Hisun PLA polymer REVODE201

Injection Molding Processing Guide

Hisun Biomaterials PLA polymer REVODE201 is a thermoplastic resin derived from annually renewable resources and is specifically designed for injection molding applications.

Products Properties of REVODE201

	REVODE201	Test Method
Physical Properties		
Specific Gravity（g/cm^3）	1.25±0. 05	GB/T1033-1986
Melt Index, g/10min (190ºC/2.16Kg)	10-30	GB/T3682-2000
Melting Point(ºC)	135-150	GB/T19466.3-2004
Glass Transition Temperature(ºC)	54-60	GB/T19466.2-2004
Mechanical Properties		
Tensile Strength (MPa)≥	45	GB/T1040-1992
Elongation at Break (%)≥	3.0	GB/T1040-1992
Impact Strength (KJ/m2, Izod)	3~5	GB/T1043-1992
Molding Shrinkage	0.004	ISO 294-4: 2001

Applications

Many products can be produced from REVODE201, such as transparent or opaque tableware, stationary, toys, gardening tools, outdoor products and etc. The application field of this resin is extended gradually.

Processing Information

REVODE201 can be processed in conventional injection molding equipment. The material is stable in molten state, provided that drying procedures are followed. Mold flow is highly dependent on melt temperature. This process can be controlled through balancing the screw speed, back pressure and process temperature. The recommended processing temperatures are listed in the following table (the specific process should be optimized):

Processing Parameters of REVODE201

Processing condition	Data set(℃)
Feed Throat	20-40
Convey Section	190-210
Compression Section	180-200
Metering Section	180-200
Nozzle	180-200
Back Pressure	100-300psi

Note: The resin can be processed at temperature between 150~160 ℃ if the materials are moist. On the surface of the resulting products, phenomena such as bubbles, white traces may appear and the products may become brittle.

Processing Details

1, Mold requests

(1) A good cooling system is needed for mold. Water chiller is necessary in the process. For example, a 200g injection molding machine need a 2-kw water chiller(groundwater with a temperature lower than 25 ℃ can be another option)

(2) Fast injection speed is recommended for thin-wall injection parts, while relative slow injection speed is recommended for thick-wall injection parts. The wall-thickness should be less than 6mm. Cooling water is needed for mold core, mold cavity and mold board. Make sure that mold temperature should be controlled between 20~30℃.

(3) Different products require different molds, especially for the gates. If the thickness of products is between 3~5 mm, and the injection route is short, pin gate should be used, and the diameter of the gate should be set between 1.0~1.5 mm. If the thickness of products is less than 1 mm, a sprue gate with diameter larger than 3.0 mm is needed. Hot runner molding is another option, with diameter between 0.8~1.0 mm.

(4) There are some other requests for the mold. Dimensional accuracy of parting surface should be less than 0.02 mm. For container-type products with large molding depth, the request for the demoulding gradient is not less than 1.5 degree for outer surface, and not less than 3.0 degree for the inner surface.

2, Drying

REVODE101 has been processed by drying crystallization at our factory. Highest heat stability of the resin is 110 ℃ and the moisture content is less than 200 ppm. The resin is stored in Aluminum foil bag, protected by box or bag as the outer packaging, and can be used directly. Keep the package sealed until ready to use and promptly reseal any unused material, otherwise the resin will absorb moisture. If that happens, the resin may show increased mobility during the process, and the products will become brittle, crazing will occur on the surface and white materials will also appear on mold polishing surface. If the resin is exposed to the atmosphere for more than one hour, it should be re-dried before use. The resin can be processed directly if it is exposed to atmosphere for less than one hour, but the possibility of moisture absorption cannot be excluded if the moisture in atmosphere is high.

When re-drying the resin, un-dehumidified hot air is forbidden (by using un-dehumidified air, it will speed up water absorption of PLA resin and cause degradation on the resin). Only dehumidified air can guarantee good drying effect of PLA resin in desiccator. When using conventional oven, dehumidification equipment should be installed to dehumidify the air in the oven.

SD-H series of honeycomb-wheels-type dehumidifiers supplied by Shini Plastics Technologies Inc. are strongly recommended for PLA drying, other equipments with the same dehumidification effect can also be selected.

Typical drying conditions are shown in the table below:

Drying Parameter	Typical Settings
Residence Time（hours）	2-3
Air Temperature（℃）	70 (Temperature of Drying hopper)
Air Dew Point（℃）	-40 (Temperature of molecular sieve dehumidifier)
Air Flow Rate（m^3/hr-kg resin）	＞1.85

Note: During the molding process, if the molding mass is light in weight, the 25 kg/bag resin should not be used at one time when coloring the materials. The suggestion is: only use half bag of the resin and seal the bag immediately with heat sealing device. The aim is to avoid exposure to the atmosphere. If dehumidifier is available, make use of it in molding process. The use of dehumidifier can stop moisture absorption of the resin during process, thus problems mentioned above can be avoid.

3, PLA resin REVODE201 is different from other resins, and special treatment should be followed:

1.Clean extruder and bring temperatures to steady state with low-viscosity, general-purpose polystyrene or polypropylene.

2. Humidity of the air should be kept below -40℃ air dew point. Contamination of hopper system should be avoid.

3. PLA resin can be introduced into injection molding machine after step 1 and 2.

4. Adjust the temperature of equipment to the operating condition.

5. When shutting down, the machine should be cleaned with low-viscosity polystyrene or polypropylene.

Notice: Close the baffle at the bottom of the hopper and purge the barrel when shutting down the machine for a short period of time (within 30 min) to avoid blocking of the feed throat. Open the baffle and feed resin after confirm to re-start injection again.

If color changing and decomposing happened during molding process, purge the barrel immediately to observe the state of the material. Keep on running if the material is normal; otherwise, adjust the parameters.

Recovery treatment of renewable materials

PLA regrind can be reused, but the regrind can only bear temperature below 58 ℃, because of the absence of the re-crystallization treatment. Regrind should be processed by the following two methods, and can be mixed with fresh resin at any ratios after re-drying.

Method1: Crush the regrind directly in the process, and mixed to use with fresh resin. The temperature of the hopper should not be higher than 55℃, or the hopper may be blocked. (recommended)

Method 2: Cumulate the regrind before crush and dry (the regrind should not be stored longer than 3 months), and process together with fresh resin. Typical PLA drying conditions are shown in the table below:

Drying Parameter	Typical Settings
Residence Time（hours）	4-6
Air Temperature（℃）	55 (Temperature of Drying hopper)
Air Dew Point（℃）	-40 (Temperature of molecular sieve dehumidifier)
Air Flow Rate（m^3/hr-kg resin）	＞1.85