Dow Packaging & Specialty Plastics

Product Data Sheet

BYNEL™ 21E781

Adhesive Resin

General Information

Product Description	BYNEL™ Series 2100 resins are anhydride modified ethylene acrylate resins. They contain a temperature stable ester which makes them functional in high temperature coextrusions. They are available in pellet form for use in conventional extrusion and coextrusion equipment designed to process polyethylene (PE) resins.

Status

Material Status	Commercial: Active

Typical Characteristics

Composition	Low% By Weight Maleic Anhydride Graft levels are defined as: Low < 0.2%; Medium 0.2-0.5%; High 0.5-1.0%; Ultra high > 1.0%
Characteristics / Benefits	Physical properties of BYNEL™ Series 2100 resins are typical of polyethylene/acrylate copolymer resins with similar density and melt index values.
Applications	BYNEL™ 2100 series resins adhere to a wide variety of materials. They are most often used to adhere to PET to EVOH or PA. They also adhere to PE, PP, and ethylene copolymers. The BYNEL™ 2100 series resins can be used in a variety of coextrusion coating and laminating applications.

Typical Properties

Physical	Nominal Values	Test Method(s)	
*Density ( )	0.927 g/cm³	ASTM D792	ISO 1183
*Melt Flow Index (190°C/2.16kg)	2.1 g/10 min	ASTM D1238	ISO 1133
Thermal	**Nominal Values**	**Test Method(s)**	
*Melting Point (DSC)	97 °C (206.6 °F)	ASTM D3418	ISO 3146
Freezing Point (DSC)	91 °C (195.8 °F)	ASTM D3418	ISO 3146

Adhesive Evaluation	The performance of any adhesive resin should be evaluated within the context of the application. The adhesive is designed to bond materials that would not ordinarily adhere to each other. In most cases, peel strength is used as a measure of performance. Although this is a convenient test, peel strength is affected not only by adhesion, but also by peel angle, separation rate, temperature, and tensile and modulus properties of the materials, and often by the time elapsed since the formation of the bond. Post-treatment of the multi-layer structure, such as heat sealing, thermoforming or orientation can also affect peel strength. If peel strength is used as a measure of adhesive performance, it is imperative that peel strength be evaluated not only at the time of manufacture, but throughout the life of the product and under all the various conditions to which the structure will be exposed. Only then can the performance of the adhesive be related to peel strength.

Processing Information

*Maximum Processing Temperature	260 °C (500 °F)
General Processing Information	The temperature profiles shown below are for initial evaluations of BYNEL™ adhesive resins in the 2100 series. These profiles are designed to provide adequate exposure time of the adhesive resin to elevated temperatures. Exposure to elevated temperatures activates the anhydride which improves the bonding capability of the adhesive resin. Regardless of the profile used, the adhesive resin should be

exposed to temperatures above 210C (410F) for several minutes prior to contact with the other molten resins in coextrusion in order to ensure adequate performance of the adhesive resin.

Because the BYNEL™ 2100 Series resins have low softening points, it is a good idea to run the rear of the extruder as cool as possible, then build quickly to the melt temperature. Water cooling of the screw and/or hopper feed throat may help avoid bridging problems.

Specifically, in coextrusions with thermally sensitive resins such as EVOH or EVA, we suggest that the maximum melt temperature be limited to 235C (455F) to guard against overheating the EVOH or EVA. If adhesion results are adequate, we suggest evaluating even lower melt temperatures such as 210 - 220C (410 - 428F).

For coextrusion with polyamides or other thermally stable resins, the melt temperature can be higher. We suggest a maximum melt temperature of 260C (500F). This should provide acceptable bond strengths and film quality under almost all coextrusion conditions. If adhesion results are adequate, melt temperatures can be lowered. While it is possible to extrude certain grades of BYNEL™ 2100 series resins as high as 300 (572F), such high extrusion temperatures, particularly when coupled with long residence times, may result in some film imperfections. In certain streamlined extrusion operations, where residence times are short, it may be possible to use temperatures higher than 260C (500F).

Variation of these suggested temperature profiles may be appropriate depending upon the screw configuration, potential extruder horsepower limitations, potential back pressure limitations, the need to match rheologies and/or the stability of the other resins in the coextrusion. Film quality will also depend upon the residence time of the adhesive resin in the system. Dead spots may result in localized overheating and should be avoided by ensuring the flow path for the adhesive is as streamlined as possible.

We suggest using any standard polyolefin working screw when extruding BYNEL™ 2100 series resins. Excessively deep flights should be avoided as they might result in poor melting of the adhesive resin. It is also important to properly size the extruder for the output desired. Running large extruders at very low RPMs should be avoided.

For producing monolayer adhesive films with BYNEL™ 2100 adhesive resins, extrusion conditions commonly used for converting ethylene acrylate resins into films can be employed.

When extruding BYNEL™ 2100 series resins as an exposed outer surface in a multi-layer coextrusion, problems related to the tackiness and high coefficient of friction of these products may be evident. In this case, it is suggested that the extrusion temperature be lowered to 160C - 185C (320C - 365F) or less. Addition of slip and silica-based antiblock packages may also be appropriate to prevent blocking and improve film handling, although these additive packages may modify the resin's bonding characteristics.

If the coextrusion process is stopped for short periods of time, the screw in the adhesive extruder should be kept turning at a low RPM level. For a permanent shutdown, the BYNEL™ adhesion resin should be purged out using an available polyethylene resin run at the same extrusion temperature used during the extrusion process of the adhesive resin. Making frequent changes in screw speed during the shutdown process and subsequent start-up will help remove the previous material from the system more effectively. Sometimes upon start-up of the adhesive resin, excessive amounts of gel may be observed. This may be due to the natural ability of the adhesive resin to act as a purging compound. In this case, continued extrusion will eventually clear up the problem.

CoExtrusion w/ EVOH	Nominal Values
Processing Information	Proposed Extruder Set Temperatures
Feed Zone	160 °C (320 °F)
Second Zone	210 °C (410 °F)
Third Zone	235 °C (455 °F)
Fourth Zone	235 °C (455 °F)
Fifth Zone	235 °C (455 °F)

Adapter Zone	235 °C (455 °F)
Die Zone	235 °C (455 °F)

CoExtrusion w/ Nylon	Nominal Values
Processing Information	Proposed Extruder Set Temperatures
Feed Zone	160 °C (320 °F)
Second Zone	210 °C (410 °F)
Third Zone	235 °C (455 °F)
Fourth Zone	260 °C (500 °F)
Fifth Zone	260 °C (500 °F)
Adapter Zone	260 °C (500 °F)
Die Zone	260 °C (500 °F)

FDA Status Information	BYNEL™ 21E781 Adhesive Resin complies with Food and Drug Administration Regulation 21 CFR 175.105 - - Adhesives. This Regulation describes adhesives that may be used as components of articles intended for use in packaging, transporting, or holding food, subject to the limitations and requirements therein. The information and certifications provided herein are based on data we believe to be reliable, to the best of our knowledge. The information and certifications apply only to the specific material designated herein as sold by Dow and do not apply to use in any process or in combination with any other material. They are provided at the request of and without charge to our customers. Accordingly, Dow cannot guarantee or warrant such certifications or information and assumes no liability for their use.
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