Sustainable Biopolymers for Film

Masterbatch: PHACT™ MA1250P, MA1250P-A

Compounds: PHACT™ CA1280P-C1, CA1280P-O2, CA8270P-B1, CA8270P-W1 and CA1270P

Target Applications

Markets
- Flexible packaging
  - Cast film, BO film, Blown film
  - White film for labels and stickers

End Products
- Multi-layer film for F&B products
- Compost and merchandise bags
- Fruit and veggie labels

Bring a New Wave PHACT

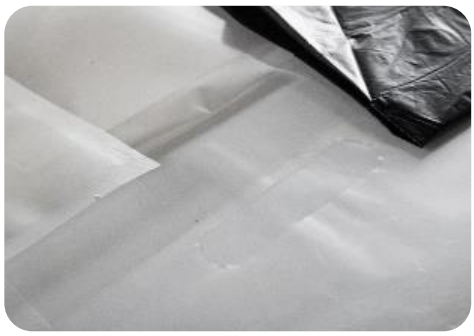
MASTERBATCH

PHACT MA1250P and PHACT MA1250P-A are masterbatch products that are composed of polylactic acid (PLA) and amorphous PHA (aPHA) known as PHACT A1000P. PHACT MA1250P contains 45% aPHA and is easier to handle than aPHA neat resin. PHACT MA1250P can be added as a dry blend during the conversion of PLA-based products. Customization of the PHACT MA1250P blending ratio is easily accomplished. PHACT MA1250P-A is ideally used in seal layers of multi-layered film products. The high concentration of aPHA increases the flexibility of compounding and blending materials. It also accelerates the degradation of PLA, improving industrial compost response.

PHACT MA1250P and MA1250P-A Features

- 100% bio content
- Good seal performance
- Enhanced tear propagation resistance
- FDA-approved for food contact(1)
- Improves flexibility and film handling capability of PLA
- Improves impact strength
- Maintains the clarity of PLA

1) US FDA FCN2281, Korea FDA authorized substances (hydroxybutyl polyester (HBP), polylactic acid (PLA))



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PLA/PHA COMPOUNDS

PHACT CA1280P-C1, CA1280P-O2, CA8270P-B1, CA8270P-W1 and CA1270P are environmentally friendly semi-crystalline biopolymer compounds that improve functional performance and enable faster composting relative to polylactic acid (PLA). These grades are compounded resins based on PLA and amorphous PHA (aPHA) known as PHACT A1000P. These grades are ideally suited for film applications with conventional film processes. The films made of PHACT compounds have superior sealability, flexibility, and less noise compared to PLA-only films. Final products made of PHACT compounds have faster rates of biodegradability than PLA-only film. PHACT CA1280P-C1, CA1280P-O2, and CA8270P-B1 are suitable for bundle pouch applications. PHACT CA8270P-W1 is white film grade ideal for sticker/label applications. PHACT CA1270P is designed for blown and cast film applications and may also be used in biaxially-oriented films.

PHACT CA1280P-C1/O2, CA8270P-B1/-W1 and CA1270P Features

- 100% bio content
- Industrial compostable
- Accelerates PLA degradation
- Colorable and printable
- FDA-approved for food contact[1]
- Relative to PLA:
  - Increased flexibility and softness
  - Less noisy
  - Enhanced oil and water resistance

1) US FDA FCN2281, Korea FDA authorized substances (hydroxybutyl polyester (HBP), polylactic acid (PLA))

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Mechanical Properties

Masterbatch

Properties	Units	ASTM	MA1250P-A	MA1250P
Forms	-	-	Pellet	Pellet
Melt Flow Rate (190 ° C, 2.16 kg)	g/10 min	D1238	5 ~ 8	5 ~ 8
Density	g/cc	D1505	1.22	1.22
Glass Transition Temperature(1)	° C	D3418	-17, 60	-17, 60
Seal Initiation Temperature	° C	F88	80	Not relevant
IZOD Impact Strength (Unnotched, RT)	kJ/m^2	D256	Non-Break	Non-Break
Biobased Carbon Content	%	D6866	100	100

1) PLA and aPHA are not miscible and the masterbatch will reveal two distinct glass transition temperature. The value reported are based on DSC re-heat scan at 10 ° C/min after cooling from 200 ℃ at 10 ℃/min.

Compound Grades for Film

Properties		Units	ASTM	CA1280P-C1	CA1280P-O2	CA8270P-B1	CA8270P-W1	CA1270P
Forms		-	-	Pellet	Pellet	Pellet	Pellet	Pellet
Specific Gravity		-	D792	1.23	1.23	1.23	1.23	1.22
Tensile Strength at Break(1)	MD	MPa	D882	50	118	42	46	45
	TD			31	159	39	43	33
Elongation at Break(1)	MD	%		527	119	300	400	450
	TD			292	90	300	400	350
Haze(2)		%	D1003	4.3	9.0	-	-	-
Seal Strength		gf/25mm	F88	2563	-	-	-	-
Melting Point(3)		° C	D3418	151	168	151	147	150 ~ 170
Glass Transition Temperature(3)		° C	D3418	-15, 58	-15, 57	-15, 60	-15, 54	-15, 60
Melt Flow Rate (190 ° C, 2.16 kg)		g/10 min	D1238	5.8	5.5	4.6	4.4	3

1) Film specimens conform to ASTM D882. Crosshead speed 200 mm/min for mechanical properties.
2) Using film specimens for measuring properties.
3) Differential Scanning Calorimeter (DSC), the peak of endotherm. Heating rate 10 ℃/min.

