oriented PLA film. This resin has excellent heat seal and hot tack performance with a seal initiation temperature of 80°C. This sealant does not adversely affect the unique properties of NatureWorks® PLA bioriented film such as high gloss and transparency, dead-fold or aroma and grease barrier.

Polymer Characteristics

PLA polymer is available in pellet form. The resin is amorphous (clear pellets) and starts to become tacky at 45°C. Drying prior to processing is essential. The polymer is stable in the molten state, provided that proper extrusion and drying procedures are followed.

Machine Configuration

PLA polymers will process on conventional extruders using general purpose screws with L/D ratios from 24:1 to 30:1 and compression ratio of 2:1 to 3:1. Screw cooling capabilities through the feed section are necessary to prevent the resin from sticking to the screw root. Smooth barrels are recommended. This grade is suitable only as a heat seal layer in a coextrusion process. Processing this resin as a monolayer film is not recommended. Optimization on specific equipment may require NatureWorks LLC technical support.

Processing Temperature Profile ⁽¹⁾		
Melt Temperature	410°F	210°C
Feed Throat	113°F	45°C
Feed Temperature	355°F	180°C
Compression Section	375°F	190°C
Metering Section	390°F	200°C
Adapter	390°F	200°C
Die	375°F	190°C
Screw Speed	20-100 rpm	

⁽¹⁾ Starting point recommendations only. Detailed Biaxially Oriented film processing guide available from NatureWorks LLC

Process Details ⁽²⁾

Startup and Shutdown

PLA polymer 4060D is not compatible with a wide variety of polyolefin 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 PLA polymer into the extruder at the operating conditions used in Step 1.
4. Once PLA polymer has purged, reduce barrel temperatures to desired set points.

5. At shutdown, purge machine with high-viscosity polystyrene or polypropylene.

⁽²⁾ Detailed Purging recommendations available at www.natureworkslc.com

Drying

In-line drying is required. A moisture content of less than 0.025% (250 ppm) is recommended to prevent viscosity degradation. Typical drying conditions are 4 hours at 110°F (45°C) or to a dew point of -30°F (-35°C), with an airflow rate greater than 0.5 cfm/lb (0.032 m³/min per kg) of resin throughput.

Note: Due to the amorphous nature of PLA polymer 4060D, it is important that drying does not exceed 120°F (50°C)

Typical Material & Application Properties		
Coex Film Properties PLA 4060D/PLA 4031D	Value	ASTM Method
Density	1.24	D1505
Transmission Rates		
Oxygen	550cm ³ .25µm/m ² .24hr .atm	D1434
Carbon Dioxide	330cm ³ .25µm/m ² .24hr .atm	D1434
Water Vapor	325g .25µm/m ² .24hr .atm	E96
Optical Characteristics		
Haze	2%	D1003
Gloss, 20	90%	D1003
Thermal Characteristics		
Glass Transition Temperature	52- 58°C	D3418
Seal Initiation Temperature	80°C	F88

Natureworks® PLA Polymer 4060D



FDA Status

European Status

This grade of NatureWorks® PLA complies with Commission Directive 2002/72/EC as amended by 2004/19/EC. No SML's for the above referenced grade exist in Commission Directive 2002/72/EC or as amended by 2004/19/EC. NatureWorks LLC would like to draw your attention to the fact that the EU-Directive 2002/72/EC, which applies to all EU-Member States, includes a limit of 10 mg/dm² of the overall migration from finished plastic articles into food. In accordance with EU-Directive 2002/72/EC the migration should be measured on finished articles placed into contact with the foodstuff or appropriate food simulants for a period and at a temperature which are chosen by reference to the contact conditions in actual use, according to the rules laid down in EU-Directives 93/8/EEC (amending 82/711/EEC) and 85/572/EEC. Please note that it is the responsibility of both the manufacturers of finished food contact articles as well as the industrial food packers to make sure that these articles in their actual use are in compliance with the imposed specific and overall migration requirements. This grade as supplied meets European Parliament and Council Directive 94/62/EC of 20 December 1994 on packaging and packaging waste heavy metal content as described in Article 11. It is recoverable in the form of material recycling, energy recovery, composting, and biodegradable per Annex II point 3, subject to the standards of the local community. Again, for any application, should you need further clarification, please do not hesitate to contact NatureWorks LLC.

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Safety and Handling Considerations

Material Safety Data (MSD) sheets for PLA polymers are available from NatureWorks LLC. MSD sheets 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, such as OSHA (U.S.A.), MAK (Germany), or WHMIS (Canada). MSD sheets are updated regularly; therefore, please request and review the most current MSD sheets before handling or using any product.

The following comments apply only to PLA polymers; 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

PLA polymers 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. 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. Pellets or beads may present a slipping hazard. Good general ventilation of the polymer processing area is recommended. At temperatures exceeding the polymer melt temperature (typically 170°C), 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 if there is a potential for exposure to particles which could cause mechanical injury to the eye. If vapor exposure causes eye discomfort, use a full-face respirator. No other precautions other than clean, body-covering clothing should be needed for handling PLA polymers. Use gloves with insulation for thermal protection when exposure to the melt is localized.

Combustibility

PLA polymers 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 options include recycling into the process or sending to an industrial composting facility, if available; 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. (For example, in the U.S.A., see 40 CFR, Part 261, "Identification and Listing of Hazardous Waste.") All disposal methods must be in compliance with Federal, State/Provincial, and local laws and regulations.

Environmental Concerns

Generally speaking, lost pellets are not a problem in the environment except under unusual circumstances when they enter the marine environment. They are benign in terms of their physical environmental impact, but if ingested by waterfowl or aquatic life, 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 ocean or any other body of water.

Product Stewardship

NatureWorks LLC has a fundamental duty to all those that make and 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, then take appropriate steps to protect the environment and the health of our employees and the public.

Customer Notice

NatureWorks LLC encourages its customers and potential users of its products to review their applications for such products from the standpoint of human health and environmental quality. To help ensure our products are not used in ways for which they were not intended or tested, our personnel will assist customers in dealing with ecological and product safety considerations. Your sales representative can arrange the proper contacts. NatureWorks LLC literature, including Material Safety Data sheets, should be consulted prior to the use of the company's products. These are available from your NatureWorks LLC representative.

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