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Recommended Processing Conditions

Masterbatch for Film

Feed-Throat Section Temp.	40 ° C	Adapters	200 ° C
Solids-Conveying Section Temp.	180 ° C	Die Zones	180 ° C
Melt Temperature	190 ° C		
Metering Section Temperature	190 ° C		

Compound Grades for Film

CA1280P-C1 and CA1280P-O2

Dry Temperature[1]	60 ° C X 5 hrs.
Feed Throat	20 ~ 40 ° C
Feed Temperature	100 ~ 120 ° C
Compression Section	150 ~ 160 ° C
Melt Temperature	160 ~ 170 ° C
Nozzle	170 ~ 180 ° C

CA8270P-B1 and CA8270P-W1

Dry Temperature[1]	60 ° C X 8 hrs.
Feed Throat	20 ~ 40 ° C
Feed Temperature	100 ~ 120 ° C
Compression Section	130 ~ 160 ° C
Melt Temperature	130 ~ 160 ° C
Nozzle	150 ~ 170 ° C

1) It is preferable to dry with air below -40 ℃ dew point.

CA1270P[1][2]

Feed-Throat Section Temp.	40 ° C	Adapters	200 ° C
Solids-Conveying Section Temp.	180 ° C	Die Zones	180 ° C
Melt Temperature	190 ° C		
Metering Section Temperature	190 ° C		

1) CA1270P may be processed easily on conventional extruders with either smooth-bore feed sections or grooved-feed sections. A low-shear screw with a low compression ratio (CR) is ideal for processing and film properties.

2) A spiral mandrel die is recommended for blown film processing. Ideal die gap for blown film processing is in the range of 1.0-1.5 mm (40-60 mils). CA1270P can be processed successfully on blown film lines equipped to operate in the traditional "low stalk" bubble configuration mode with a dual-lip air ring. Chilled air supply for the air ring and internal bubble cooling (IBC) will facilitate a more stable bubble at higher line speeds. A blow-up ratio (BUR) of 2.0 to 3.0 is recommended. Low friction bubble guides should be used to guide and center the bubble into the collapsing frame. Low web tensions (28 - 40 N/mm, 0.25 - 0.35 pli) should be used when processing thin films.

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Drying Process Conditions

- Biodegradable materials are highly hygroscopic. Store in a dry condition. A moisture content of less than 0.04% (400 ppm) is highly recommended to prevent viscosity degradation during processing.
- Recommended to use all once opened. If an opened bag must be stored for reuse, seal completely, avoid air exposal, and store at a dry, well-ventilated condition/place/location. Avoid long-term storing.
- PHACT Compounds must be dried under 60 °C for over 5 hrs. or caking can happen because the Tg of this compound is around 60 °C.
- PHACT Compounds are preferable to dry with air below -40 °C dew point.
- When exposed to moisture, completely dry in a dehumidifying dryer before use.

Purging Process Conditions (*Following PET, PA, HDPE)

PHACT compounds are not compatible with polyolefins and special care must be given to purging and cleaning the line (including feeders to avoid contamination) prior to the introduction of this product. In-line drying is recommended. It is critical to clean the material handling system of PET, nylon, and high molecular weight HDPE to assure that these materials do not inadvertently feed into the extruder during or after the purging process.

1) Purge with low MFR (e.g., <1) transition resin at normal PET operating temperatures. PET and PHACT are temperature incompatible, so the transition resin is one that can be processed at the high temperatures of PET and the low temperatures of PHACT.
   Suggested transition resins include PP, crystal PS, and PETG. Purge for at least 7x average residence time, much of the time at the typical PET production rate (~30 minutes).
2) Let the system empty as much as possible. Clean out the hopper as much as possible.
3) Introduce higher melt flow transition resin (PP, PS, PETG) and change to normal PHACT operating temperatures.
4) Let the system empty as much as possible. Then transition to pure PLA resin or PHACT and purge, again, for a minimum 7x average residence time. Change the screen pack when it becomes obvious that primarily PLA (or PHACT) is exiting the die.
5) At the completion of run, purge all PHACT from the extrusion system, using low melt index PP or PS.

*Notes: It is critical that all drying and conveying/receiving systems be free of all PET and vacuumed to ensure there is no remaining polymer dust before adding PHACT. PET will not melt at PHACT operating temperatures and will block screens if it is present in the system.

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For additional information or specific recommendations for your intended applications, please contact us at:

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